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4th International Meeting on Meteorology and Climatology of the Mediterranean

Abstracts book

Organize Associació Catalana de Meteorologia (ACAM) and Network of Meteorology of the Mediterranean with support from Spanish Ministry of Economy and Competitiveness and Météo-France

Banyuls, February 27th - March 1st 2013

General information

Location of the meeting

Observatoire Océanologique de Banyuls
Avenue du Fontaulé, 66650 Banyuls France
Tel. +33 468887373
`www.obs-banyuls.fr`

Organitzation

Network of Meteorology of the Mediterranean
Associació Catalana de Meteorologia (ACAM)
Support from:
Spanish Ministry of Economy and Competitiveness
Météo-France

Scientific Committee

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Kristian Horvath (Croatian Hydrometeorological Service, Zagreb)
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Amit Teller (Weizmann Institute of Science)
Dino Zardi (University of Trento, Trento)

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Josep Calbó (Universitat de Girona, Girona)
Joan Cuxart (Universitat de les Illes Balears, Palma)

Invited Speakers

MISTRAL session
F. Dulac, Laboratoire des Sciences du Climat et de l'Environnement, CEA/LSCE. Gif-sur-Yvette, France
I. Pairaud, (LER PAC, IFREMER. La Seyne sur Mer, France)
V. Ducrocq, (Météo France)
W. Ludwig, (Cefrem, UMR CNRS-UPVD. Perpignan, France)

S. M. Vicente (Instituto Pirenaico de Ecología, CSIC. Zaragoza, Spain)
A. Jericevic (Meteorological and Hydrological Service. Zagreb, Croatia)
M. Berenguer (Centre de Recerca Aplicada en Hidrometeorologia - Univer- sitat Politècnica de Catalunya. Barcelona, Spain)
V. Homar (Universitat de les Illes Balears, Palma)

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4th International Meeting on Meteorology and Climatology of the Mediterranean

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Oral

Block 0: MISTRALS Session

(4 invited lectures)

10:30-11:00: An overview of ChArMEx (the Chemistry-Aerosol Mediterranean Experiment)

F. Dulac and **the ChArMEx Team**

Laboratoire des Sciences du Climat et de l'Environnement, CEA/LSCE. Gif-sur-Yvette, France

Based on a French initiative driving an international cooperative effort, the project ChArMEx aims at a better understanding of the atmospheric chemistry in the Mediterranean region, of its impacts on air quality, climate and marine ecosystems, and of their future evolution in a context of climate change. It addresses emissions, chemical processes, transport processes, aerosol-climate interactions, atmospheric deposition, variabilities and trends. The strategy combines in situ and satellite monitoring with the development of background monitoring activities at coastal or island sites, intensive field campaigns with airborne means including new drifting balloons for Lagrangian-type measurements, and chemistry-transport and chemistry-climate coupled modelling. Recent and planned activities will be illustrated with focus on the 2012 pre-campaign (10 June-10 July 2012) in the north-western basin, the planned summer 2013 campaign, and the project for an oceanographic cruise on air-sea interactions.

11:00-11:30: Presentation of the MERMEX program: Marine Ecosystems Response in the Mediterranean Experiment

[1]**I. Pairaud**, [2]**C. Guieu**, [3]**X. Durrieu de Madron** and [4]**R. Sempéré**

[1]*Institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER), Laboratoire Environnement Ressources Provence Azur Corse (LER PAC). La Seyne sur Mer, France*
[2]*LOV, Université Pierre et Marie Curie. Villefranche-sur-mer, France*
[3]*CEFREM, Université de Perpignan. Perpignan, France*
[4]*LMGEM, Mediterranean Institute of Oceanography. Marseille, France*

MERMEx (Marine Ecosystems Response in the Mediterranean Experiment) is a component of the MISTRALS (Mediterranean Integrated STudies at Regional And Local Scales) decennial program dedicated to the understanding of the Mediterranean Basin environmental process under the planet global change (`www.mistrals-home.org/`). MERMEx aims to study the response of Mediterranean ecosystems and biodiversity to climate changes and anthropogenic pressure in order to better anticipate their upcoming evolution. It is focusing on the response of ecosystems to modifications of physico-chemical forcing at various scales, both in time and space, linked to changing environmental conditions and increasing human pressure. MERMEx actions concern the coastal zone to the open ocean and its interfaces, including ocean-continent, ocean-atmosphere and water-sediment. A review of past and future actions will be presented.

11:30-12:00: HyMeX, a 10-year multidisciplinary project on the Mediterranean water cycle-Focus on the first field campaign dedicated to Heavy Precipitation and Flash-floods in Northwestern Mediterranean

V. Ducroq

Météo France. Tolouse, France

The HyMeX (Hydrological cycle in the Mediterranean Experiment) programme is a concerted effort at the international level aiming at advancing the scientific knowledge of the water cycle variability and improving the processes-based models needed for predicting and adopting mitigation strategies against the impacts of climate change and human activity on the frequency and severity of hydrometeorological hazards in the Mediter-

ranean basin. Specifically, HyMeX aims to:
i) improve our understanding of the water cycle, with emphasis on hydrometeorological hazards, by monitoring and modelling the atmosphere-land-ocean coupled system, its variability from the event to the seasonal and interannual scales, and its characteristics over one decade (2010-2020) in the context of global change,
ii) assess the social and economic vulnerability to hydrometeorological hazards and the adaptation capacity of the territories and populations.
This long-term experimental program includes a series of large field experiments for process studies of high impact weather events over specific areas, embedded in a 10-year period of data collection over the whole Mediterranean basin. The first major field campaign was dedicated to heavy precipitation and flash-floods. It took place over the Northwestern Mediterranean Sea and its surrounding coastal regions in France, Italy and Spain from September to November 2012.
After a brief overview of the HyMeX program, the presentation will describe the general observation strategy and instrumentation deployed during the first field campaign, as well as the weather forecast component of the field operations coordination.

12:00-12:30: Surfaces and interfaces of coastal Mediterranean areas: an overview of SICMED

[1]**C. Leduc**, [2]**W. Ludwig**, [3]**M. Thibon** and [4]**M. Voltz**

[1]*G-Eau, UMR IRD-Irstea. Montpellier, France*
[2]*Cefrem, UMR CNRS-UPVD. Perpignan, France*
[3]*SICMED. Montpellier, France*
[4]*LISAH, UMR INRA-IRD-SupAgro. Montpellier, France*

SICMED (Surfaces et Interfaces Continentales en MEDiterranée) is dedicated to the study of Mediterranean socio-environmental systems in rural and periurban areas. The programme focuses on the impact of global change, due to anthropogenic pressures and climate variations, on hydrological and biogeochemical cycles together with the social, economic and biotechnological mechanisms associated to these cycles. It is part of the French research initiative MISTRALS which identified the Mediterranean region as highly vulnerable in the context of global change. Because of the marked gradients in terms of the climatic, demographic and socio-economic characteristics in this region, anticipation of future trajectories is here a major challenge that particularly relies on information of southern and eastern Mediterranean countries, already lacking natural resources and poorly studied before. SICMED is built on a strategy crossing disciplinary and ecosystemic approaches. The programme supports mono- and pluridisciplinary research activities in a limited number of study sites (France: Crau plain and Herault valley; Morocco: Tensift catchment; Tunisia: Lebna and Mergellil catchments; Syria (postponed): Oronte catchment) which are representative of typical Mediterranean systems and for which a significant amount of pre-existing information on their natural and anthropogenic functioning could be assembled. In addition, thematic networks (e.g. erosion, mining activities, fluxes in coastal aquifers, aquifer recharge, forest evolution) were created in order to address major issues that are not, or insufficiently, considered in the study sites and which supply complementary information on the major drivers of environmental change at regional scales. After having launched a series of research tasks in the selected study sites and thematic networks during the initial phase of the programme, emphasis is now given on thematic consolidation of the supported activities and further long-term acquisition of relevant information in key environments of the Mediterranean drainage basin.

Block 1: Climatology

14:00-14:30: (Invited talk) Climate change evidences and associated impacts in Spain

S. M. Vicente

Instituto Pirenaico de Ecología, CSIC. Zaragoza, Spain

Recent studies on climate change processes in Spain, developed in the Department of Geoenvironmental Processes and Global Change of the Pyrenean Institute of Ecology (Spanish National Research Council), are presented. The studies show recent evolution of climate in Spain, including trends of widely *analyzed* climate variables like precipitation and temperature but also other parameters highly relevant to understand observed climate change impacts: wind speed, relative humidity, evapotranspiration, drought, etc. Analyses are covering both average values and frequencies, considering the frequency and magnitude of daily precipitation and temperature records. How climate change processes are affecting different natural systems is also showed, including information on surface hydrology (streamflows and reservoir storages), ecosystems (forests and other natural areas), soil erosion, and snow cover and melting processes. The studies are mainly focused on natural systems living in areas with limiting conditions (e.g., climate aridity), and they show how, in these vulnerable regions, the impacts of the climate change processes are already identified.

14:30-14:50: Historical archive of meteorological information in Italy since the end of 19th century

[1]**A. M. S. Delitala**, [1]**P. Boi**, [2]**C. Bruno**, [2]**J.P. Giorgetti**, [3]**V. Bonati** and [4]**G. Agrillo**

[1]*Hydro-meteo-climatological , ARPAS (Regional Environmental Defence Agency of Sardinia). Sassari, Italy*
[2]*Météo France*
[3]*ARPAL (Agenzia Regionale Per La Difesa Dell'Ambiente*

Ligure)
[4]*Liguria Ricerche*

RESMAR project, aiming to create a network for environmental protection in the "maritime area"across Italy and France (i.e. regions of Sardinia, Corsica, Liguria and Tuscany), is presented.
Specific attention is then posed to the project activity in the field of climatology, in particular a set of case studies are presented and described from the meteorological point of view.
Such cases affected most of the focal area, as for example the recent "flood of Genoa"(November 2011) that impacted upon Corsica, Tuscany and Sardinia, or the "flood of SE Corsica"(novembre 1993) that impacted upon Sardinia and Liguria, as well. They can then become a transnational approach to study intense meteorological events affecting this geographically complex region.
For each case-study attention is devoted to the meteorological evolution at synoptic-scale situation and to mesoscale or local scale ground effects.
Project RESMAR is partly funded by the Operational Programme "Italy-France Maritime"of the E.U.

14:50-15:10: Automatic benchmarking of series homogenization packages

J. A. Guijarro

Mediterranean Meteorological Studies, AEMET (State Meteorological Agency). Palma de Mallorca, Spain

COST Action ES0601 (2006-2011) performed an extended and time consuming exercise of comparison of homogenization methods which helped in drawing interesting conclusions about the strengths and weaknesses of different methodologies (Venema et al., 2012). But many of those methods, and in great part due to that Action, have improved their performances, while repeating that comparison in the same way seam not feasible in a near future.
Yet potential users of the freely available homogenization packages demand some guidance about their characteristics and potentialities. Therefore, automatic benchmarking stands as a desirable strategy, and here results of such an approach are presented.
Simulated series of monthly temperature and precipitation data have been generated with different degrees of spatial correlation. These series are sampled and randomly inhomogenized in several degrees of complexity, and the original homogeneous series are compared with the output of several homogenization packages running in automatic mode.
Summaries of these results indicate that, apart from the absolute homogenization (which should be avoided), most of the tested packages improve the inhomogeneous series. Other differences are discussed in relation to the different characteristics of the problem series.

15:10-15:30: The bioclimate potential of tourism in Croatia in 21st century

[1]**K. Zaninovic**, [2]**C. Brosky** and [2]**A. Matzarakis**

[1]*Climatological and Biometeorological Research , Meteorological and Hydrological Service of Croatia. Zagreb, Croatia*
[2]*Meteorological Institute, Albert-Ludwigs-University. Freiburg, Germany*

Impact of climate change on potential of tourism in two climate periods of the 21st century in Croatia is analysed. A thermal index, physiologically equivalent temperature (PET) derived from the human energy balance, was used for the assessment of human-biometeorological conditions.
For future climate, two randomly chosen simulations from the global atmosphere-ocean circulation model ECHAM5-MPIOM under the IPCC emission scenario A2 were downscaled using regional climate model RegCM3. The integration domain covered almost the whole Europe with the 35-km horizontal resolution. Climate change of biometeorological conditions in the two future 30-year periods, P1 (2011-2040) and P2 (2041-2070), was analysed. The differences in the frequency of days with heat stress between future periods and simulated reference climate period P0 (1961-1990) were used to estimate the future vulnerability.
The thermal conditions during the summer months June, July, and August are examined analysing the number of days with air temperature greater than 30 $°C$ (Ta $>$ 30 $°C$) as well as the number of days with heat stress (PET $>$ 35 $°C$). The future periods are compared with period 1961-1990 resulting in an increase of both air temperature and heat stress in the future along the Adriatic coast of Croatia. Therefore, it is likely that future thermal conditions during the summer are not preferable for touristic activities due to increasing heat stress. Consequently, this is able to lead to a shifting of tourism flow and visits to the off-peak seasons as climate in spring and autumn can be supposed to be more suitable for people and therefore preferable for tourism and recreation in Croatia in the future.

15:30-15:50: Climate change effect on sustainable development of the Tigris-Euphrates basin in Turkey by using the WEAP Model

[1]**T. Sanjuan Olleta** and [2]**E. Tan**

[1]*Universitat Politècnica de Catalunya, Spain*
[2]*Meteorological Department, Istanbul TeknikÜniversitesi. Istanbul, Turkey*

The results of climate models have recently emphasized that statistically significant winter precipitation in Southeast Turkey is approximately expected to decrease by 24%, whereas a 34% decrease is projected for Mediterranean region of Turkey for the period of 2071-2100 (Önol and Unal, 2012). Although summer and spring precipitation rates show small increases, water demand may increase in Southeastern region with cli-

mate change, since only Euphrates and Tigris basins provide fresh water to this region and Turkey has also the responsibility to share the water with its neighbours, approximately 90% of Euphrates and 50% of Tigris are originated in the borders of Turkey (Altinbilek, 2004), (Kibaroglu, 2004). Therefore, it is vital to determine possible impact of climate change on this region in order to prevent a likely drought and to manage the continuation of having access to water without causing any crisis. Due to the reasons discussed previously, in this study, our goals are to give a projection for water budget change in Southeastern Turkey and to analyse the optimum management solution under the risk of climate change by using the WEAP model. The model allows us to analyse the current hydrological conditions for Turkey and to create different scenarios in order to measure the impact of changes in any parameters. Increase in population and agricultural demands, dam construction policies, improvement in irrigation systems and industrial development are also considered. Finally, climate change effect is taken into account in the creation of future scenarios, as it may highly affect the outflow of the basin. The preliminary results are going to be discussed in terms of necessary improvements on current water management strategies of Turkey as a part of GAP (Southeastern Anatolia Project) region and additional needs for Southwestern/Mediterranean part, which may also be vulnerable to climate change, are also emphasized.

16:50-17:10: Dynamical downscaling of wind speed over the Adriatic region

K. Horvath, **A. Bajic** and **S. Ivatek-Sahdan**

Research and Modelling of Atmospheric Processes , Meteorological and Hydrological Service. Zagreb, Croatia

The global model reanalysis, forecast or climate data needs to be downscaled to provide information for regional interpretation. This is especially true in the Adriatic basin, where the wind regime is closely tied to frequent terrain-induced downslope windstorms.
Dynamical downscaling was performed with the use of ALADIN model, driven by the ERA-40 reanalysis, at 8 km horizontal grid spacing during a 10-yearly period (1992-2001). Thereupon, so-called dynamical adaptation, a simplified and cost-effective model version, was carried out with a 1-hourly frequency at 2 km horizontal grid spacing. Complimentary moment-based and spectral verification, performed on a number of surface stations in different climate regions of Croatia, suggested that downscaling was successful. The greatest average wind speeds are associated with areas where gap flows and gravity-wave breaking take place during bora flows. The interannual variability reaches $\pm 15\%$ of the 10-early mean and is larger over the coastal mountains than over the sea or flat continental areas. Systematic errors of 10-m wind speed are close to 1% in flat terrain and reach up to 10% for coastal stations in the vicinity of Dinaric Alps, the latter due to underestimation of the strongest wind speeds. The shape of kinetic energy spectrum follows theoretical considerations regardless of the season and generally relaxes towards the orography spectrum as approaching the ground. Near the surface, divergent flows show more energetic than rotational at wavelengths smaller than 200 km. The main improvement of both mesoscale model versions is found for diurnal circulations, whereas the energy variance of subdiurnal flows is largely underestimated. Dynamical adaptation shows beneficial primarily for cross-mountain winds determined by the pressure gradients over the mountain range.

17:10-17:30: Evaporation and precipitation over the Mediterranean Sea in a WRF physics ensemble

A. Di Luca, **E. Flaounas** and **P. Drobinski**

Institut Pierre Simon Laplace/Laboratoire de Météorologie Dynamique. Palaiseau, France

The use of high resolution atmosphere-ocean coupled regional climate models (AORCMs) to study possible future climate changes in the Mediterranean Sea (MS) requires an accurate simulation of the atmospheric component of the water budget. In particular, a biased representation of the atmospheric water budget can lead to modifications on the thermodynamic properties of the MS surface layer, eventually followed by changes in the thermohaline circulation and ultimately resulting in a perturbed future atmospheric circulation.
Drobinski et al (2012) have shown that the WRF-NEMO AORCM tends to systematically overestimate the MS water budget (here defined as evaporation minus precipitation) mainly due to an excess of evaporation compared to observed estimations. In order to gain some insight on the reasons why this is happening, the WRF RCM has been used to perform a total of 72 1-year simulations differing on the representation of sub-grid scale processes associated with convection (6 cumulus schemes), boundary layer exchanges (4 planetary boundary layer schemes) and radiative fluxes (3 radiation schemes). In this presentation, we will show some results from a variance decomposition analysis aims at quantifying the contribution of the each parameterization to the total variability across the ensemble of simulations. The method is applied to the annual-mean evaporation, precipitation and water budget fields. Finally, we will evaluate the performance of individual schemes and discuss the key parameters that seem to control their behavior.

17:30-17:50: Medicanes and climate change: analysis with two different methods

M. Tous, **R. Romero** and **C. Ramis**

Grup de Meteorologia, Dept. de Física, Universitat de les Illes Balears . Palma de Mallorca, Spain

Medicanes or "mediterranean hurricanes" are extreme cyclonic windstorms morphologically and physically similar to tropical cyclones (Tous and Romero, 2012). Owing to their potential destructiveness on the islands and continental coastal zones, medicane risk assessment is of paramount importance. With an average frequency of only 1-2 events per year and given the lack of systematic, multidecadal databases, an objective evaluation of the long-term risk of medicane-induced winds is impractical with standard methods. Also, there is increasing concern on the way these extreme phenomena could change in frequency or intensity as a result of human influences on climate.
First attempts to evaluate the medicane risk and its possible changes have been undertaken recently by our group based on two different perspectives. The first approach consists of detecting and tracking symmetric warm-core cyclonic disturbances generated in nested climatic simulations. This technique is limited by its high computational cost, which prevents it from using very high grid resolutions and from analysing enough climatic realizations to permit an adequate and complete sampling of the probability distribution function of storms. As an alternative, the second risk assessment method takes advantage of the statistical-deterministic approach developed by Emanuel et al. (2006) in the context of the long-term wind risk associated with tropical cyclones. This approach generates thousands of synthetic storms with low computational cost, thus enabling a statistically robust assessment of the spatio-temporal risk function, in the form, for instance, of geographical distributions of return periods for medicane-related extreme winds.
Here we present unprecedented medicane risk maps based on both techniques, using ERA40 reanalysis and GCM outputs as input data. Both methods generally agree with regard to the medicane-prone geographical areas and times of the year, and point out fewer storms but an increased probability of violent cases at the end of the century compared to present.

17:50-18:10: Future hydroclimatic changes and their impact on the Pontinia plain

[1]**A. Monti**, [2]**N. Devineni**, [1]**F. Cioffi** and [2]**U. Lall**

[1]*Civil, Structural & Environmental Engineering, University of Rome La Sapienza. Rome, Italy*
[2]*Department of Earth and Environmental Engineering, Columbia University. New York, USA*

The Pontinia plain is a relevant example of reclamation area. The area, which is maintained dry by a complex canal network and pumping stations, presents the typical hydrogeological features of Mediterranean coastal environments: coastal lakes bounded by dunes, phreatic aquifers bounded toward the sea by a salt/fresh water interface, depressed zones vulnerable to flooding during extreme precipitations. As with most of the Mediterranean coastal areas, it is densely populated and is the site of important economic agricultural and industrial activities.
In this context water supply by superficial and underground sources plays a key role and any change in hydrologic cycle could constitute an hazard and adversely affect the sustainability and the future economic development of the area.
In this study we propose an analysis of the actual and future precipitation features on Pontinia plain. Daily rainfall occurrence and amount at 32 stations over the region are examined for the summers and the winters 1916-2004 using a Hidden Markov Model (HMM). Daily rainfall variability is described in terms of occurence of ' weather state' identified by the HMM and associated to variables representing the main characteristics of large scale atmospheric circulation as obtained by reanalysis data. A nonhomogeneous hidden Markov model (NHHM) is then used to make future projections of the downscaled precipitation as by using the GCM's simulations under different global warming scenarios. Improvements over a standard NHMM are offered to explore extremes in precipitation and to assess their potential impact on the regional hydrology

Block 2: Processes and Applications

8:30-9:00: (Invited talk) Boundary layer processes and air pollution modelling in coastal areas

A. Jericevic

Meteorological and Hydrological Service. Zagreb, Croatia

Understanding, monitoring, and forecasting the transport and dispersion of pollutants in the atmosphere in coastal areas is of particular importance since coastal areas are often highly populated. The coastline constitutes an abrupt change in all surface parameters, such as roughness, temperature, and terrain height. Therefore the responses in the atmospheric boundary layer (ABL) are complex and diverse and studies of boundary layer processes in the complex terrain and effects on air pollution levels are needed.
The results of analyses of high ozone levels in northern Adriatic are presented as well as physical and chemical characteristics within the two distinct meteorological regimes, i.e., convective and stable atmospheric conditions in a complex highly urbanized terrain of the California South Coast Air Basin (CSCAB; the Los Angeles area). The Community Multi-scale Air Quality (CMAQ) model was used with a horizontal resolution of 5 km x 5 km to produce the 3D fields of pollutant concentrations. Input meteorological fields were obtained by the MM5 numerical weather prediction model while the input emissions were provided by the Californian Environmental Protection Agency. Modelled meteorological surface parameters and their vertical profiles as well as modelled planetary boundary layer heights (PBL) were compared to the corresponding measurements and ABL heights determined from the available

radiosounding measurements. The CMAQ simulations of ozone concentrations were compared against the relatively large number of measurements from the CSCAB area. The main goal of the research was to identify the governing atmospheric processes and sources in the coastal area that contributed to the high levels of pollution and to investigate the air quality model's capabilities to simulate the air quality in the complex topography.

9:00-9:20: Nighttime surface inversions under thermally-driven low-level jets

J. Cuxart Rodamilans, [2]**J. Dünnermann**, [2]**B. Wrenger**, [3]**M. A. Jiménez** and [4]**J. L. Palau**

[1]*Physics, Universitat de les Illes Balears. Palma de Mallorca, Spain*
[2]*Hochschule Ostwestfalen-Lippe. Hoexter, Germany*
[3]*IMEDEA (UIB-CSIC). Esporles, Spain*
[4]*CEAM (GVA-UMH). Paterna, Spain*

Time evolution of nocturnal inversions in clear nights without fog is conditioned by the mesoscale structure of nighttime flows. In this work we dispose of data for inversions in three different locations, all them under a thermally-driven low-level jet, and also the corresponding high-resolution mesoscale simulations. These locations are Lleida in the Ebro Basin, inland on the Mallorca island and the BLLAST experiment site, in Lannemezan, at the foothills of the northern central Pyrenees.
The evolution of the inversion in all cases is described, focusing on the interaction with the low-level jet blowing a some tens of meters above, that may be mixing until the ground along the night, like in BLLAST, or decoupled from the surface and mixing intermittently, like in Lleida and Mallorca. The main characteristics of the inversions will be explored, as well as their coupling with the surface, through exploration of surface layer data (including the surface energy budget terms). The role of the low-level jet in these cases is evaluated, especially how it becomes decoupled from the surface and how it connects inttermittently with it, providing major ventilation events. Comparison with model behaviour is also provided.

9:20-9:40: Evaluation of a lake model over a Mediterranean coastal lagoon: THAUMEX field campaign

[1]**P. Le Moigne**, [1]**D. Legain**, [2]**F. Lagarde**, [3]**R. Salgado**, [1]**D. Tzanos**, [1]**E. Moulin**, [1]**J. Barrié**, [3]**M. Potes**, [2]**G. Messiaen**, [2]**A. Fiandrino**, [1]**S. Donier**, [1]**Traullé** and [1]**D. Suquia**

[1]*CNRM-GAME, Météo-France-CNRS. Tolouse, France*
[2]*IFREMER, Séte, France*
[3]*Universidade de Evora, Evora, Portugal*

The THAUMEX measurement campaign, carried out during summer 2011 on a Mediterranean coastal lagoon in southern France, focused on episodes of marine breezes. On this occasion, Three Intensive Observation Periods (IOPs) were conducted and at the same time a large amount of data collected. These have resulted in a standalone type modelling with the FLake lake model, to determine firstly the necessary intrinsic characteristics of the Thau lagoon, in order to assess in particular the surface temperature and the surface energy balance, and secondly to realize a heat budget of the water column at the measurement place. It turned out that heat exchanges are dominated by evaporation, which appeared to be more sensitive to wind speed than to moisture gradient. The FLake lake model was then evaluated in three-dimensional numerical simulations made with the Meso-NH mesoscale model, to assess more accurately the changing structure of the boundary layer above the lagoon during the IOPs. We showed the importance of the lagoon and more precisely that of the Lido, a sandy strip of land between the lagoon and the Mediterranean sea, on the vertical distribution of turbulent kinetic energy.

9:40-10:00: Effects of the large-scale wind on the sea breeze and cumulonimbus cloud interaction over Istria

M. Telšman Prtenjak, **M. Kvakić** and **G. Poljak**

Andrija Mohorovičić Geophysical Institute, Department of Geophysics, Faculty of Science, University of Zagreb. Zagreb, Croatia

AN ANALYSIS OF DEEP CONVECTIVE ACTIVITY HAS BEEN SHOWED THAT THE NORTHEASTERN ADRIATIC REPRESENTS THE MOST CONVECTIVE AREA IN CROATIA. IN PARTICULAR, THE ISTRIAN PENINSULA. EVERY OTHER DAY THERE WAS MARKED AS A DAY WITH CONVECTION IN THE WARM PART OF THE YEAR. FURTHERMORE, IN 82% OF DAYS WITH CONVECTIVE ACTIVITY WAS OBSERVED DURING THREE DOMINANT WIND REGIMES ON A LARGE SCALE. THEY WERE FROM THE SW (46%), NE (18%) AND NW (18%) DIRECTIONS (MIKUŠ ET AL., 2012). MESOSCALE LOCAL THERMAL-INDUCED WIND IS ALSO COMMON IN ISTRIA, APPEARING EVERY OTHER DAY IN AVERAGE DURING THE SUMMER (PRTENJAK AND GRISOGONO, 2007). THEREFORE HERE, WITH THREE SELECTED CASES (FOR EVERY TYPE OF THE DOMINANT LARGE-SCALE WIND REGIME) WE INVESTIGATE THE IMPACT OF JOINTED LARGE SCALE WIND AND THERMALLY-INDUCED LOCAL WIND ON THE DEVELOPMENT OF CUMULONIMBUS CLOUDS. FOR THIS PURPOSE WE USE THE AVAILABLE MEASUREMENTS, SATELLITE IMAGES AND WRF NUMERICAL SIMULATIONS A_T FINE RESOLUTION. AMONG OTHER, RESULTS INDICATE THAT THE SW LARGE-

SCALE WIND SUPERIMPOSED ON THE WESTERN SEA BREEZE INCREASES HUMIDITY ADVECTION A_T THE FOOT OF THE MOUNTAINS IN THE NORTHEAST OF THE ISTRIAN PENINSULA. THE LARGE-SCALE NE WIND IS OPPOSITE TO THE DOMINANT WESTERN SEA BREEZE AND PREVENTS ITS DEEPER PENETRATION OVER THE PENINSULA. NEVERTHELESS, THE INTERACTION REINFORCES THE CONVERGENCE OF THE FLOW FIELD IN THE BOUNDARY LAYER AND CONSEQUENTLY THE INTENSITY OF SEA BREEZE FRONTS AND ITS UPDRAFTS. THE EFFECTS OF NW FLOW IN THE REAR SIDE OF THE CYCLONE CAUSED THE MOST INTENSE CUMULONIMBUS CLOUD DEVELOPMENT OVER ISTRIA AND THE LARGEST IMPACT ON THE SB DAYTIME EVOLUTION.

10:00-10:20: A model for modification of air in a small town by using the evaporative cooling method

A. Shayia, **H. H. Salman** and **B. Y. Humood**

Atmospheric science, Al-Mustansiryah university. Baghdad, Iraq

In this study a new model to quantifying the effect of evaporative cooling produced by the evapotranspiration from trees on the air temperature of Ali- Al Sharqi town, south of Iraq, (lat. 32.1°N, long 46.85°E) was suggested. The ASCE and FAO Penman Monteith model was used to calculate the actual evapotranspiration from tree in the selected town. The dispersion of moisture from trees in the neighborhood in the three dimensions by using the Gaussian dispersion model was estimated. The decreasing of air temperature due to the moisture added by trees on a specific control volume was calculated by using the psychometric chart. The maximum cooling degree achieved by the suggested model reached to 2.6 $^{\circ}C$ in July while minimum value was (1.8 $^{\circ}C$) and appeared in April. The results of applying the model on a hot and dry day indicated that the higher cooling degree can be obtained reach to 3.6 $^{\circ}C$ at the noon time.

11:20-11:40: Impact of wildfire-induced land cover modification on local meteorology: a study of the 2003 wildfires in Portugal

[1]**C. Hernández**, [1]**P. Drobinski** and [2]**S. Turquety**

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Wildfires alter the land cover in most of its characteristics, creating changes in dynamic, vegetative, radiative, thermal and hydrological properties of the surface. The objectives of the study presented here are to assess the modifications of atmospheric dynamics over a recently burnt area. For illustration, we consider the case of the Portugal wildfires in 2003, using MODIS data to retrieve the spatial structure of the burnt area.
In order to study the effects of this surface alteration, several numerical simulations using the Weather Research and Forecasting modeling system (WRF) were performed. We will present the impacts of the modification of the surface energy balance caused by the fire-induced decrease in albedo and near-surface soil moisture. We show that it creates the conditions for a mesoscale circulation to take place and that it enhances the turbulent mixing and convective activity inside the burnt area during summer. An analysis of the impacts on the precipitation patterns will also be discussed.
In order to refine our understanding of the mechanisms leading to these results and test their robustness, downscaling in dynamic and land use resolution was performed. The dynamic downscaling allows us to study the small scale impacts of our surface modification, whereas the land use downscaling gives us information about the effects of small scale land cover contrasts over the dynamics at a given scale.

11:40-12:00: Large-eddy simulation of wave-turbulence interaction in the stable boundary layer

[1]**M. Udina Sistach**, [1]**M. R. Soler**, [2]**J. Sun** and [2]**B. Kosovic**

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Recent analysis of measurements carried out in a stably-stratified atmospheric boundary layer during CASES99 field experiment have shown the existence of three distinct turbulent regimes (Sun et al. 2011).
The first regime is characterized by weak wind conditions, below an observed threshold, and weak turbulence. Turbulence in this regime is generated by local shear instability and modulated by vertical temperature gradients. The length scale of turbulent eddies in this regime is defined by local shear and eddies do not directly interact with the ground. The second regime is characterized by strong wind, above the observed threshold, and continuous turbulence with turbulent eddies that extend to the ground. Third regime is the turbulence regime when the wind speed is below the threshold value and top-down turbulence sporadically bursts into the otherwise weak turbulence regime resulting in intermittent turbulence. To explore the intermittent turbulence regime and study the details of the wave - turbulence interaction we propose to carry out high-resolution numerical simulations of a in a stably-stratified boundary layer.
We propose to carry out several large-eddy simulation

(LES) to study these different turbulence regimes in a stably-stratified ABL under a range of stability conditions with the WRF-LES model. In order to study wave turbulence interaction we will simulate a flow over a small (∼100m high) elliptical hill. Under stably-stratified conditions gravity waves will be generated in the lee of the hill. Gravity waves generated in this way will interact with shear generated by boundary layer turbulence.

12:00-12:20: Aerosol radiative impact on the Mediterranean climate in coupled atmosphere-ocean regional climate simulations

[1]**P. Nabat**, [1]**S. Somot** and [2]**M. Mallet**

[1]*Météo-France / CNRM. Toulouse, France*
[2]*Laboratoire d'Aérologie. Toulouse, France*

The Mediterranean region is characterized by the accumulation of aerosols from different sources : industrial and urban aerosols from Europe and North African towns, biomass burning from Eastern Europe, dust aerosols from Africa, and marine particles from the sea. These aerosols show a strong spatio-temporal variability and a resulting large variety in aerosol optical properties over this basin. Through their interactions with solar and thermal radiation, they have very important effects on its climate.
The present work can be considered as a link between the ChArMeX and HyMeX projects. We consider a regional climate modelling approach, using the ALADIN-climate model (50 km resolution), in order to better understand the influence of aerosols over the Mediterranean. This regional climate model can be coupled to the ocean model NEMOMED8 (10 km resolution) to take into account the feedback of the sea surface temperature (SST). Aerosols are included in ALADIN through monthly interannual climatologies, which come from a combination of satellite-derived and model-simulated products. The aim is to have the most possible relevant estimation of the atmospheric aerosol content for the five most relevant species (sea salt, desert dust, sulfates, black and organic carbon aerosols). The first results confirm the strong impact of aerosols due to absorption and scattering of the incident radiation, and also show contrasts between different regions. Ocean-atmosphere coupling enables us to highlight the role of SST in the response to aerosol forcing, thus modifying the air-sea fluxes. We will also present the climatic response to the decrease in sulfate aerosols since the 1980s, and the consequences on the trends of SST and air-sea fluxes compared to observations.

12:20-12:40: the CALIOPE air quality forecast system for year 2011

[1,2]**J. M. Baldasano**, [1]**M. T. Pay**, [1]**G. Arévalo** and [1,2]**S. Gassó**

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The system CALIOPE forecasts air quality predictions for up to 48h in Europe (12 km x 12 km, 1h) and Spain (4 km x4 km, 1h) since July 2007. It presents the evaluation of year 2011, considering the air quality forecasts and the technical reliability of the system. Are used hourly data on more than 300 air quality stations without filter process. The pollutants evaluated were: O_3, SO_2, NO_2, PM10 and PM2.5. The average correlation coefficient for O_3 is 0.68, with a bias of 1 $\mu g/m^3$. The worst results are obtained for SO_2, this behavior is influenced by the emission variability of this pollutant; background levels of SO_2 are low (∼ 4-5 $\mu g/m^3$), but in the vicinity of power plants or refineries SO_2 is transported by highly concentrated plumes; failure to address the emission characterization strongly penalizes the statistical value, especially the correlation coefficient. NO_2 results show that 91% of the stations have an annual average bias $\pm 5 \mu g/m^3$ hourly concentrations; regarding the correlation, 74% of the stations has a behavior between "very good" and "good" (correlation coefficient > 0.40, and 33% with the stations > 0.60). PM10 assessment indicates that 93% of the stations have an annual average bias ± 10 $\mu g/m^3$; for the correlation, 57% of the stations show a behavior between "very good" and "good" (r > 0.4, with only 6% of the stations with r > 0.55). PM2.5 assessment indicates that 86% of the stations have an annual average bias $\pm 5 \mu g/m^3$; for the correlation, 39% of the stations show a behavior between "very good" and "good" (r > 0.4, with only 7% of the stations with r > 0.55). During certain episodes of Saharan dust intrusion, BSC-DREAM8b model overestimates the contribution of dust to PM10 and PM2.5. It also identifies the limitations and needs improvements.

Block 3: Remote and in situ measurements

14:00-14:30: (Invited talk) On the performance of rainfall nowcasting using Continental radar mosaics

M. Berenguer

Centre de Recerca Aplicada en Hidrometeorologia - Universitat Politècnica de Catalunya. Barcelona, Spain

The presented work studies the performance of an ensemble technique for very short-term rainfall forecasting (for leadtimes up to 6 hours) based on the extrapolation of radar observations. The study focuses on the performance of the method in different meteorological conditions and on how the ensemble method describes the uncertainty of the forecasts. Also, the work looks at the impact of forcing mechanisms such as the diurnal cycle of precipitation (associated with the diurnal cycle of solar heating) in the quality of the generated forecasts. The method has been adapted to the use of European-scale radar mosaics (with a resolution of 4 km and 15 minutes), and the analysis extends along

the period June-December 2012. This dataset allowed studying the dependence of the performance of the technique on location. Finally, the use of multi-sensor rainfall products (specially useful in areas not covered by radar networks) has been explored.

14:30-14:50: A decade of precipitation in the Mediterranean basin as seen from the TRMM-3B42 satellite product

[1]**F. Dulac**, [1]**B.Sarrand**, [2]**N.Hamdi**, [2]**Z. Bargaoui**, [3]**M.Baldi**, [4]**K.Cindrić**, [5]**C.Dubois**, [5]**V.Ducrocq**, [5]**S.Somot**, [6]**M.Labiadh**, [7]**J.Schiavone**, [8]**L.deSilvestri** and [9]**A.Tovar-Sánchez**

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This work presents a detailed analysis of 11 yrs of the version 6 of the TRMM-3B42 multi-sensor precipitation product (3-h and 0.25° resolution) from March 2000 to June 2011 over the whole Mediterranean basin and surrounding areas including the Black Sea (25°N-50°N, 10°W-43°E). We first discuss some issues in the data set regarding spatial and temporal discontinuities in coastal areas, and further illustrate a critical underestimation of light rains at latitudes higher than 36-37° that somewhat improves from 2007 on and is associated to the absence of coverage by the Precipitation Radar. North of the radar field of view. It seems also that the marine coastal band is subject to a significant under detection of precipitation, whereas, on the opposite, the terrestrial coastal band south of 35°N in North Africa and the Near East shows unrealistic over detection of precipitation. We then evaluate the product against rain gauges with a focus on the western Mediterranean basin and the Adriatic. Our reference rain gauge data set includes 1166560 daily rain reports from 471 Mediterranean surface stations from Croatia, France, Italy, Malta, Spain (including 2 stations on the northern coast of Africa) and Tunisia, and from 9 additional non-Mediterranean stations from a flat region in France. It includes stations from 18 Croatian, French, Italian and Spanish Mediterranean islands. The comparison shows a significant correlation between TRMM-3B42v6 and rain gauges but with an overall tendency to underestimation. The average ratio of daily rates between surface stations and the TRMM product is $0.42pm0.18$ with significant regional variations, Italia and Corsica showing the poorest results (resp. 0.27 and 0.30) and Malta the best (0.95). Over the Mediterranean stations considered, the average rate of success on the occurrence of precipitation ($75.0\%pm6.5\%$) is enhanced by the high proportion of dry days in the Mediterranean climate (70.1% on average in the rain gauge data set): it drops off ($36.8\%pm10.4\%$) when only days with precipitation recorded at surface stations are considered. Averaging fallout at monthly and annual time scales somewhat improves the comparison to rain gauges. Using a few TRMM pixels that cover 3 or more (up to 8) surface stations, we further illustrate how the small scale heterogeneity of terrestrial precipitation is a limitation in the comparison between the integrated view of precipitation from space and the local surface measurements. Finally we integrate the variability of the rainfall geographical distribution at seasonal and annual scales over 5 sub-basins (western and eastern Mediterranean, Adriatic, Aegean, and Black Sea). An increasing trend in annual precipitation in the Mediterranean basin is observed over the decade that is also found at the global scale and appears related to the improving performance of the product with time regarding the detection of light rains, especially significant over Europe and the Mediterranean. Finally we compare the TRMM-3B42v6 precipitation budget over the basin with comparable budgets from HOAPS (0.5° resolution), ERA-Interim (0.7°), and CMAP (2.5°) data sets. Over the common March 2000 to December 2005 period, annual means over the Mediterranean (Black Sea excluded) range from 0.71 (HOAPS) to 1.31 (CMAP) mmd^{-1} with a value of 1.12 for ERA-I and 1.20 for TRMM. The TRMM average slightly increases (up to 1.25 mmd^{-1}) when computed on the same masks as the other products since marine coastal pixels where TRMM tends to show low values are discarded. Differences in average rainfall between the western and the dryer eastern Mediterranean basin are significantly variable between the products with a ratio ranging from 1.14 for CMAP to 1.48 for HOAPS.

14:50-15:10: Land surface albedo and downwelling shortwave radiation from MSG geostationary satellite: method for retrieval, validation, and impact assessment in NWP and LSM Models

[1]**J.-L. Roujean**, [1]**D. Carrer**, [1]**X. Ceamanos**, [1,5]**O. Hautecoeur**, [3]**J. Cedilnik**, [1,2]**B. Geiger** and [1]**J.-F. Mahfouf**

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The European Meteorological Satellite Organization

(EUMETSAT) maintains a number of decentralized processing centers. The Portuguese Meteorological Institute hosts the Satellite Application Facility on Land Surface Analysis (LSA-SAF) (`http://landsaf.meteo.pt/`). The objective of the LSA-SAF is to provide added-value products for the meteorological science communities. Since 2005 observations from METEOSAT SG / SEVIRI are routinely processed in near real time by the LSA-SAF operational system based in Lisbon to deliver in an operational mode relevant surface products amongst which albedo, temperature, down-welling radiation fluxes, and vegetation parameters. The down-welling shortwave radiation is calculated at 30 minutes interval based on a every second SEVIRI imagery. It essentially depends on solar geometry and clouds. The albedo product is delivered on a daily basis in order to capture rapid evolution such as ones caused by snowfalls. The algorithm to estimate surface albedo fully exploits the daily variability of solar geometry of illumination.
The relevance of LSA-SAF albedo product is analyzed through a weather forecast model (ALADIN) in order to account for the inter-annual spatial and temporal variability. Results clearly show a positive impact on the 12 hour forecast of 2m temperature in Mediterranean regions. The added value brought by the use LSA-SAF shortwave and long-wave products is also diagnosed through SURFEX Land Surface Models (LSM) simulations with the surface temperature, the water content and the energy fluxes. The SAFRAN system provides a high-resolution atmospheric analysis over France in off-line mode for the category of Land Surface Models (LSM) devoted to meteorological or hydrological studies. A comparison is established between incoming solar and infrared radiation fluxes between SAFRAN and LSA-SAF products through LSM simulations. The impact on temperature, water content, and energy fluxes simulated at surface level and in the root-zone (up to 1.5 m depth) is in favor of the use of LSA-SAF satellite estimates.

15:10-15:30: Detection and retrieval of dust storm episodes in Mediterranean region in combining visible and thermal infrared MSG/SEVIRI bands

X. Ceamanos, **D. Carrer** and **J.-L. Roujean**

CNRM, Météo-France. Tolouse, France

Aerosols influence significantly the radiation balance of the atmosphere. Therefore, their role is crucial for a projection of the future climate scenario of Mediterranean regions. Atmospheric forcing by aerosol concerns different domains such as epidemiological risk, air quality, natural hazards management, weather forecasting, and climate change.
The main difficulty of aerosol detection is the separation of the contributions to the measured signal coming from atmospheric scattering and surface reflectivity, especially over bright surfaces. An innovative method is presented to estimate the vertical column aerosol optical depth (AOD) over land on a daily basis (Carrer et al., 2010). The approach takes into account the high frequency of geostationary visible observations from SEVIRI sensor aboard MSG and the high temporal variability of aerosols. A simultaneous retrieval of AOD and surface reflectance is obtained by operating a model-based discrimination between the directional signatures of the surface and the aerosols. The information is propagated with time using a Kalman filter. As a result, tracking of rapid variations due to sudden aerosol episode becomes possible. Also, dust aerosols impact the longwave outgoing radiation, allowing the detection of aerosols over desert surfaces in the thermal infrared (TIR) wavelengths (De Paepe et al., 2009). The use of TIR SEVIRI channels is investigated in combination with the visible ones.
The study is carried on from June 2005 to August 2007 for regions in Europe. The estimates of the satellite-derived AOD compare favorably with AERONET measurements and MODIS products for a number of ground stations, typically within a 20% of accuracy. The method appears to be competitive to track anthropogenic aerosol emissions and to detect dust events. Owing to the diverse information enclosed in the different SEVIRI channels, the presence of particles of different sizes is revealed. Large dust mode over ocean is evidenced at 1.6 μm whereas fine and medium dust modes are detected at 0.6 m and 0.8 μm.

15:30-15:50: Looking into the surface energy balance of a Mediterranean vineyard through its thermal characterization

[1]**J. M. Sánchez**, [2]**C. Doña**, [3]**J. Cuxart**, [2]**V. Caselles** and [2]**M. Bisquert**

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Evapotranspiration (ET) has long been recognized as the parameter connecting surface water and energy balances, and then used as a key input in numerical climate and weather prediction, as well as drought detection and crop irrigation management. In the past 20 years, different surface energy balance models have been proposed to estimate ET from land surface temperature (LST) data. In these models, energy exchange between surface and surrounding atmosphere is controlled by the difference between LST and the air temperature. Thus, ground LST measurements must be representative of the target. This is not an issue over fully vegetated landscapes, but problems may arise when working under partial vegetation coverage, especially in semi-arid conditions where differences between soil and canopy component temperatures are stressed. The objective of this work is to highlight the significance of a good ther-

mal characterization of the soil-canopy structure, and analyze its effect on the different terms of the energy balance equation. An experiment was carried out in a row-crop vineyard in Mallorca, Spain, in 2012. A set of 6 thermal-infrared radiometers (IRTs) were mounted in a mast placed in the middle of a vineyard N-S row. Two IRTs pointed to the soil between rows and other two pointed to the plants from a frontal view, measuring both east and west sides of the row. A fifth IRT pointed upward to collect the downwelling sky radiance and the remaining IRT was mounted at 4.5-m height over the canopy measuring the composed soil-canopy temperature. Measurements of the four components of the net radiation over the canopy and soil heat fluxes, as well as air temperature, humidity, wind speed, and soil moisture, were collected and stored in 15-min averages. A two-source energy balance approach was applied to the vineyard from remote sensing data, and results of surface fluxes were tested using ground measurements.

16:50-17:10: Study of temperature and humidity vertical profiles: Cerdagne transects

[1]**M. Pagès Secall**, [2]**N. Pepin** and [1]**J. R. Miró**

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[2]*University of Portsmouth, Portshmouth, United Kingdom*

Making accurate weather forecasts in regions of complex topography is challenging, particularly when settled synoptic conditions reverse the normal lapse rate conditions through periods of cold air accumulation in valleys. This study will validate NWP forecast models used by Meterological Service of Catalonia for the Cerdanya region, within the Oriental Pyrenees, through comparison with a high resolution surface network of temperature and humidity observations ranging from ∼1000 to 2484 m.
Cerdanya has long been known to suffer from temperature inversions through cold air ponding, particularly in the upper reaches of the valley around Das, and the new network of 40 sensors, installed in July 2012, is centred upon this area. Sensors were programmed to measure data every 30 minutes and mounted in white Pvc radiation tubes. Tubes were tied to trees in six transects, three north facing and three south facing on either side of the Cerdagne valley, as well as a valley bottom transect extending from Llivia in the east, via Das to Seu d'Urgell in the west. An additional transect was installed in the upper reaches of Conflent to act as a comparison, since previous research has shown that the vertical temperature and humidity profiles are substantially different in this valley system, more influenced by maritime influences due to its more direct exposure to onshore winds from the Mediterranean, and less influenced by cold air drainage.
Temperature and humidity profiles from each transect will be compared with forecast profiles obtained from high resolution models for the Cerdagne region to improve understanding of cold air drainage and lapse rate variability. Also, moving downward through intermediate elevations (∼ 1200-2000 m), the influence of free-air profiles becomes reduced, thus current synoptic scale models give reliable predictions only at higher elevations. The study will analyse the temporal and spatial variation of this transition, in particular quantifying the critical elevation(s) below which the slope climate becomes decoupled from the free atmosphere, and therefore where and when synoptic and mesoscale scale models need substantial modification.

17:10-17:30: Measuring the atmospheric boundary layer with the unmanned aerial vehicle 'MASC': features and applications

D. Martínez-Villagrasa, **N., Wildmann** and **J. Bange**

Centre for Applied Geoscience (ZAG), University of Tübingen. Tübingen, Germany

The significant advances in unmanned aerial vehicle (UAV) technology performed in the last years have converted this type of platforms into a cost-efficient alternative to manned aircraft, able to provide high-resolution spatial data sets of in situ measurements over a large area in the atmospheric boundary layer. Several UAV systems have already participated in field campaigns for atmospheric research, like the BLLAST campaign in Summer 2011, where a selection of UAVs with different payloads and characteristics were operated together for the first time.
The automatically operating small and light UAV of type MASC (multi-purpose airborne sensor carrier) represents one of these airborne platforms from the last generation, recently built in Tbingen. The MASC is an electrically powered research UAV of 3 m wingspan and 5 kg weight with the meteorological equipment, including a five-hole probe, and fast humidity and temperature sensors. This equipment allows to measure the wind vector and temperature fluctuations at sufficient high frequency to calculate the turbulent momentum and heat fluxes. The aircraft is controlled by an autopilot system that allows for very low measurement heights and very precise flight paths, whereas a human safety pilot at the ground controls the aircraft during take-off and landing. The present communication will show the current features of the MASC system and its preliminary results, as well as its future application to the study of the boundary layer flows in the Mediterranean basin.

17:30-17:50: An investigation of the Ora del Garda wind in the Alps by means of Kriging of airborne and surface measurements

[1,2]**L. Laiti**, [1,2]**D. Zardi**, [1,2,3]**M. de Franceschi** and [1,2,4]**G. Rampanelli**

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The present study investigates a coupled lake-valley wind, known as Ora del Garda, which typically arises in the late morning on clear-sky days along the northern shorelines of Lake Garda and then channels northward into the Sarca Valley and Valley of Lakes, in the southeastern Italian Alps. This thermally-driven circulation is very regular, and marks the local climate with a strongly mildening influence.
A series of targeted measurement flights with an instrumented motorglider allowed to explore three selected vertical sections of the valley atmosphere, namely over the lake's shore, at the end of the valley, and one in between. Dominant vertical profiles of potential temperature were inferred from airborne data, and 3D potential temperature fields were mapped over high-resolution grids for each explored section, applying a Residual Kriging (RK) technique both to airborne and to surface data from weather stations disseminated along the valley floor.
These procedures allow to identify atmospheric boundary layer features typical of most diurnal valley winds. In particular, rather shallow convective mixed layers, surmounted by deep stable layers, occur up-valley. Closer to the lake the advection of colder air tends to stabilize the atmosphere throughout the boundary layer depth. Small-scale features of the wind field originated by the coupling between the Ora del Garda lake breeze and the up-valley circulation into a unified mesoscale flow were revealed by RK-interpolated potential temperature 3D fields; the development of an Internal Boundary Layer and of a lake-breeze front structure in the shoreline area is captured, while up-valley sections display cross-valley thermal asymmetries, amenable to surface coverage inhomogeneities and to the curvature of the valley axis.

17:50-18:10: Analysis of long-term solar ultraviolet index observations in Catalonia (Northeastern Spain)

J. Bech, **Y. Sola**, **A. Ossó** and **J. Lorente**

Astronomia i Meteorologia, Universitat de Barcelona. Barcelona, Spain

Monitoring solar ultraviolet radiation reaching the ground is of primary importance in order to assess potential risk for plants, animals and particularly for human beings as an excess of solar radiation may cause sunburns, eye damage or skin cancer among other problems. A usual method to communicate current and expected values of solar radiation is the UV index or UVI which describes the biologically effective irradiance considering a reference weight to different ultraviolet wavelength ranges (CIE, 1998).
Since the year 2000 the Department of Astronomy and Meteorology of the University of Barcelona in collaboration with the Meteorological Service of Catalonia (SMC) is carrying out UVI forecasts for Catalonia (NE Spain) and SMC performs UVI observations at selected stations of their automatic surface observation network. Complementarily, the State Meteorological Agency (AEMET) has been measuring the UVI in Barcelona for the same period.
In this study we examine a long-term data set of UVI observations in order to derive average hourly distributions for different months and seasons for each station. Data obtained are related to different conditions such as total ozone column, altitude, cloud cover or solar zenith angle. Additionally, an overview of forecasting performance is carried out. Results are discussed considering previous related studies such as Badosa et al. (2005), Marín et al. (2005) or Sola et al (2008, 2012).

Block 4: Numerical Modelling

8:30-9:00: (Invited talk) Can we target observations betting on forecast sensitivity fields for the Mediterranean high impact weather?

L. Garcies and **V. Homar Santaner**

Grup de Meteorología, Física, Universitat de les Illes Balears. Palma de Mallorca, Spain

Within the second phase of MEDEX, the DTS-MEDEX-2009 field experiment was carried out during the autumn of 2009 and the adaptive observation concept was applied to the operational radiosounding network and to commercial aircraft data (AMDAR). This targeting campaign focused on improving the forecast skill of HIW events linked to Mediterranean cyclones and used the Data Targeting System (DTS) from the European Centre for Medium-Range Weather Forecasts (ECMWF) to manage the main issues in the targeting observation process. However, the most crucial concern in any targeting campaign is to guide the decision about where additional observations would most benefit the quality of the forecast of each potential adverse event. To this end, five different sensitivity analysis techniques were carried out to provide targeting guidance: Singular Vectors (SV) from the ECMWF; Ensemble Transform Kalman Filter (ETKF) and Kalman Filter Sensitivity (KFS) from Mto France; and ensemble and adjoint sensitivities from the University of Balearic Islands. Despite not all sensitivity computations were available to the forecasters/scientific teams in real-time, all these sensitivity computations were devised to identify the best location for additional observations. Therefore one immediate question arises: which sensitivity method best advise decision makers on where to deploy an extra observation? This talk attempts to shed light on this question and other such observational and sensitivity concerns by analyzing the guidance provided by these five sensitivity analyses for one case study of the DTS-MEDEX-2009 campaign.

Since radiosonde and AMDAR profiles were the only observational means available during the DTS-MEDEX targeting campaign, this study tests the ability of each sensitivity product in identifying the region where a plausible sounding leads to a greater impact on the forecast of a potential high impact cyclone over Southern Italy on December 5th 2009. All targetable radiosoundings sites are also tested and a severe weather meteorologist is used as a confronting reference. The verification testbed comprehends single sounding experiments and multiple sounding strategies by using the WRF Data Assimilation system. Single sounding tests reveal that sensitivity products fail to recognize the best location for a primary observation since most of the soundings added over operational radio-sounding stations have a larger influence on the intense cyclone forecast than the areas indicated by the objective sensitivity calculation methods. Additionally, after evaluating available sensitivity information, human-based decisions are proved to be non optimal, neither in single nor in multiple sounding strategies. These results evidence the need for an improvement of the tools aimed at providing a more robust objective guidance to operations centers during targeting campaigns.

9:00-9:20: Maping evaporative moisture sources for two extreme rainfall episodes in the Alpine region: setting up a new mesoscale system

[1]**G. Gangoiti**, [1]**E. Sáez de Cámara**, [2]**I. Gómez-Domenech**, [1]**L. Alonso**, [1]**M. Navazo**, [1]**J. Iza**, [1]**J. A. García** and [1]**J. L. Ilardia**

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After the relatively frequent episodes of rainfall in the Alpine region during the last decade, the role of the evaporation in the Mediterranean Sea and surrounding basins has draw the attention of scientists (Reale et al, 2001; Sodemann and Zubler, 2010).The estimation and mapping of moisture sources attributed to selected rainfall episodes is usually based in back-trajectories of vapor parcels emitted from "a target"precipitation/area (Dirmeyer and Brubaker, 1999; Sodemann and Zubler, 2010). The required meteorological data is usually based in the re-analysis by the ECMWF or NCEP. We showed that this approach can be improved when trying to evaluate/map evaporative sources at higher space/time resolution (Gangoiti et al., 2011). Considering the lifetime of water vapor in the troposphere, the dynamics of the evaporation-precipitation events develop in the mesoscale, going from regional-to-continental scale. The adequate use of atmospheric mesoscale models can give extraordinary results in estimating surface evaporative sources (Gangoiti et al., 2011). The evaporation from precipitating columns (virga) is now included into our modeling system, previously limited to surface sources. Thus, the new methodology has a great interest to be applied to precipitation during foehn episodes and summer storms. Evaporative sources during two exceptional heavy rainfalls in the Alpine region, the episode of 11-13 August and the south foehn event of 14-16 November 2002, are discussed. Our results show evidences of the key role of the Mediterranean during the initiation of both episodes. The relative importance of land, oceanic and atmospheric sources is also discussed, together with the vapor accumulation mechanisms. After our estimations, terrestrial sources dominate marine sources during the August episode, while the contrary is true for the autumn episode. However, atmospheric sources are negligible respect to surface sources for both episodes.

9:20-9:40: Assessment of the contribution of the Mediterranean Sea to the moisture supply to 04/11/2011 Heavy Precipitating Event over Genoa: sensitivity to the sea surface representation

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Mediterranean heavy precipitating systems are fed by a marine low-level flow providing the moisture required for the precipitating systems to produce huge amounts of precipitation. Duffourg and Ducrocq (2011) have shown that the Mediterranean Sea is a major source of moisture for the supply of heavy precipitating systems. It provides up to more than 60% of the moisture supply when anticyclonic conditions prevail over the Mediterranean before an Heavy Precipitating Events (HPE), and about 40% under cyclonic conditions. However, these results were obtained based on 4-day numerical simulations forced by constant sea surface conditions. The study presented here aims to evaluate the sensitivity of these results to a change in the model representation of the sea surface conditions.
For that, the HPE that occurred on 4 November 2011 over Genoa (Northwestern Italy) was simulated with the research model Meso-NH in a multi-scale set-up. A 2.5-km horizontal resolution simulation provides a fine description of the precipitating systems and their short-range moisture supply, while 2 larger-scale simulations enable to describe the moisture transport over 4 days and to identify the moisture sources. The larger-scale simulations were either forced by constant sea surface conditions provided by the OSTIA analysis or coupled with a one-dimensional oceanic mixed layer model initialised with the MERCATOR analysis. The moisture fluxes in both simulations were analysed thanks to lagrangian backward trajectories.
Both simulations differ mainly in the South of the Tyrrhenian Sea with a local change in the low-level flow due to local discrepancies of Sea Surface Temperature between OSTIA and MERCATOR analyses reaching about 4K. This change in the low-level flow induces an expansion of the transport of African air masses to-

wards Genoa. However, for both simulations, the HPE moisture supply remains mostly provided by the evaporation of the Mediterranean Sea within the last 3 to 4 days before the HPE, similarly to HPEs in Southeastern France (Duffourg and Ducrocq, 2011).

9:40-10:00: Frontogenesis in the meso-α and meso-β scales in the Mediterranean basin: From cloud arch to cloud cells

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Many regions in the Mediterranean basin could be considered as a frontogenesis area. Considering different temporal and spatial scales, clouds and sometime precipitation bands have been observed associated to fronts, formed by different mechanisms.
By using the version 3 of WRF mesoscale model two type of fronts, with different spatial and temporal scales, formed in the Mediterranean basin by different mechanism have been simulated to analyze the dynamical mechanisms in the front formation. The first selected front was formed over the West Mediterranean Sea on 25th August 2012, within the Meso-α scale according the classification of Orlanski (1975). The WRF simulation of this event shows a cold air mass from the northwest that increases their velocity in arriving to the gulf of Lion. The advection of this cold air formed a cold front over the gulf of Lion at noon on 25th, in which an arch cloud is detected in the visible channel of the Meteosat satellite. The front expands out offshore to the Southeast. The WRF simulation reproduces a weak cloud arc at this time with the cloud base around 700 m. However, a stronger second cloud arch is simulated in the evening, with the cloud base around 800 m, when the thermal difference between the north advected air mass and the Mediterranean air mass are higher.
The second selected example of frontogenesis occurred in the west coast of Greece during the night on 2nd October 2011 within the Meso β scale. The WRF simulation shows that the origin of this front is due to the interaction between cold drainage winds and the warm and wet Mediterranean air mass. A small convergence area was formed near the coastline that moved offshore. Over this convergence area, an individual precipitation cell was simulated, approximately at the same area and time that the reflectivity radar image shows a small precipitation area.

10:00-10:20: The 8 November 2011 medicane event: the roles of model physical parameterizations and upper-level dynamical forcing

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A Mediterranean cyclone developed on 8 November 2011 was classified as a tropical storm for the first time by NOAA. This tropical-like cyclone, or medicane, reached its mature state after passing through Majorca Island and then evolved towards the Gulf of Lion region where it dissipated. The event produced heavy rain over Southeast France, parts of Italy and Corsica. It was previously established that the MM5 numerical model, running at moderate horizontal resolutions, is able to simulate the subsynoptic cyclone and the disturbance general trajectory. This study aims to improve our current understanding of key factors involved on medicane development like air-sea interaction and synoptic scale dynamical forcing. To describe the air-sea interaction mechanism operating on this medicane, we test the role of the sea surface latent and sensible heat fluxes on its trajectory and intensity by running simulations switching these factors on and off. Additional numerical experiments with displaced, weakened or strengthened upper-level potential vorticity (PV) anomalies serve to analyse the connection between the medicane development and the dynamical forcing at synoptic scale.
Moreover, our regional ensemble prediction systems (EPSs) allow us to expand this study to a probabilistic framework. The ensembles generation method takes advantage of the connection between PV structures and cyclones, and of the different physical parameterization schemes available in the numerical model. Therefore, they are able to provide statistical information regarding the role of the physical parameterizations and the upper-level PV structures on the medicane trajectory and intensity.
The sensitivity experiments highlight the importance of the air-sea interaction and the synoptic scale dynamical forcing on the medicane development, both in terms of track and intensity. In fact, the tested EPSs are shown to take great advantage of this type of physical and dynamical dependences for a better forecast of medicanes in the short and mid range.

11:20-11:40: Dynamical dowscaling of IPSL-CM5 CMIP5 historical simulations over the Mediterranean: Benefits on the representation of regional surface winds and cyclogenesis

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The Mediterranean region is identified as one of the two main hot-spots of climate change and also known to have the highest concentration of cyclones in the world. These atmospheric features contribute significantly to the regional climate but they are not reproduced by the Atmosphere-Ocean General Circulation

Models (AOGCM), due to their coarse horizontal resolution, which have recently been run in the frame of the 5th Climate Model Intercomparison Project (CMIP5). This article investigates the benefit of dynamically downscaling the Institut Pierre Simon Laplace (IPSL) AOGCM (IPSL-CM5) historical simulation by the Weather and Research Forecasting (WRF) for the representation of the Mediterranean surface winds and cyclonic activity. Indeed, when considering IPSL-CM5 atmospheric fields, the dramatic underestimation of the cyclonic activity in the most cyclogenetic region of the world jeopardizes our ability to investigate in-depth the Mediterranean regional climate and trend in the context of global change.
The WRF model shows remarkable skill to reproduce regional cyclogenesis. Indeed, cyclones occurrence is quasi-absent in IPSL-CM5 data but when applying dynamical downscaling their spatial-temporal variability is very close to the re-analysis. This is a clear benefit of dynamical downscaling in regions of strong topographic forcing. This "steady"source of forcing allows the production of lee cyclogenesis and the development of strong cyclones, whatever the quality of the large-scale circulation provided at the WRF's boundaries by IPSL-CM5. However, dynamical downscaling still presents disadvantages as for instance the fact that large-scale inaccurate features of the IPSL-CM5 regional circulation are replicated by WRF due to the boundary controlled (small domain) simulation.

11:40-12:00: Temperature and precipitation trends for Catalonia as derived from dynamical downscaling of climate scenarios

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Complex topography regions, such as Catalonia, located in the Northwestern Mediterranean Basin, would benefit from high resolution climate projections in order to assess regional impacts and provide detailed information for decision makers. Dynamic downscaling techniques are applied in this study to derive temperature and precipitation trends for the 2011-2050 period, according to three different emissions scenarios: A1B, B1 and A2 (Nakienovi et al.; 2000). WRF-ARW mesoscale model is applied at high resolution, 10 km and 33 vertical sigma levels up to 10 hPa, to the nal domain of study covering the Catalonian region, forced by the global climate model ECHAM5/MPI-OM runs 1 and 3 from the Fourth IPCC assessment report. The modelling system is assessed for the 20th century (1971-2000) against observational data from the Meteorological Service of Catalonia. WRF-ARW predictions forced by ERA40 reanalyses provide temporal correlations up to 0.92 for annual mean temperature and 0.65 for annual mean accumulated precipitation. Future scenarios would suggest increases of annual mean temperature ranging from 0.6 to 2.2 $^{\circ}C$, depending on the location and scenario, and a slight general decrease in annual mean precipitation, up to 10%. Seasonal precipitation trends are quite uncertain, varying depending on the considered scenario. However, all simulations consistently show a seasonal precipitation decrease in the Pyrenees region, except for summertime. This work shows that high resolution dynamical downscaling allows identifying vulnerable areas to climate change within a region and the definition of patterns of mean temperature and precipitation change in future scenarios, providing fundamental information for mitigation and adaptation to climate change impacts.

12:00-12:20: Study of the nocturnal flows generated in the Northern Central Pyrenees through a high-resolution mesoscale simulation

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The area located north of the Central Pyrenees is selected to study the organization of terrain thermally-driven flows at lower levels. This is done through a mesoscale simulation using two nested domains, the outer one covering the Southwestern part of France at a resolution of two kilometres and the inner one over the Aure valley and the Lannemezan plateau at a resolution of 400 m.
Under anticyclonic conditions, locally generated thermally-driven flows dominate the circulations in the lower layers. Before sunset, downslope winds appear in the layers adjacent to the slopes whereas down-valley winds develop later, following the convergence of the downslope air that flows down the valley, in agreement with the available surface observations. Furthermore, the Aure valley is taken to study the organization of the flow inside a narrow mountain-valley. These effects are only properly reproduced at very high resolution and are very sensitive to the state of the surface.

12:20-12:40: Intercomparison and evaluation of dust prediction models

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The modelling of mineral dust often focusses on the understanding of the most outstanding dust events because they cause considerable damages on environment and health. In the European context, the desert dust transported from North Africa over European countries causes exceedances of the daily PM10 European air quality limit value (50 gm3), particularly in areas around the Mediterranean basin and Iberian Peninsula. The present contribution describes the intercomparison of dust prediction models carried out in the framework of the Sand and Dust Storm Warning Advisory and Assessment System (WMO SDS-WAS) Northern Africa, Middle East and Europe (NA-ME-E) Node (`http://sds-was.aemet.es`).
Seven modelling systems: BSC-DREAM8b, MACC, DREAM8-NMME-MACC, NMMB/BSC-Dust, MetUMTM, GEOS-5 and NGAC provide daily 72h-forecasts of surface concentration and dust optical depth at 550 nm for Northern Africa, Middle East and Europe. The forecast products include a joint visualization of model outputs, an evaluation system and the generation of multi-model products that are generated from the different model predictions. The performance of the median multi-model is assessed by comparing its evaluation scores with those of individual models. The range of variation of the models at every grid point is also displayed in order to evaluate the dispersion of the models and to allow identification of areas where there is a better agreement between the different model predictions.
The forecasts of dust optical depth are compared with the total aerosol optical depth (AOD) provided by the AERONET network for 36 selected dust-prone stations. The system produces near-real-time evaluation as well as monthly, seasonal and annual evaluation scores for the full domain, three sub-regions (Sahara-Sahel, Middle East and Mediterranean) and individual stations. Furthermore, a second level of model evaluation activities is conducted by means of study cases. The evaluation and analysis of 4 (BSC-DREAM8b, NMMB/BSC-Dust, MACC and MetUMTM) dust (regional and global) models is also shown in the present contribution for the case of the dust cloud that occurred in April 2011. The dust cloud was blown out over Morocco and Algeria on the 5th of April, reached the coast of Portugal and South-Western Spain the next day and it reached Scandinavia on April the 10th. The model evaluation includes in-situ measurements of surface concentration (PM10) and aerosol optical depth (AOD) as well as satellite-retrieved AOD (OMI and MODIS) and aerosol extinction profiles (CALIOP). The model intercomparison discussion will focus on the model capability to properly simulate a dust event which is directly linked to the accuracy of the computed saltation threshold velocity. In addition to the accuracy on the wind speed, the surface characteristics, which are never perfectly reproduced, also play an important role in the simulation of dust emissions. The evaluation of several models and eventual different model versions is crucial to understand the reason of individual model performance for an extreme dust event.

Poster Program

Block 1: Climatology

PB1.1: Influence of the WeMO and NAO decadal trends on the airborne pollen levels recorded in Catalonia (NW Mediterranean)

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Airborne pollen records constitute a powerful tool for different purposes. First, in studies of dispersion and source identification of pollen grains, which, incorporated into the atmosphere by anemophilous plants, produce allergic symptoms in a part of the population sensitive to it. On the other hand, aerobiological databases provide useful information for the understanding of the trends induced by the climate change. The decadal series allow the extraction of patterns with intra-annual variability (seasonality of the events and their relationship with the atmospheric transport patterns) and inter-annual variability (inter-annual trends and its possible relationship with climatic variability indexes). The longer the aerobiological monitoring series the better the understanding of the effects of climate change on pollination trends.
The aim of this study is to explore the influence of climate change on the airborne pollen series recorded in Catalonia during the period 1994-2012 by the analysis of its correlation with both, the *NAO* index and the new regional teleconnection *Western Mediterranean Oscillation (WeMO)*, defined within the synoptic framework of the western Mediterranean basin (Martín-Vide and Lopez-Bustins, 2006)

PB1.2: Effect of the ocean/atmosphere coupling and of the SST resolution on the location of heavy precipitation events in southern France

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The Mediterranean Sea is a key source of heat and humidity for convective mesoscale systems which generate intense precipitation on the Mediterranean coast during fall. A comparison between two 20-km resolution simulations with the atmospheric WRF model, one coupled with the 7km-resolution oceanic model NEMO-MED12 and one forced by the ERA-interim reanalyzed SST on the Aude case of intense precipitation on the 12-14 of November 1999 (Lebeaupin-Brossier et al., 2012) led to the identification of two phenomena:

A better resolution of the SST in the coupled model allows the representation of a cold SST anomaly in the Gulf of Lion which induces an easterly shift of precipitation compared to the uncoupled simulation.

- The ocean-atmosphere interactions allow the model to generate this anomaly during Mistral events occurring before heavy precipitation. The horizontal oceanic circulation in the Gulf of Lion permits the persistency of this anomaly for several days.

The study of this memory effect was extended to 22 cases of heavy precipitation events (HPE) over the Cvennes region between 1989 and 2008 in the coupled model WRF-NEMO MED12 and the forced model. Two conclusions have been drawn:

- The climatological SST mean difference over all the events between the coupled model and the forced model of $2°C$ in the Gulf of Lion generates a significant easterly shift of precipitation in the coupled simulation relative to the forced simulation in the composite of the 22 cases.

- 25% of the HPE are preceded by Mistral events within 10 days. In some cases, the wind and precipitation fields are affected by the SST, as in the case studied by (Lebeaupin-Brossier et al., 2012). In other cases, they remain unaffected. Analyzing the relative importance of synoptic conditions and local SST impact on the pressure field is a way of explaining the difference between these two scenarios.

PB1.3: Intense precipitation event affecting maritime regions across Italy and France

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RESMAR project, aiming to create a network for environmental protection in the "maritime area"across Italy and France (i.e. regions of Sardinia, Corsica, Liguria and Tuscany), is presented.
Specific attention is then posed to the project activity in the field of climatology, in particular a set of case studies are presented and described from the meteorological point of view.
Such cases affected most of the focal area, as for example the recent "flood of Genoa"(November 2011) that impacted upon Corsica, Tuscany and Sardinia, or the "flood of SE Corsica"(novembre 1993) that impacted upon Sardinia and Liguria, as well. They can then become a transnational approach to study intense meteorological events affecting this geographically complex region.
For each case-study attention is devoted to the meteorological evolution at synoptic-scale situation and to mesoscale or local scale ground effects. Project RESMAR is partly funded by the Operational Programme "Italy-France Maritime"of the E.U.

PB1.4: Assessment of climate models with ISCCP over the Mediterranean Sea

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Clouds are an important regulator of climate due to their influence on the water balance of the atmosphere and their interaction with solar and infrared radiation. At any time, clouds cover a great percentage of the Earth's surface but their distribution is very irregular along time and space, which makes the evaluation of their influence on climate a difficult task. At present there are few studies related to cloud cover comparing current climate models with observational data.
In this study, the database of monthly cloud cover provided by the International Satellite Cloud Climatology Project (ISCCP) has been chosen as a reference against which we compare the output of ECHAM climate models, from the Max Planck Institute (MPI), on the domain South-Europe-Mediterranean (SEM) established by the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2007). The study covers the period between 1984 and 2009, and the performance of cloud cover estimations for seasons has also been studied. To quantify the agreement between the databases we use two types of statistics: bias and SkillScore, which is based on the probability density functions (PDFs) of the databases (Maximo et al., 2007).
Results indicate that there are areas where the models accurately describe what it is observed by ISCCP, for some periods of the year (e.g. Northern Africa, for autumn), compared to other areas and periods for which

the agreement is lower (Iberian Peninsula in winter and the Black Sea for the summer months). However this difference should be attributed not only to the limitations of climate models, but possibly also to the data provided by ISCCP.

PB1.5: Statistical study of UVB and Global solar radiation from ten years of data of the Spanish Radiomeric Network

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UVB radiation has many harmful effects on alive beings. On humans, it acts mainly on the skin (Diffey, 1998; Gallagher and Lee, 2006), eyes (Lonsberry et al., 2008, Roberts, 2001) and immune system (Norval, 2001, 2006). It has also an influence on plants (Kunz, 2006, Li et al., 2010) and animals (Pahkala et al., 2003; Sinha and Hader, 2002). UVB also has effects on the degradation of building materials, particularly plastics (Verbeek et al., 2011; Liu and Harrocks, 2002) and paintings (Johnson and McIntyre, 1996; Allen, 2008).
The Spanish Meteorological network has different measures of atmospheric parameters, including UVB radiation and global radiation. This paper presents a study of incident UVB solar radiation and its relation with solar radiation measured in the whole spectral band (broadband solar radiation). The study has been made employing data corresponding to 10 years obtained by the national radiometric network stations. It includes records of 16 stations spread throughout the Iberian Peninsula, Baleares and Canarias Islands. The results are extensible to other locations at similar latitudes.
In the comparison of broadband and UVB measurements, hourly data of both magnitudes have been used. A study of monthly mean values has also been made in order to investigate the seasonal dependence of both magnitudes. The principal aim is to establish a relationship with the local characteristics considering coastal or continental situation.

PB1.6: Climatological characterization of the "Ora del Garda"wind in the Alps

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The present study investigates a coupled lake and valley breeze, named "Ora del Garda", by means of the analysis of a dataset from surface weather stations. During clear sky days, in the warm season, the Ora del Garda arises in the morning from the northern shorelines of Lake Garda, in the southern Italian Alps, and channels northward into the Sarca Valley and the Lakes Valley nearby. In the early afternoon it reaches the Adige Valley through an elevated saddle and it mixes up with the local up-valley wind, producing a strong and gusty flow. The analysis of data from surface weather stations located on the valley floor of the Sarca, Lakes and Adige valleys allows to identify some typical features of the wind development. The arrival of the lake breeze front is clearly marked by a sudden increase of the wind from south in the basin of Arco-Riva, immediately north of the lake, while the propagation of the front in the Sarca and Lakes valleys cannot always be clearly detected, being the arrival of the lake breeze masked in some days by the presence of a pre-existing valley wind. However the arrival of the lake breeze is marked by a characteristic temperature drop, which can be detected also in the Adige Valley. Furthermore it is found that the onset of the Ora del Garda is progressively delayed from spring to summer, probably due to the heating of the lake water surface during the warm season and hence the reduced contrasts with surface air temperatures over land.

PB1.7: Does the WeMO index affect the precipitation amount and chemistry in the north-eastern Iberian Peninsula?

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Modifications in the wind circulation and precipitation patterns have been predicted for the Mediterranean region linked to climate change. The amplitude Mediterranean basin favours the presence of a synchronised but opposed behaviour by atmospheric dynamics between its eastern and western sub-basis. The proposal of a new regional teleconnection pattern, the Western Mediterranean Oscillation (WeMO) (Martin-Vide and Lopez-Bustins, 2006), only defined within the synoptic framework of the western Mediterranean basin and its vicinities has attracted much recent interest as a possible indicator of trends in global climate change. The positive phase of the WeMO corresponds to the anticyclone over the Azores enclosing the south-west Iberian quadrant and low-pressures in the Liguria Gulf; and its negative phase coincides with central European anticyclone located north of the Italian peninsula and a low-pressure centre often cut off from northern latitudes, in

the framework of the Iberia south-west.
At a site in the north-eastern Iberian Peninsula (Montseny mountains, 41°46'N, 2°21'E, 700 m.a.s.l) the precipitation chemistry has been analyzed since the early 1980s. We explore here whether the WeMO index has had an effect on the precipitation amount and precipitation chemical signal of air masses distinguished by cluster analysis during the last 25 years.

PB1.8: Future variability of droughts in Catalonia, northwestern Mediterranean Basin

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We attempt to analyze the magnitude and frequency of long-term droughts throughout the current century in Catalonia (northern Iberian Peninsula). This northwestern Mediterranean region has recently suffered one of the most extreme droughts (2006-2008) in the last few decades. This calls for further study of future perspectives of drought variability at the local scale. We selected three medium-sized catchments on the Catalan littoral: Fluvià, Tordera and Siurana. They are quite similar in area and present a wide range of topographic, climatic and environmental conditions, land uses and water demands and have almost no regulation in channel runoffs.
We employed both instrumental and simulated temperature and rainfall data to calculate two multiscalar drought indices: the SPI (Standardized Precipitation Index) (McKee et al., 1995) and the SPEI (Standardized Precipitation Evapotranspiration Index) (Vicente-Serrano et al., 2010). Our instrumental data consisted of several weather stations for each catchment for a recent period: 1984-2008. Future projections, 1984-2100, were extracted from a dynamical downscaling procedure at a 15-km horizontal grid resolution, nesting the mesoscale model MM5 into the atmosphere-ocean coupled model ECHAM5/MPI-OM (Cunillera and Barrera-Escoda, 2011). We calculated 24-month SPI and SPEI values for the future series and there is no doubt about the important role of temperature and its implications on potential evapotranspiration (PET) with regard to assessing future water resource availability in climatic conditions.
No changes were found in drought variability for the near future. For the mid-century, high climatic variability was detected. At the end of the present century, we generally detected, particularly in the dry catchment of southern Catalonia, Siurana, more severe and longer droughts than in the last extreme dry episode in 2006-2008. There is a need to implement appropriate and specific adaptation strategies for water management of each catchment over the next few decades to reduce the risk of the forecasted drought conditions. It is likely that by the end of the century, overall water resource availability in Catalonia will not be guaranteed for many uses without full implementation of suitable hydrologic plans based on water saving, efficiency and reuse.

PB1.9: A stochastic Weather Generator for daily precipitation generation: a study case for Policoro - Basilicata Region (IT)

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The objective of this work is to analize the capability of a weather-generator based on a multivariate quasi-stationary and weakly depending stochastic process as a tool to take future decisions under the impact of a climate change at Basilicata country(IT).A Weather Generator, WG, is a statistical model to generate daily sequences of weather variables,such as precipitation,maximum and minimum temperature,humidity. Among the different WG available,a 'family of WG' are those built in a twostep processes,first-order Markov chain to generate daily precipitation occurrence and an exponential distribution to assign daily non-zero precipitation amounts up to a given threshold (Gaji-apka, M. (1), Cindri, K. (1), Brankovi, . (1) Castellví et al. 2003). Climgen is a widely used WG that belongs to this kind (Geng et al., 1986; Srikanthan and Mcmahon, 2001).However, the parameters implemented in Climgen as a default to generate daily precipitation are not reliable for the climate at Policoro. For this reason, the present study centers on precipitation and a new stochastic model has been proposed to generate daily amounts of precipitation that suits climate features at Policoro including variability in frequency of wet days in a month.The methodology was applied for ALSIA-stations that are well distributed in the study area in particular for Policoro station for which we have observed daily data of precipitation for the following period, 19512011.Statistical tests(K-S test and Student's t-test) were conducted to evaluate the capability in reproducing montlhly patterns which are maybe required for operational purposes in enginnering (Linacre, 1925; Castellví and Castillo 2001).The results obtained suggest that nearby Policoro a first-order Markov chain is capable to capture dry and wet spells, and that the single-parameter Weibull distribution function is suitable to generate the monthly amounts of precipitation. It was found that, despite the approaches implemented in Climgen are rough at Policoro, Climgen is capable to explain dry and wet spells, and the monthly amounts of precipitation. This issue is because the probability to have a dry day after a dry day is very high. For the proposed model and Climgen, it was found that the climatological-synthetic-series show the trend reported by the IPCC; that is, in the Mediterranean re-

gion the frequency and severity of droughts could increase in some areas as a results of a decrease in total rainfall and more frequent dry spells with potentially important implications for the agricultural irrigation systems of the river basin (IPCC, 2012). Therefore the models reproduces the main features of precipitation required for agricultural, forestry and civil planning uses with regard to take some decisions concerning on irrigation,potential agricultural productions, and managing the risk of extreme events and disasters due to climate change, such as frequency of drought or flood events.This study concludes that the proposed model captures key patterns of the precipitation at the surroundings of Policoro.Though further research is required, the performance obtained suggests that the model can be used in similar climates, such as the Mediterranean Region, and can be implemented in any two-step WG to provide synthetic series of primary weather data, such as minimum and maximum air temperature,solar radiation.

PB1.10: Changes in indices of precipitation extremes over the Croatian Adriatic in the near-future climate

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Five indices, calculated on annual basis, are used to assess the changes of extreme precipitation in future climate (2011-2040) relative to the reference climate (1961-1990) over the Croatian Adriatic: dry days (DD), simple daily intensity index (SDII), moderate wet days (R75), very wet days (R95) and precipitation fraction due to very wet days (R95T) (Gajić-Čapka and Cindrić, 2011). Reference and future climate simulations were made with the Regional Climate Model (RegCM3) which was driven by 3 members of the coupled atmosphere-ocean model ECHAM5-MPIOM ensemble (Branković et al., 2012). Future climate simulations were performed under the IPCC A2 emission scenario. Simulated extreme precipitation indices in the reference period are validated against observations from 19 meteorological stations. In the reference climate, simulated annual precipitation is underestimated in the northern and in the very southern region, while it is overestimated in the middle part of the eastern Adriatic. The SDII and DD indices are underestimated in RegCM3 simulations, while R95T, R75 and R95 are generally overestimated. Observed interannual variability is well captured by the model except for DD which is larger than observed. Simulated trends in indices of precipitation extremes agree in sign, but they are smaller in magnitude when compared with observed trends.
In future climate, annual precipitation is projected to decrease over a large part of the Croatian Adriatic, mainly because of an increased number of dry days. SDII does not change much except over isolated areas where it is projected to increase. For indices based on percentile thresholds, a reduction in R75 in future climate is seen only over a small part of the middle eastern Adriatic while changes in R95 are negligible. However, the fraction of precipitation from very wet days is projected to increase in some parts of the analysed area.

PB1.11: An improvement of AEMET operational methodology for the estimation of high wind gust areas for insurance applications of the CCS

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The CCS is the Spanish body that provides reinsurance to private insurance companies against meteorological phenomena that imply extraordinary risk. One of the extraordinary risks covered by the CCS is related to extraordinary winds defined as the wind gusts over 120 Km/h.
For about 2 years, the operational methodology carried out in AEMET for the estimation of high wind gusts areas applies the Universal Kriging interpolation technique to the observational data. The external variables that enter in the interpolation are the terrain elevation, the distance from the shore and wind gust outputs from HIRLAM 0.05 model. The objective of the procedure is to delimitate the areas with high wind gusts exceeding the limit of 120 Km/h.
In the course of previous investigations focused on studying the effect of the introduction of the HIRLAM model on the accuracy of this estimation technique, we carried out several validation analyses. These validations showed a systematic negative bias for estimated high wind gusts implying an underestimation of the high wind gusts by the operational methodology.
In this work a new interpolation methodology is presented which provides a significant improvement. It reduces the bias by about 50% at those stations that have maximum wind gust values above 80 Km/h.
The new methodology combines two interpolation fields. The first one is obtained applying the present operational methodology and includes all available observational data. The second one is obtained in a similar way but using only observational values from meteorological stations with high wind gusts. The combination of both fields is performed through a grid-point based weighting that depends on the local observation network density.

PB1.12: Establishing the drought trends in the Northern Africa by using dynamical downscaling

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Droughts are one of the most important natural hazards, as its effects are pervasive encompassing all the resources in the affected region. According to the IPCC AR4, climate change is projected to worsen conditions (high temperatures and droughts) in the Mediterranean region, already vulnerable to climate variability, and to reduced water availability, hydropower potential, summer tourism and, in general, crop production.
This work presents an assessment of drought patterns for simulations performed with WRF regional climate model (RCM) over the Mediterranean countries of northern Africa for present-day climate conditions. The existence of trends and other temporal patterns in drought indices have been investigated. Hence, the analysis described here calculates diverse drought indices for an integration of the period 1989-2010 performed with WRF-RCM for the African domain as defined in CORDEX project (Nikulin et al., 2012) and also using simulations from ESCENA initiative (Jiménez-Guerrero et al., 2012). The simulations were driven by ERA-Interim reanalysis to fit it as much as possible to the actual evolution of the climate in the recent past. The complexity of the area covered forces to use high horizontal resolution data to characterise accurately the drought patterns and evolution.
We focus on meteorological drought, for which a number of indicators have been included in this work, such as the Palmer Drought Severity Index (PDSI), the Standardized Precipitation Index (SPI) and some other indices derived from the ENSEMBLES project, such as the consecutive dry days (cdd). The results have been compared to those derived from the CRU database to assess the uncertainty of the simulation.

PB1.13: Variability of turbidity level in Girona, Spain

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An atmospheric turbidity index in a determined locality can be associated with the pollution level at that place. The aim of this research is to determine the temporal variation of the Linke turbidity factor at a Mediterranean site. The Linke turbidity factor describes the optical thickness of the atmosphere due to both the absorption and scattering by aerosol particles and the absorption by water vapor relative to a dry and clean atmosphere.
The study is based on measurements of global, diffuse and direct irradiance taken in Girona, Spain, between August 2000 and December 2012. The data was filtered to select only those values corresponding to cloudless sky conditions. Then, the Linke turbidity factor was estimated and the obtained values were analyzed both on monthly and seasonal basis, and separating morning and afternoon values. In addition, aerosol optical depth has been determined for morning and afternoon periods for a year of Multi-Filter Rotating Shadowband Radiometer (MFRSR) measurements. Moreover, precipitable water column has been also estimated from relative humidity and temperature data.
Seasonal (monthly) variations of the atmospheric turbidity are found, with a summer (July) maximum and a winter (January) minimum. We also note that spring values of the turbidity factor are closer to summer values and can be related to atmospheric aerosol load. The general features and characteristics of the findings and the possible relationships with MFRSR data are examined and discussed.
The strong correlation between atmospheric turbidity and water vapor is also treated: they coincide in the pronounced difference between the summer values (maximum) in comparison with the winter values (minimum).

PB1.14: Dry spell length distributions in the Mediterranean

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The Mediterranean is one of the regions of the world largely affected by the Climate Change. Long dry spells have been more frequent in last years, occurring not only in the southern Mediterranean countries, but extending to other neighbouring European regions characterised by a more regular regime of precipitation. A spatial and temporal analysis of the dry spell length (DSL) distributions is investigated for about 200 European stations close to the Mediterranean along the 1950-2000 period. A DSL is defined as the number of consecutive days with precipitation less than 0.1 mm/day. The spatial distribution of the longest and the 95th percentile dry spells are represented. The spatial gradient obtained is especially high in the southern Mediterranean countries, with values of longest dry spells above 160 days. For each station, the DSL cumulative distribution has been computed and several models tested. The L-skewness L-kurtosis diagram show that 85% of the stations follow a Pearson type-3, PE3, model. Only a few southern Mediterranean observatories fit better other models such as Weibull, Log-normal or Generalised Pareto, GP, distributions. When this same diagram is applied for the partial duration series (PDS) at 95th percentile, most of the stations follow a GP model. Only four observatories at the southeast Mediterranean coast notably depart from the expected GP model. Finally, DSL return period maps for 2, 10, 25 and 50 years are represented by taking into account PE3 parameters, when considering all DSL, and GP parameters, when considering the PDS.

PB1.15: Comparison between the cloud optical depth from the UV erythemal radiation and from the broadband solar radiation, during year 2011 in Valencia, Spain

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In this study the cloud optical depth from the UV erythemal solar radiation (UVER) is compared with the cloud optical depth from the broadband solar radiation during the year 2011 in Valencia, Spain. This analysis is made for overcast skies with low clouds. To obtain the cloud optical depth we have measured UVER, global radiation and cloud cover fraction and a multiple scattering model are been used.
Measurements of global UVER were taken using a broadband UVB-1 radiometer by Yankee Environmental Systems, which has a spectral range between 280 and 400 nm and has a spectral sensitivity close to the erythemal action spectrum. Global solar radiation measurements were registrated using a CM-6 pyranometer by Kipp & Zonen, which has a spectral range between 305 and 2800 nm. In order to collect data of cloud cover, an automatized sky camera SONA SIELTEC SL was used; it takes pictures of the total hemisphere.
The multiple scattering model SBDART was been used to calculate UVER and global solar radiation. The daily total ozone column was taken from OMI satellite and the daily average of aerosol optical depth and water vapor were measured with a CIMEL CE-318 Photometer.
The cloud optical depths have been calculated using a minimization method. The SBDART program is looping with different cloud optical depth values as long as the experimental UVER or global solar radiation and the radiation modeled by SBDART is less than 3%.
We have obtained a lineal correlation between the cloud optical depth from UVER and broadband solar radiation. Moreover the influence of several radiative parameters such as the simple scattering albedo or the cloud height has been analyzed as well.

PB1.16: Climate variability in the Mediterranean Sea over the last two millennia: of contribution PaleoMex/MISTRALS

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Two new high-resolution sea surface temperature (SST) time-series were generated from the shallow coastal shelf sediments of the Gulf of Lions and deeper Aegean Sea using alkenone paleothermometry. SST values were roughly $2°C$ warmer in the Eastern than Western Mediterranean sites in agreement with our knowledge of the production pattern of the main alkenone producer Emiliania huxleyi in the two basins. While distant from each other, the two site SST signals show some degree of similarity: increasing SSTs from $\sim$ 600 to 1300 AD followed by a significant cooling till the early 1600's marking the onset of an outstanding warm period reaching values similar to present day. After a sharp decrease ending around 1700 yrs AD, SSTs have been gradually rising ($\sim 1°C/100$ yrs) over the last three centuries. To our knowledge the latter feature has been undocumented in North Atlantic cores but often observed in paleoclimate reconstructions of the European climate, though with different regional rate and timing. This unexpected finding may reflect feedbacks from the surrounding land-masses contributing to "continentalize"the Mediterranean climate. Another notable feature is the short-lived $2°C$ cooling seen in the Aegean record between 1816 and 1824 yr AD possibly expressing surface ocean cooling subsequent to the Tambora volcanic eruption of 1815 yrs AD.

Block 2: Processes and Applications

PB2.1: Integrated environmental and Meteorological forecasting and Alert System (SIAM). Air quality, Meteorological and Oceanic applications.

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SIAM is an integrated prediction-alert system which provides environmental information. The aim of this system is to provide prediction and hindcast products operationally in order to alert the exceedance of critical thresholds in different meteorological dependent fields. The basis of this system is the coupling of meteorological models with applied models providing information organized in different units based on the field application.
SIAM tool has been developed in order to help performing a better management of the impacts and the conflictive situations that different environmental phenomena may cause, and to be a warning communication system

to authorities and population of health and environmental risks.
SIAM provides high-quality forecast and alerts with different resolutions. SIAM can trigger alerts in case that extreme events or exceedences happen. The system lets to planning and managing production, human resources and activities. SIAM tool is applicable anywhere in the world and configurable in any language.
In this contribution we examine the ability of the modelling system to forecast the air quality and different meteorological and oceanic variables.
To this end, the Weather Research and Forecasting (WRF, Skamarock and Klemp, 2008) modelling system is coupled to: an emission model, the Air Emission Model of Meteosim; to the Community Multiscale Air Quality (CMAQ, Byun and Ching, 1999) modelling system; to the wave model Wave Watch III (WWIII, Tolman, 1991); to a specialized shallow-water wave model, the Simulating Waves Nearshore (SWAN, Booij et al., 1999); and to the Regional Oceanic Modelling System (ROMS, Shchepetkin and McWilliams, 2005).
SIAM is applied in different Mediterranean regions obtaining different variables: temperature, cloud cover, precipitation, wind, relative humidity, air quality concentrations (NO_2, O_3, PM10, CO and SO_2), wave and surface currents. The outputs of the modelling system are compared with measurement data from buoys, meteorological and air quality stations.

PB2.2: Sensitivity of a spatially-explicit fire model to wind data: a comparison of two downscaling methods in a Mediterranean fire-prone landscape (Valencia, Eastern Spain)

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In Spain, as in most northern Mediterranean countries, wildfires have become one major cause of landscape degradation. The magnitude of the problem will likely be enhanced by climatic change, making necessary the implementation of landscape-level designed mitigation and adaptation strategies. Such management efforts require a careful planning based on a better understanding of how fire may respond at that operational level to changes in both vegetation (i.e. fuel) and climatic/weather conditions.
Spatially-explicit fire models, such as FARSITE (Finney, 1998), allow to project fire growth and behavior of hypothetical fires through real landscapes. The reliability of their predictions depends particularly on the accuracy and spatial resolution of both the fuel-and wind-related inputs.
In July 2009, large wildfires broke out across Mediterranean basin. Strong and variable winds during a hot dry period increased the chances of fires. We chose that past weather extreme to quantify the effect that different downscaling approaches (statistical and dynamic) have on the simulation of fire on complex terrain, i.e. the Ayora site (Valencia, eastern Spain).
Statistical analogue downscaling was carried out for two locations. Dynamic downscaling was performed using a mesoscale model, RAMS (Pielke et al. 1992), and implementing a high spatial (1 km) and temporal (1 hour) resolution configuration using four 2-way nested grids covering the entire site.
The resulting two weather datasets allowed the creation of the corresponding wind files (speed, direction) required by FARSITE. Two sets of random fires were simulated with FARSITE combining current fuel scenario and the wind files derived from each downscaling. Preliminary results confirm that FARSITE is highly sensitive to the wind-related inputs. Its predictions may be, thus, strongly influenced by the selected wind downscaling method. This has to be considered when promoting the use of fire modelling as a fire management supportive tool in Mediterranean landscapes under global change.

PB2.3: Assessing the air quality impact of harbor emissions in a Mediterranean coastal city

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Harbours represent a significant driving force for the economic development all over the Mediterranean basin, but they also have a potential negative environmental impact due to multiple emission sources (e.g. Pay et al., 2010). The presence of competing activities in coastal areas can lead to potential conflicts, which need to be managed by the institutional bodies. In this sense, the main objective of this work is to develop, tune and apply a regional air quality modeling system for the city of Cartagena (Spain), which hosts one of the largest harbours in the Spanish Levantine coast. The selected modeling system is MM5-CHIMERE, applied with a resolution of 1 km for the entire region of southeastern Spain. To characterise the emissions in the harbour of Cartagena, the Techne (1998) detailed methodology has been applied, considering the emissions generated by three different operation modes: (1) maneuvering, that includes the operations of entrance and exit to the harbour; (2) hotelling refers to the stay of the ship in the harbour where emissions are generated due to lighting, heating, refrigeration, ventilation, etc; and (3) tank loading and offloading. The spatial allocation distinguishes between harbour and maneuvering emissions.
The results of the work assess the impacts of the maritime activities on the levels of atmospheric pollutants in the target region (Cartagena and downwind areas) and compares the modeled values with those values set in the

European regulations (Directive 2008/50/CE). A sensitivity analysis performed when zeroing-out the emissions of the harbour indicates that Cartagena-downwind presents high levels of air pollutants (especially SO_2 and NO_x) caused by a large contribution of maritime activities. This poor air quality must be substantially improved with subsequent management strategies.
With respect to the exceedances of the alert and information thresholds, limit values, target values and assessment thresholds in Cartagena are caused by harbour emissions, the main problems being related to the exceedance of the limit value for 1-hr NO_2 and daily limit values for particulate matter (PM10).

PB2.4: Formation and development of a heavy precipitation event in the Southern Adriatic area

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The event analyzed in this paper is geographically focused on the southern part of the eastern Adriatic region. The area is prone to relatively frequent heavy precipitation in autumn and winter, with annual amounts of precipitation higher than 5000 mm, being one of the rainiest parts of Europe. The aim of this study is to identify mesoscale features and mechanisms responsible for the extreme precipitation event, as a contribution to understanding the factors which cause that climatic maximums of the annual precipitation amounts located over this region. The event occurred during the morning hours on 22 November 2010 over Dubrovnik coast, Croatia and the hinterland mountain range of the southern Dinaric Alps. A peak intensity of 145.5 mm was registered in the four-hour period. The mechanisms responsible for this event were analyzed through synop measurements, satellite data and convection-permitting numerical experiments performed with the WRF model. The formation and development of the precipitation system was supported by the positive temperature and PV advection associated with very strong large-scale ascent over the southern Italy and southern Adriatic. The numerical simulations highlighted the essential role of southerly low-level jet stream (LLJS) in the transport of warm and moist air towards the affected area. The convergence of two branches of low-level marine air favored convection triggering over the coast and sea. Persisting for about four hours, the convergence line contributed to large precipitation amounts in the Southern Adriatic area. Numerical sensitivity experiments suggested that the orography of Dinaric Alps had an essential role for precipitation maximum over the mountainous hinterland, but also that the orography was not the crucial factor for the heavy precipitation near Dubrovnik. This study highlights the need for a dense network of observations, especially radar measurements, to validate the simulated mechanisms and improve the numerical forecasts through data assimilation.

PB2.5: The bora flow over the complex orography of the Mid-Adriatic region

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While severe northern-Adriatic downslope windstorms are since long in the research focus, strong bora winds in the hinterland of mid-Adriatic coast are much less studied, yet frequent phenomenon in the region. The predictability of these events is considerably lower than for its northern counterpart due to the flow complexity induced by the chain of secondary orographic mountain sub-ranges and deep valleys.
A late winter strong anticyclonic bora event in the mid-Adriatic was analyzed with the use of measurements and numerical sensitivity experiments carried out with the WRF model. The analysis used wind tower measurements at 10 m, 22 m and 40 m levels above the ground at 5 Hz sampling frequency. The WRF model was configured with grid spacings ranging from 9 km in the outermost domain telescoping to 333 m in the innermost domain.
The three-dimensional bora flow in the mid-Adriatic had a pronounced directional vertical wind shear within the bora layer, while valley circulations interacted with the near-surface bora flow in deep valleys. The strongest observed wind speed pulsations had periods of 7 11 minutes and were found to originate near the primary mountain wave region. The pulsations propagated far away from the point of origin during the daytime convective boundary layer, but were quickly dissipated during the stable nighttime conditions. The secondary orography had a crucial role on the propagation of the bora flows away from the primary mountain range, and apparently promoted the hydraulic-jump type of flow recovery. Finally, main differences in the bora subtle structure there and over the northern areas, the latter pertaining to more known bora cases, are pointed out.

PB2.6: Characterization of the sea-breeze in the island of Mallorca

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The breeze in Mallorca is studied combining climatology, satellite and surface observations and mesoscale modelling. The size and topography of the island make that there is convergence of breezes in the centre of the island, the main ones coming from the basins of Palma

and Campos in the South, and of Alcudia in the North. The circulation is inverted during night-time. The topography and the shape of the coast play a major role in the evolution of the sea breeze, which, at the south keeps the direction almost constant along the day.
The Campos basin is further analyzed (4-6 June 2010) and it is possible to describe the diurnal cycle of the breeze with three stages. At around 1030 UTC the wind suddenly turns to the sea breeze direction and the wind increases fast. The steady state phase is between 1200 and 1500 UTC when the sea breeze has a maximum of wind speed of about 8 m/s at around 200 m (above the ground) and with a vertical depth of 600 m. In the afternoon, the breeze weakens at around 1600 UTC up to 1900 UTC, at a lower rate than during the formation. The turning of the wind towards the land breeze direction starts at lower levels at around 2100 UTC, while the surface temperature cools down. The importance of the shape of the basin as well as the surface characteristics is also evaluated.

PB2.7: Characterizing the sources of future air pollution over the Mediterranean basin through sensitivity analysis

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Chemistry transport models (CTMs) play a key role in assessing and understanding the atmospheric emissions abatement plans through the use of sensitivity analysis approaches for the source apportionment of air pollution (Koo et al., 2009). Since the management strategies of air pollution emissions is one of the predominant factors for controlling future air quality, this work assesses the impact of various emission reduction scenarios in the air pollution levels over the Mediterranean Basin under a climate change scenario through a zero-out methodology of source apportionment. The modelling system includes the use of a climate version of the meteorological model MM5 off-line coupled to the CHIMERE chemistry transport model (as described in Jiménez-Guerrero et al., 2011). Experiments range the periods 1971-2000, as a reference, and 2031-2050, as a future enhanced greenhouse gas and aerosol scenario (SRES A2). The atmospheric simulations have a horizontal resolution of 25 km and 23 vertical layers up to 100 hPa, and were driven by the global climate model ECHAM5. In order to represent the sensitivity of the chemistry and transport of aerosols, tropospheric ozone and other photochemical species, several hypothetical scenarios of emission control and zero-out emissions have been implemented to quantify the influence of different emission sources in the area of the Mediterranean basin.
Results depict that the system is able to characterise the exceedances occurring in Europe. The sensitivity analysis indicates that large reductions of precursors emissions are needed in all the scenarios examined to meet the thresholds set in the European Directive, especially related to on-road traffic, power plants and maritime activities. Results also unveil the propagation of uncertainties from the meteorological projections into future air quality and claim for future studies aimed at deepening the knowledge about the parameterised processes and the definition of emissions.

PB2.8: Spatial patterns of water vapor variability on the Mediterranean Sea

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In this study we present the spatiotemporal variability of total column of precipitable water in the whole Mediterranean basin. This kind of studies are relevant for distinguish some of the feedbacks driving climate change in both the Western and the Eastern Mediterranean Basins (WMB and EMB respectively) as, e.g., precipitation regimes, secondary pollutant production, ventilation conditions, etc. The dataset used is provided by the MODIS instrument on board the Terra Satellite: IR Total column precipitable water with the time pass over the Mediterranean at 11:00 h. In this study we have used an eleven-year period (2000-2010).
To show water vapour spatial patterns, we have combined some different statistical techniques. The empirical orthogonal function (EOF) and the regression box are used to highlight the different spatial behaviour of the total column of precipitable water vapor, comparing the WMB and the EMB. In this study, on one hand, we show how the first component (EOF1) is related with annual variability and it extends over the whole Mediterranean sea; whereas, on the other hand, the second component (EOF2) is associated with a semi-annual cycle and shows a completely differentiated pattern between the WMB and the EMB. Both components explain the 74% of the total variability in the datasets. Additionally, this study shows the water vapor cycles (or periodicities), both in the WMB and the EMB, using a numeric methodology based in a parametric reconstruction of harmonics of non-steady and noisy time series (Palau and Rovira, 2012). This latter result remarks the spatial and seasonal differences, between both Mediterranean basins, that are in good agreement with previous short-term field campaigns and mesoscale modelling studies on the area.

PB2.9: Average spatial distribution and temporal variability of NO_2 on the Valencia area (Spain)

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Some meso-meteorological peculiarities in the Mediterranean Basin have been evidenced regarding processes responsible of air quality. Specifically it has been documented how, on one hand, the atmospheric flow regimes in the Western Mediterranean Basin favours, during most part of the year, the accumulation of water vapour and atmospheric pollutants (Palau et al. 2009, TRANSREG and MODELISMOS projects), and, on the other hand, how this accumulation can determine not only rainfall but also modify the prevailing chemical mechanisms under those weather conditions (CIRCE project; Millán et al. 2009).
In this context, MODELISMOS project is currently being developed. The main objective of this project is to deepen the knowledge of the seasonal variability of the mesometeorological processes responsible for the accumulation of air pollutants on the Mediterranean coasts of the Iberian Peninsula, and its influence on the prevailing chemical degradation mechanisms under winter and summer meteorological conditions.
The intensive field campaigns carried out in Valencia (Spain) during the last years (TRANSREG and MODELISMOS projects) evidence some meso-meteorological peculiarities regarding meteorological processes responsible of air quality in the Turia basin. Measurements were performed using instrumented (mobile) vehicles measuring simultaneously SO_2, NO_2 and O_3, and one radiosounding system instrumented with meteorological and ozone sensors. All these measures constitute a big experimental database of atmospheric pollutants around the Valencia conurbation obtained under different meteorological conditions throughout the six years.
In this study we show, using this experimental database, the average spatial distribution and the temporal variability of NO_2 on the Valencia area: Valencia harbour Valencia city Valencia conurbation. Furthermore, in this work, we present the daily cycle of the urban plume integral advection under summer weather conditions and also the quantification of the apportionment of NO_2 emitted from each one of the three NO_2 sources (harbour, city and conurbation).

PB2.10: Fine-scale numerical study of the 27/10/2011 and the 03/11/2011 Heavy Precipitating Events over Catalonia and Andorra

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During the first week of November 2011, various regions all over the whole Northwestern Mediterranean region were affected by successive Heavy Precipitating Events (HPE). On November 3, while persistent orographic precipitation affected the French Cevennes region with 24-h accumulated rainfall exceeding 400 mm, quasi-stationary heavy precipitating systems also developed over Northeastern Iberian Peninsula. 24-h rainfall accumulations of more than 200 mm were observed over central Catalonia, of more than 300 mm at the Spanish-French border and of almost 100 mm over Andorra (Pyrenees). On October 27, a similar HPE over Catalonia occurred. This post-event study aims at identifying the meteorological ingredients and mechanisms favouring the development and stationarity of the precipitating systems over Catalonia for these 2 HPEs and examining their representation in the numerical simulations.
Numerical simulations of the HPE have been performed with the Meso-NH research model at 2.5 km resolution. The simulations were initialised and coupled with the AROME-WMED analyses (2.5 km). This version of the Mto-France convective-scale operational NWP (Numerical Weather Prediction) modelling system AROME was developed specifically for the HyMeX campaign and covers the whole Western Mediterranean basin. Firstly the performance of the Meso-NH simulations is examined, especially in terms of quantitative precipitation forecast (QPF), chronology and localisation, by comparing to the observations recorded by the French and Catalan radar and raingauge networks. The ingredients and mechanisms involved in the triggering and maintain of the simulated precipitating systems are then analysed thanks to Meso-NH tools (diagnoses, backward trajectories).

PB2.11: Influence of winter and summer meteorological conditions on chemical reaction mechanisms and generation of secondary products: simulations at the EUPHORE chamber

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Field measurements give on-site information about the state of the atmosphere under certain meteorological conditions on a specific time and location. But the atmosphere is a highly complicated reactive system on which many processes (transport, accumulation of pollutants, deposition, chemical reaction, etc) affected by weather conditions happen at the same time. For this reason, to study any of these processes separately, simulation chambers play an important role, because they allow recreating atmospheric environments under controlled experimental conditions.
In this sense, the EUropean PHOtoREactor (EUPHORE, Valencia-Spain) is one of the major outdoor simulation chambers (2x200 m^3) on investigation into the photochemical degradation of atmospheric pollutants and generated products. These simulation chambers are equipped with a broad number of analytical instruments in order to analyze VOCs, O_3, NO, NO_2,

PAN, hydroperoxides and organic acids.
Within the MODELISMOS project (Modelling and analysis of mesometeorological processes on transport and accumulation of pollutants in the Western Mediterranean and their influence on chemical degradation mechanisms) two different campaigns, the first one in winter-(February 2012) and the second one in summer (September 2012), were carried out at the EUPHORE simulation chambers to study the influence of the meteorological conditions (temperature, relative humidity and radiation) on the chemical reaction mechanisms in the atmosphere. The reactants and experimental conditions used were based on the field measurements performed along the Turia river (Valencia- Western Mediterranean) during 2011.
In this work, some of the results obtained in both campaigns regarding reactants degradation and formation of secondary pollutants like ozone, PAN, glyoxal, methylglyoxal, OH and HO_2 radicals, etc, are presented. Moreover, to evaluate the degradation mechanisms involved, the results of some simulations executed using the Master Chemical Mechanism (MCM, University of Leeds-UK) are included.

PB2.12: Field measurements of volatile organic compounds in the Mediterranean side of the Iberian Peninsula under winter and summer meteorological conditions

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Pollutants are emitted into the troposphere as a result of human activity and natural sources. Once emitted, these compounds undergo physical and chemical changes that result in the formation of other secondary pollutants that may be even more harmful than their predecessors. These transformations are strongly affected by the meteorological conditions (vertical stratification, pressure, temperature, cloud cover, radiation, season, location, etc).
With the aim of characterizing the main air pollutants (anthropogenic, biogenic and secondary reaction products) present in the Mediterranean coast of the Iberian Peninsula under different meteorological conditions, within the framework of the MODELISMOS project (Modelling and analysis of mesometeorological processes on transport and accumulation of pollutants in the Western Mediterranean and their influence on chemical degradation mechanisms) two field campaigns in winter (February 2011) and summer (June 2011) were performed.
Specifically, these field campaigns were carried out around the city of Valencia where under sea breeze conditions the anthropogenic emissions coming from the city are driven inland through the Turia's River Basin. During the way, the biogenic emissions coming mainly from orange trees are incorporated into the air mass. For the measurement of Volatile Organic Compounds (VOC's) and its degradation products, three sampling points at Valencia, Paterna and Villar del Arzobispo using C-18, DNPH and XAD2 cartridges were established. In this work the main results regarding VOC's detected on the air samples taken during the winter and summer campaigns, and the main differences observed during both seasons are presented. The main compounds detected were acids, alcohols, aldehydes, alkanes, aromatics, ketones and monoterpenes. According to this chemical speciation differences between winter and summer results are discussed.

PB2.13: Pesticides dispersion: a case study in the Valencian region

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Pesticides are widely used in agriculture and gardening. The majority of the pesticides used nowadays have short or at least medium half-lives in the atmosphere. However, atmosphere is an important transport medium for pesticides and their degradation products. The potential for the long or short transport of pesticides in the atmosphere depend on their half-lives
Within IMPESTAT project, a monitoring study carried out in several locations at the Valencian Region to study the presence of selected pesticides and their seasonal behavior, some pesticides have been detected in a remote site in the gas-phase. Transport from other agricultural areas was the most likely option for justifying the presence of the pesticides in the remote site.
In this work, some model results for the transport of pesticides measured in some locations are presented. Simulation have been done considering two points of emission, for what field data have been obtained, during a specific period of 2009. Model used was the Regional Atmospheric Modelling System (RAMS version 6.0) with a validated configuration for the Mediterranean region, together with the RAMS Hybrid Particle and Concentration Transport model (HYPACT version 1.5.0). With this study of high-resolution dispersion modeling, an estimation of the dispersion and fate of selected gas-phase pesticides was carried out.

Block 3: Remote and in situ measurements

PB3.1: Realistic climate phenomena

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Climate changes refer to the global changes of Earth climate at different spatial and historical-temporal scales,

with respect to one or more environmental and climate parameters: temperature, precipitation, cloudiness, etc. They are due to natural causes, although in the last 150 years much of the scientific community considers them to be also due to human action, in the form of greenhouse effect alteration, whose exact influence on climate is still partly subject of heated scientific debates. In the Earth evolution, climate has undergone several cyclical variations, from the cold of the ice ages to long periods of heat and vice versa. Variations of so-called systematic forcings, such as solar activity, Earth orbit, continents arrangement, atmosphere composition, ocean currents, which can change the energy distribution thus altering the global climate, contribute to climate change. In several instances the human influence on climate is considered an external forcing because its influence is more systematic than chaotic. A large number of neither systematic nor chaotic phenomena are found among the internal causes. This group also includes the factors that amplify or reduce the underway changes in form of retroactive feedback. Climate change is systematic or chaotic depending on the dominant factors. It especially depends on the time scale of observation, since regular low frequency variations could be hidden in chaotic high frequency variations or vice versa. Instead, according to some researchers, a global cooling would be occurring. Scientists in support of this theory attribute it to sunspots activity, recently decreased, challenging the theory of anthropogenic global warming, arguing instead that the heating and cooling phases are alternated according to the solar surface activity. To reinforce this theory the different behavior of the Arctic and Antarctic ice is taken into account.

PB3.2: Comparative performance analysis of surface energy balance residual models

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The objective of the present work is to compare the performance of three different residual models for the retrieval of surface energy fluxes and actual evapotranspiration from satellite images and in situ measurements. The residual models are based on the energy balance equation, from which, once evaluated the net radiation and sensible and soil heat fluxes, the latent heat flux, and therefore the evapotranspiration, is obtained as the residual term of the equation. Particularly, in the present work, METRIC, STSEB and revised 3T models are applied to the Landsat satellite image of the Ionian coast of the Basilicata region (South Italy) corresponding to 26 September 1999. In the METRIC model, which is an evolution of the SEBAL (Bastiaanssen et al., 1998a,b), the sensible heat flux, H, is calculated as a function of the one dimensional aerodynamic temperature gradient, dT, based on the heat transport equation and on a linear relationship between dT and the surface temperature, Ts. In the STSEB (Sánchez et al., 2008b) the total sensible heat flux, H, is obtained by combining the contributions of bare soil, Hs, and vegetation cover, Hc, proportionally to their respective areas. The characterization of land use and vegetation cover is based on a pixel-oriented supervised classification of the study area (Scavone et al., 2012). In the revised 3T model (Xiong and Qiu, 2011) the components of energy balance equation are divided into bare soil (evaporation) and vegetation cover (transpiration) contributions, as a function of three temperatures: the land surface temperature (LST), the air temperature, Ta, and the reference soil and vegetation temperatures, Ts and Tc, defined as the maximum temperatures of bare soil and canopy pixels in the study area. Particularly, for the LST evaluation, Qin et al. (2001) model is here applied (Copertino et al., 2012). The results of the three applied models are subsequently compared each other and with the evapotranspiration measurements provided by a weighing lysimeter located in Policoro. The three models show a good performance, providing evapotranspiration values very closed to the measured ones ($\pm$ 0.5 $mmday^{-1}$, although METRIC and revised 3T show greater accuracy than STSEB.

PB3.3: Effect of the soil emissivity anisotropy on the surface temperature and energy balance from remote sensing under different moisture conditions

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Accurate knowledge of emissivity is essential to retrieve precise values of Land surface temperature (LST) or outgoing longwave radiation (F), key parameters for many environmental studies or climatologic models. Present study deals with the effect produced on zenithal (θ) variation of relative-to-nadir emissivity (ε_r), when soil moisture (SM) content of a wide variety of inorganic bare soils, characterized by its physical and chemical soil properties, is changing. To retrieve ε_r a goniometer assembly was used, together with two identical CIMEL CE312-2 thermal radiometers, to perform simultaneous angular measurements at different combinations of zenith and azimuth angles. Results showed that ε is almost constant, independently of SM for θ <30° at 8-9.4 μm and for θ <50° at 10-12 μm and 7.7-14.1 μm spectral ranges. Significant decreases of ε_r with θ range from 0.010 to 0.132 at 8-9.4 μm and from 0.010 to 0.049 at 10-12 μm and 7.7-14.1 μm at high θ values. Finally, the impact of ignoring ε angular effects on the retrievals of LST, using split-window-type algorithms, and of F, was analyzed. Results showed systematic errors ranging between $\pm$ 0.4 K to $\pm$ 1.3 K for atmospheres with

water vapor values lower than 4 cm in the case of LST, and errors between 2%-8%, in the estimation of different terms of the surface energy balance.

PB3.4: Atmospheric scenarios of acid rain on the Mediterranean slope of the Iberian System

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The knowledge of the atmospheric scenario constitutes one of the foundations of the environmental analysis. Everything that can be said regarding the quality of the air and the waters will be exposed to serious errors if they are not part of a rigorous determination of the atmospheric scene. Not in vain this is the environment in which atmospheric pollutants are injected, transformed, disseminated and precipitated. These processes are specially pronounced in episodes of acid rain, which occur when the emissions of SO_2, and NO_x interact in the atmosphere with water, oxygen and other chemical species to form acid compounds. This acidification passes from the atmosphere to the soils and can explain the phytotoxic damage that has been observed in certain forest masses. All this takes a special significance in a region of very complicated orography as the Mediterranean slope of the Iberian System and where between 1979 and 1980 the C. T. of ENDESA started operating in Andorra (1.05 GW). The main fuel of the thermal plant consists of the lignite and coal bituminous black of the own town of Andorra and nearby areas, with a sulfur content of 7%. Currently, the desulphurisation processes installed in 1999 remove more than 90% of the SO_2 present before the desulphurisation. These processes have been studied during the 2005-2012 period by an automatic analyzer of pH in rain water (Kimoto, AR-106), calibrated annually and controlled with ad hoc measures in field and laboratory. The analyses carried out between 2005-2012, with more than one thousand and one hundred measures taken every ten minutes, have given an average pH of 5.67 in Morella. However, the obtained series shows episodes of strong acidification opposite to others of basic or alkaline nature. These oscillations are explained by the different climatic stages in which they have taken place.

PB3.5: VErtical Structure and Sources of AERosols in the Mediterranean Region (VESSAER)

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The VESSAER campaign (VErtical Structure and Sources of AERosols in the Mediterranean Region) was designed to characterize the different sources of aerosol in the Mediterranean Basin and assess the regional impact of aerosol on cloud microphysical and radiative properties. VESSAER was conducted on an ultra-light aircraft in summer 2012. Activities include ground observations in the central and northern regions of Corsica, as well as aerosol lidar and sunphotometer measurements on the eastern coast. The main scientific goals are to investigate local versus long-range sources of aerosol and cloud condensation nuclei (CCN) and their vertical stratification in the lower troposphere, study evolution and ageing due to atmospheric processes, and determine aerosol direct radiative impacts over a larger spatial scale.
The vertical profiles clearly show the long-range transport of dust from the Saharan Desert and pollution from the European continent - which were the two major sources of aerosol during the campaign. Two of the research flights coincided with CALIPSO overpasses, when Saharan Dust layers are transported within the lower 5 km. Concentrations of particles show a corresponding increase throughout the troposphere, and aerosol optical depth increased up to 0.7 (at 440 nm) during dust event. Comparisons of the overpass with the in-situ measurements and ground-based lider will be presented.
The background aerosol concentrations within the boundary layer in Corsica are nearly 2000 cm^{-3}, which are not considered pristine conditions. We were surprised to find that nearly all of these particles are CCN-active at 0.3% supersaturation. Ageing of European emissions occurred exclusively in the boundary layer and not in aerosol layers aloft. Aerosol hygroscopicity did not change as a function of transport time in elevated aerosol layers, which suggests that photochemical ageing of less hygroscopic material is relatively slow compared to ageing processes in the boundary layer.

PB3.6: Development of an autonomous device for the continuous acquisition of angular thermal-infrared measurements for remote sensing applications

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Dedicated ground-truth experimental sites for thermal-infrared (TIR) radiometric measurements are commonly used to validate remotely sensed skin temperature data (Niclòs et al., 2011). Requirements to elaborate more accurate LST retrieval algorithms, such as equations containing angular-dependent coefficients, imply more detailed ground measurements at convenient equipped monitoring stations. Additionally, this type of ground observations can be used to better understand many land-atmosphere interactions such as the partitioning of latent and sensible heat fluxes or the monitoring of partly cloudy sky emissions for the appropriate correction of skin temperature by sky reflected radiance. All these requirements lead to the convenience of using a specific device with automatic rotation to radiometrically scan sky and land surface temperatures at different azimuth and zenith angles and to estimate hemispherical magnitudes by numerical integration.
Having in mind the above concerns, an autonomous device for field angular TIR data acquisition has been developed with the aim of being easily deployed at any traditional meteorological tower station. The device scans both hemispheres: sky and land, at several steps to attain remotely sensed temperatures by means of a single infrared radiometer. Apogee radiometers were selected to be included in the prototype not only because of their reduced size and easy functioning but also for their measurement accuracies as proved in calibrations against NIST blackbodies (Theocharous et al., 2010). During the 2012 summer, a prototype of the device was deployed at a site with a fraction of vegetation cover close to one, particularly at a homogeneous and flat widespread cultivated-rice area extensively used in experimental CAL/VAL campaigns of satellite TIR sensors (Niclòs et al., 2011). The obtained angular TIR measurements have been analyzed.

PB3.7: Temporal evolution of total and anthropogenic CO_2 and pH in the Mediterranean Sea for the 1995-2011 period

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Ocean acidification is governed by various factors which are not yet understood satisfactorily. In previous works concerning the Mediterranean Sea, Touratier and Goyet showed that the distribution of oceanic carbonate system key properties like pH, total alkalinity A_T, total inorganic carbon C_T and CO_2 partial pressure pCO_2 are rapidly modified due to regional and large-scale pressures on the Mediterranean Sea. In particular, they found that both total and anthropogenic CO_2 (resp. C_T and C_{ant}) for intermediate and deep waters are increasing in the eastern basin, while in the western basin, C_{ant} is decreasing although C_T is increasing.
A method for calculating C_{ant} in surface waters was developed, and applied to understand the temporal evolution of C_T and C_{ant} from 1995 to 2011 at the DYFAMED site (north-western Mediterranean). The contributions of physical and biological processes to the temporal evolution of C_T and pH were estimated as well. We found that the key factor that governs the distribution of C_T in the surface layer is C_{ant} absorption. The Western Mediterranean Sea surface waters are accumulating C_{ant} at a rate of 4.3 $\mu molkg^{-1}y^{-1}$, inducing a significant annual pH drop of 0.002 units. However, the decreased surface pH signal remains much smaller than seasonal and inter-annual variations. Thus, more accurate estimates of acidification rates require repeated measurements of the key properties implicated in ocean acidification over many decades, including pH, C_T and A_T as core parameters.

Block 4: Numerical Modelling

PB4.1: Ensemble prediction systems applied to aeronautics

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Meteorology plays a fundamental role in aviation. Spanish Meteorological Agency (AEMET), as aeronautical meteorological authority in application of the Convention on International Civil Aviation, provides Terminal Aerodrome Forecast (TAFs) and warnings for the Spanish airports. A new project focused on graphical representation of probabilistic forecasting from Ensemble Prediction Systems (EPSs) for specific locations (airports) is being developed at the Territorial Delegation in Catalonia (DTCAT-AEMET). With the aim of supporting a 24-hour TAFs forecast, the probabilistic product, known as WPS meteogram or EPSgram, is being produced showing the time evolution of predicted probabilities of wind (intensity and direction), temperature, dew point, precipitation and low cloud cover. Espgrams hold valuable information about forecast uncertainty and therefore a measure of its predictability. At present, two ensemble forecasting systems are used: the 51-member ECMWF WPS, taking into account both in the initial conditions and in the Numerical Weather Prediction (NWP) model, and the 20-member multi-model multi-boundaries AEMET-SREPS. The use of probability groups included in TAFs, the issue of Airport Weather Warnings (AWWs) as well as high unpredictability of extreme weather make this kind of prediction system very useful. The application is characterized, among other points, by its adaptability to any EPS and dynamism (percentiles to show, number of steps and so on). Apart from that, land-sea mask, height correction for temperature and information about the nearest grid points are being considered. Verification, calibra-

tion and feedback comments from aeronautic forecasters are the next steps in order to try to improve product quality.

PB4.2: Evaluating the patterns of air pollution by PAHs over Europe by modeling techniques

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The impact of climate change on air pollution is an issue of vital importance. Changes in climate for the past decades can affect the patterns of polycyclic aromatic hydrocarbons (PAHs) by changing the dispersion (wind speed, mixing layer height, convective fronts), deposition by precipitation, dry deposition, photochemistry, natural emissions and concentrations background (e.g. Jiménez-Guerrero et al., 2012). Hence, evolution and trends of these pollutants should be studied with a multi-scale system through chemistry transport models, allowing the characterization of transport patterns and distribution of PAHs.
This work relies mainly on the combination of MM5/CHIMERE models, with the addition of the modified EMEP (European Monitoring and Evaluation Programme) emissions. Experiments span the period 1989-2010 and cover the Mediterranean basin. The atmospheric simulations have a horizontal resolution of 25 km and 23 vertical layers up to 100 hPa, and were driven by the ERA-Interim reanalysis.
In order to understand the spatial patterns of PAHs, modelled concentrations of benzo-α-pyrene (BaP) will be evaluated against observations at the monitoring stations belonging to the EMEP network. A number of metrics will be used to examine the model performance. For example, the mean bias (B) is a common metric used to quantify the departure between modelled and observed quantities, while the mean normalized bias (MNB) represents a useful measure of the overall over- or under-estimation by the model of the monitored concentrations. These parameters will provide information on the skill of the model to reproduce accurately the dynamics of PAHs over the target area. Moreover, the trends and processes affecting the levels of PAHs over the Mediterranean basin will be characterised and defined.

PB4.3: Boundary-layer processes and local circulation systems in the valleys around the city of Trento: a numerical study

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Numerical simulations were performed with the Weather Research and Forecasting (WRF) model, to investigate boundary-layer processes and daily-periodic local circulation systems in the Alpine valleys surrounding the city of Trento (Italy). Simulations, with 500-m grid spacing in the inner domain, focus on summer fair weather days, when daily-periodic local circulation systems are well developed. Particular attention is devoted to the creation of the suitable input datasets necessary to perform realistic simulations in complex terrain. Validation of numerical results against measurements from surface weather stations shows that the model is able to simulate reasonably well the development of valley winds, as well as the complex interaction occurring north of Trento between the local up-valley of the Adige Valley and a lake breeze arriving from a tributary valley. In particular it is found that the model captures well the typical twice-a-day wind reversal, with a light down-valley wind at night and a stronger up-valley wind in the afternoon. Results suggest also that the presence of the city of Trento, located in the Adige Valley, has an impact on the development of valley winds, altering the typical down-valley wind in the early morning, and the interaction between the up-valley wind flowing in the Adige Valley and the lake breeze.

PB4.4: Application of EnKF for the mesoscale forecast of a severe weather event in the western Mediterranean

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The western Mediterranean is a region climatologically prone for the development of high impact weather events. The prediction of such events is a great challenge for current operational offices due to the fundamental imbalance between degrees of freedom in the forecasting system (i.e. high spatial resolution) and the operationally available atmospheric information in the area (i.e. very low density of in-situ observations over the sea).
In this poster we assess the value of an Ensemble Kalman Filter for the initialization of a mesoscale ensemble prediction system by comparing different configurations, including the basic downscaling from the operational ECMWF EPS predictions. Results suggest that the use of EnKF is significantly beneffiting the accuracy of the probabilistic predictions as the filter transfers information

PB4.5: The NMMB/BSC Chemical Transport model air quality results from global to regional scales

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The NMMB/BSC Chemical Transport Model (NMMB/BSC-CTM) is a new air quality modeling system under development at the Earth Sciences Department of BSC in collaboration with several research institutions. It is an on-line model based on a unified multiscale atmospheric driver. The meteorological core is the NCEP new global/regional Nonhydrostatic Multiscale Model on the B grid (NMMB). Its unified nonhydrostatic dynamical core allows regional and global simulations and forecasts. NMMB/BSC-CTM incorporates an aerosol module that simulates the global life cycle of mineral dust, sea salt, black carbon and organic carbon, and sulfate. Additionally, a fully coupled gas-phase chemical mechanism based on Carbon Bond 2005 solves the tropospheric gas-phase chemistry. Stratospheric chemistry is solved with a simplified linear model with the aim to provide a proper characterization of the stratosphere-troposphere exchange fluxes. In this contribution, the current status of development of the new modeling system will be presented. Results from annual evaluations of the mineral dust module, sea-salt module, and gas-phase module will be discussed at both global and regional scales. Special attention will be given to the multiscale processes associated with air quality.

PB4.6: he Aerosol Direct Radiative Impact in the MEDiterranean (ADRIMED) project

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The Mediterranean climate can be considered as a prototype of the future warm conditions that are predicted to prevail in many areas of Europe. The Mediterranean region has also been identified as one of the most prominent "Hot-Spots"in future climate change projections with a substantial precipitation decrease and warming. Presently, most of the global and regional climate simulations have only investigated the impact of global warming on the Mediterranean climate without considering the possible influence of various (natural and anthropogenic) aerosols that significantly modify its radiative budget.
The general goal of the ADRIMED (Aerosol Direct Radiative Impact on the regional climate in the MEDiterranean region) project is to assess the impacts of the direct radiative effect of aerosols on the regional climate of the Mediterranean. ADRIMED is part of the international ChArMEx (the Chemistry-Aerosol Mediterranean Experiment; `http://charmex.lsce.ipsl.fr`) program.
The ADRIMED strategy is based on an integrated approach combining an intensive experimental field campaign during summer 2013 including in-situ surface, aircraft and spaceborne observations associated with climate regional models particularly adapted to capture the high complexity of the Mediterranean region. The database will be used to significantly improve the parameterizations of aerosol optical properties in the regional climate models: RegCM4 and ALADIN. Simulations will be conducted first for past-present climate conditions (1990-2010) and in a second phase, the same kind of simulations will be carried out using future climate boundary forcing and emission scenarios (2030-2070).
We propose here to present the main objectives and the associated methodology of the ADRIMED project but also the first results obtained (1) from regional climate model simulations and (2) the pre-campaign conducted during summer 2012.

PB4.7: Nocturnal offshore precipitation near the coastline in the Mediterranean basin

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Nocturnal offshore precipitation near the coastline caused by the convergence of a cold air mass, lead by drainage winds, with a warmer air mass or a synoptic flow has been well studied in the tropics (e.g. Yu et al., 2004; Frye, 2001; Oshawa et al., 2001; Mapes et al., 2003). However, there are not many references in the Mediterranean basin, and all of them focused in two areas, the Iberian Peninsula (Callado et al., 2002; Mazón and Pino, 2010, 2011) and in the Israel area (Greich et al., 2004; Newman 1951).
By using Tropical Rainfall Measurement Mission (TRMM) database and in some cases radar reflectivity images in the Mediterranean basin we have detected many events in the Mediterranean basin, in different seasons. Some of these events have been simulated using the version 3 of the WRF model, to analyze and characterize this phenomenon, and the role of several physical variables, such as the sea-land thermal difference

that induces the drainage wind, the depth of the cold air, the LFC and LCL associated to the precipitation cells, and other parameters as the NLFC/U (Minglietta et al., 2010) and B=U/N (Wang et al., 2000). As a main conclusion, nocturnal offshore precipitation is not a rare phenomenon in the Mediterranean basin. As in the tropical regions, convergence lines are formed with several rainfall cells appears. The main difference lays in the lower precipitation rates found in the Mediterranean basin.

PB4.8: An analysis of the performance of WRF shortwave radiation schemes in the prediction of the surface irradiance using idealized and measured 1-D atmospheric profiles

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An accurate computation of the radiative transfer equation in the Numerical Weather Prediction (NWP) models arises as a critical issue in a variety of applications, including renewable energies, air quality and climate forecast. The shortwave radiation transfer modeling often assumes various approximations to decrease the computational requirements in the weather simulations. The degree and the characteristics of the impact of these simplifications on the accuracy of the irradiance predictions and the overall NWP forecasts are not well known. A study concerning the limitations of four shortwave schemes available in the Weather Research and Forecasting-Advanced Research WRF (WRF-ARW) is presented: Dudhia, Goddard, GFDL-Eta and the Rapid Radiative Transfer Model (RRTMG). These limitations include the discretization of the vertical column, simplifications in the radiative transfer equation (i.e. approaches in the source function, in the spectral bands, in the multiscattering or in the interaction with clouds and water vapor), assumption of climatic values for the trace gasses profiles and the effect of a finite atmosphere due to a nonzero pressure value at the top of the model among others.
Each scheme is isolated and adapted to work in a single atmospheric column using several vertical profiles as input data. The analysis is divided in two parts: on the first one, a theoretical atmosphere is considered comparing the results with the analytical value in different conditions: dry atmosphere, clear-sky wet atmosphere and cloudy sky atmosphere. On the second one, real data from soundings are considered within various scenarios in Barcelona, comparing the irradiance from the model with real measurements in the same location.
The poster will discuss the limitations of each scheme that are revealed by the results of the experiments. The relative contribution of each source of error to the total error in the irradiance prediction by each scheme will also be presented.

PB4.9: Impact of climate change on coastal benthic ecosystems from a modelling study of the NW Mediterranean Sea

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The project ClimCares is devoted to assess the potential impacts of climate change on biodiversity conservation of coastal areas of the NW Mediterranean region. Shifts in species' geographical distributions and mortality events have been linked to a significant regional warming and positive anomalies occurred during the last decades (1999, 2003, 2006 and 2009). Under the actual climate projections, the NWM sea surface temperature may experience an average warming of 2 to $4°C$ by the end of the century along with a very likely increase in the occurrence of heat waves and changes in wind regimes. High resolution hydrodynamical modelling addressing (sub)mesoscales processes based on the model MARS3D/MENOR will be used to assess the temperature variations over the last 10 years, using temperatures measured at sensitive sites for validation (`http://www.tmednet.org`). Evaluating the occurrence of impacting warming events, we will link the temperature changes with a range of biological responses to get the potential areas affected by mortality events. Biological responses are compiled from in situ data obtained during mass mortality events as well as from thermotolerance experiments on affected species.
Future possible impacted areas will be assessed using temperatures from the NEMOMED8 modelling under IPCC climate change scenario A2.

PB4.10: Offshore wind simulations near the Catalan coast using the WRF model

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The main target of the current research on Wind Energy is to get a high level of reliability in the wind power forecasting, so that the difficulties of penetration in the grid can be solved, as well as the new guidelines about the requirements to the wind energy companies of estimating the wind power prediction can be fulfilled.
Due to the high level of the Wind Energy development, to the fact that there are many onshore places that have reached the top of their wind power installation capacity, and to the high wind potential in the ocean areas, the Offshore Wind Energy has become one of the main topics in the current Wind Energy Research.

Although there are quite a few prediction models with a high level of reliability for onshore places, the wind prediction needs further investigations for adaptation to the Offshore emplacements, taking into account the interaction atmosphere-ocean.
The main problem in these ocean areas is the lack of wind data, which neither allows for characterizing the energy potential and wind behaviour in a particular place nor validating the forecasting models. In this work, the first results obtained for the EC Kic INnoEnergy NEPTUNE project, will be shown.
The first area for the project development is the "ZEFIR"area, Mediterranean near the Catalan coast, where it is planned the future installation of a wind farm.
A 10 year hind cast wind data simulation set for this area, has been obtained using the WRF (Weather Researh and Forecast Model, WRF, `http://www.wrf-model.org/`) de PSU/NCAR (1) model. Then, a global analysis of this data base has been preformed in order to know the wind behaviour and potential in this place.
Some first results of the WRF (1) simulations validation will also be shown, comparing the results with the new ZEFIR buoy measurements, gathered since 2011.

PB4.11: Heavy rains and sea surface temperature in the Mediterranean: Modelling of recharge areas

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Torrentiality is a known feature of rainfall in the Western Mediterranean. As part of Mediterranean climate, heavy rain events are recorded in many areas of the Western Mediterranean that cause economic damage and even human casualties. The Western Mediterranean basin is formed by a deep and almost closed sea surrounded by a series of mountain ranges. This configuration favors the development of its own atmospheric behavior. A main factor in the genesis and development of torrential rainfall are the ocean-atmosphere exchanges of moisture and heat that can destabilize the air mass travelling over the sea. The Mediterranean is a semi-enclosed sea with its own oceanic circulation and little exchange of water masses with other seas. A surface temperature climatology of the Mediterranean has been built from satellite data to study spatial distribution patterns. From this analysis, we have determined the existence of two main distribution modes for sea surface temperature in winter and summer, with transitional periods in spring and autumn.
From the knowledge of sea surface temperature climatology and spatial distribution, three heavy precipitation events have been selected in Valencia to study the effect of sea temperature distributions in the simulation of torrential rains. To this end, we selected rainfall events for winter and summer regimes and for fall transition. For all events a simulation with unperturbed sea surface temperature data was performed as control simulation. Then, simulations of each event were run in which sea surface temperature was modified in areas along the air mass path. It has been found that the variation of sea surface temperature in certain areas causes significant changes in the precipitation accumulated in the simulation. Therefore, the existence of recharge areas where the air-sea interaction favors the development of torrential rainfall in Valencia has been shown.

PB4.12: Evaluating the impact of different PBL, MC and Radiance Data assimilation schemes on DANA forecast with WRF in Spanish Mediterranean Coast

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DANA is the spanish acronym for isolated high levels depression, which is one of the atmospheric mechanisms that can join the necessary ingredients to generate torrential rains. Frequently, it occurs in coast zones during the autumn, when great sea water mass appears with temperature higher than usual. As consequence, the ascending warm and moist air sometimes produce very heavy and durable rainfall. The known potential damaging and its difficulty to be predicted by the numerical weather prediction models makes necessary constant development of solutions to improve the forecast. In this work, we present several simulations under different cloud microphysics (MC), planetary boundary layer (PBL) and radiance data assimilation schemes in WRFDA-WRF cycling system. We evaluate the impact of ATOVS (Advanced TIROS Operational Vertical Sounder) radiance assimilation through the Community Radiative Transfer Model (CRTM). We compared the results with the observations collected in the Spanish Mediterranean Coast in order to finding the optimal configuration which allows us to predict these events as accurately as possible.
To perform the simulations, NCEP FNL input data for initializing WRF, NCEP radiance BUFR from AMSU-A/B, HIRS3/4 and NCEP PREPBUFR observation data were used.

PB4.13: Seasonal cycle of temperature and precipitation over the Iberian Peninsula as represented by a simulation using WRF and 3DVAR data assimilation

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A simulation over the Iberian Peninsula using WRF and the WRFDA data assimilation system has been carried out through the period 1960-2002. WRF has been nested with a resolution of 15km x 15km inside ERA40. The impact of data assimilation has been checked through the comparison of three different integrations. The first one (IPRA_NODA) covers the period 1990-2000 and has been created without data assimilation. The second integration (IPRA12) covers the same 1990-2002 period but 3DVAR data assimilation has been performed at 00Z and 12Z. The last integration (IPRA06) covers the period 1960-2002 and has been run using data assimilation at 00Z, 06Z, 12Z and 18Z. Observations ingested by WRFDA have been obtained from the analysis feedback files created by ECMWF during the preparation of ERA40. They include SYNOP, TEMP, air reports, ship reports and buoy data amongst others.
Results from the simulation are compared to observational gridded daily datasets. It is shown that the assimilation produces a better response by the model in terms of bias and correlation coefficient over the whole Iberian Peninsula. The sensitivity of the assimilation to the frequency of assimilation is also explored comparing the results from IPRA06 and IPRA12. It is shown that, despite the careful design of the system, Mediterranean precipitation is difficult to simulate at the daily scale.

PB4.14: Severe Thunderstorms during SAARC Storm Programm 2009: Observations and WRF model Simulations

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Severe thunderstorms, locally known as 'Kal-baishakhi' or Nor'wester, are among the most common natural meteorological phenomena in Bangladesh, Bhutan, southwestern parts of Nepal and northeastern parts of India that occur, especially during the pre-monsoon season (March to May). These systems are embedded within squall lines and accompanied by lightning, thunder, tornadoes, hailstorms and heavy rains. Generally, squall line has spatial extent of about few hundred kilometers and travel several hundred kilometers causing large number of loss of life and severe damages to properties within few hours. A warm, moist, southerly low-level flow from the Bay of Bengal mixing with a cold, dry westerly/northwesterly flow aloft makes a favourable synoptic situation i.e. buoyancy of moist air parcel for their formation. However, assessing their initiation in space and time is still a challenge. Some of the severe Nor'westers also develops into Tornadoes. In this study we discusses composite characteristics of thunderstorms developed over Bangladesh and adjoining areas during pre-monsoon season of 2009 using synoptic and radar observations and WRF model.

PB4.15: Soil moisture-temperature feedbacks at meso-scale during heat waves over Western Europe

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Heat waves and droughts are intrinsically linked through the strong coupling within the Earth's energy and water cycle, and the several mechanisms that compose them. At the mesoscale land-surface details are believed to strongly modify the influence of soil moisture on temperature, cloudiness and precipitations.
We investigate the complex role of meso-scale boundary layer dynamics generally produced by the land-surface heterogeneity (e.g. mountainous or coastal regions) on the sign of the soil moisture-precipitation feedback and thus on the magnitude of the temperature anomaly of the heat wave. In the framework of HyMeX and MED-CORDEX programs, two simulations have been performed at 20 km resolution with the WRF model with two different land-surface models. One resolves the hydrology and is able to simulate summer dryness, while the other prescribes constant and high soil moisture and hence no soil moisture deficit. A sensitivity analysis conducted for all heat wave episodes highlights different soil moisture-temperature responses (i) over low-elevation plains, (ii) over mountains and (iii) over coastal regions. In the plains,soil moisture deficit induces less evapotranspiration and a drier atmosphere. A positive feedback loop is thus created which contributes to amount 20 to 40% of the temperature anomaly during the heat wave. In mountainous regions, enhanced heat fluxes over dry soil reinforce upslope winds producing strong vertical motion over the mountain slope, first triggered by thermal convection. This favors high relative humidity at the boundary layer top, thus producing more clouds and precipitation over the mountains. In coastal regions, dry soil enhances land/sea thermal contrast, strengthening sea-breeze circulation and moist cold marine air advection. This damps the magnitude of the heat wave temperature anomaly in coastal areas, up to 25% near the Mediterranean coast. During heat waves, soil dryness can thus have a significant cooling effect over mountains and coastal regions due to meso-scale circulations.

PB4.16: An Improvement in Flash Flood Prediction by using 3DVAR Analysis with the

WRF Model for Turkey

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As one of the issues in numerical weather prediction models, determination of the timing of an event accurately is very challenging for flush flood prediction purposes. Since the time evolution of flash flood events is quite short, it might even possible not to predict them. On the other hand, a systematic improvement in flash flood prediction might prevent a projected increase in life and property losses, especially under the circumstances that the frequency of flash flood events is expected to increase with climate change in Turkey. Sensitivity analyses of a flash flood event occurred in Istanbul have been recently performed by using the high resolution WRF model (Caglar et al., 2011; Caglar, 2012). The resolution is increased up to 450m, 3 microphysics scheme are analysed, 3 different topography maps are used to mention the landuse effect, and initial and boundary conditions are updated by 3 different sources, ERA Interim, NCEP, and GFS. The results of these combinations show that although high-resolution simulations have improved the prediction of the character of an event, timing and also the magnitude of the precipitation are still a puzzle for all combinations. Convective precipitation event has not been captured as expected although different combinations of resolution, microphysics, and topography in the WRF model give some improvement. Thus, in this study, another method 3DVAR analysis is applied in order to improve the prediction of flash flood events occurred 3 different regions of Turkey; Thrace, Marmara, and Black Sea regions. Ground base precipitation, radar, and both rain gauge and radar observations are used to tune initial and boundary conditions in 3DVAR analysis. The preliminary results show that although there is a slight improvement in magnitude of the precipitation, timing might still need to be improved.

PB4.17: Estimation and monitoring of the wave energy potential in Cyprus

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In the frame of theE-Wave project, funded by the Cyprus Research Promotion Foundation, the wave energy - the energy that can be captured by sea waves - is being studied in the sea area of Levantine Basin in the Eastern Mediterranean Sea. The approach adopted is based on the simulation of the sea state over the area of interest by numerical wave modeling systems at a very high temporal and spatial resolution mode for a ten-year period (2001-2010). Moreover, statistical approaches have been developed for the study of the wave energy distribution in the above sea area. The main outcomes of the project is a detailed wave climatology for the Levantine Basin focusing on the wave parameters that directly or indirectly affect the estimation of the available wave energy potential, as well as a series of maps that monitor the distribution of the wave energy itself over the sea area of interest with special emphasis in the Exclusive Economic Zone of Cyprus. These results provide a solid basis for the study and exploitation of a renewable energy source that, although it is generously provided by the nature, has not been exploited like other "clean"forms of energy.

Contribucions