REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: SPAIN

Principal Investigator[1]: JOAN CUXART RODAMILANS

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Project Title: **ATMOSPHERIC BOUNDARY LAYER PROCESSES IN COMPLEX TERRAIN**

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** ESTURB	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2012	
Would you accept support for 1 year only, if necessary?	YES ☐	NO ☐

Computer resources required for 2013-2015: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2015.)		**2013**	**2014**	**2015**
High Performance Computing Facility	(units)	150000	150000	
Data storage capacity (total archive volume)	(gigabytes)	200	200	

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 30th April 2012

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

It is expected that Special Projects requesting large amounts of computing resources (500,000 SBU or more) should provide a more detailed abstract/project description (3-5 pages) including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used. The Scientific Advisory Committee and the Technical Advisory Committee review the scientific and technical aspects of each Special Project application. The review process takes into account the resources available, the quality of the scientific and technical proposals, the use of ECMWF software and data infrastructure, and their relevance to ECMWF's objectives. - Descriptions of all accepted projects will be published on the ECMWF website.

The analysis of the small scale motions in complex terrain, in our case from the mesoalpha (large basins) to the microscale (hundreds of meters), is made by our group through the combined use of experimental data (often self-produced) and numerical modelling. The principal source of computing time for the very high-resolution runs is this project on the ECMWF computers.

We have been using the resources of the ECMWF since 2002 with full satisfaction and with the support of the Spanish Meteorological Agency (AEMET) that may provide extra resources if needed and available. During the last decade we mostly concentrated on flows in the stable boundary layer over land, introducing progressively complex terrain to understand the reasons of the observed evolution of wind, temperature and humidity in the nocturnal surface layer and the morning and evening transitions. After an extensive analysis of the Duero basin, we have lately analyzed the Ebro basin, focussing in the heterogeneity of the wind and temperature in the lowlands and the occurrence of fog.

Currently we are analyzing, using available experimental data, three problem locations. In the Garonne basin at the northern side of the Pyrenees, we take advantage of the BLLAST campaign held there in 2011, in which we participated measuring the near-the-surface temperature profile and the local heterogeneities with the help of Unmanned Aerial Systems (UAS). Simulations at the scale of the basin are made at 2km of horizontal resolution (Δx), with a second domain of Δx=400 m covering the experimental site of Lannemezan and the mountain valley in front of it, and two hourly integrations with Δx=80m around the site itself to evaluate the local variability. With this effort we also check the validity of the surface layer approximations in the stable ABL, using all the experimental information available. These simulations are already made in their first version but they may need to be rerun as we progress in our understanding.

Our second location is the lower Reusstal valley, a tributary of the Aar in Switzerland. There the Agrarian school of the ETHZ (Zurich) has an instrumented site (Chamau) with measurements of fluxes of energy and matter, including CO2 and CH4. In August 2011, the FasMef campaign took place there with extensive use of captive balloons and manned and unmanned instrumented aircrafts. We are now modelling one of the days of this campaign at the scale of the Reuss valley with Δx= 400m. This experience will be repeated in the following years and we intend to provide the modelling part of it, supplementing the information on the mesoscale and boundary layer structures of the flow to understand the transport of mass and energy. This will be the main computational effort for 2012 and 2013.

Finally, our default location is Mallorca, where we study the cycle of land and sea breezes and where late spring campaigns are planned from 2012 to 2015 every year. Simulations of Δx around some hundreds of meters will be made to capture the development of the breezes and data from captive balloons, free balloons, UAS and the dense meteorological network of the island will be used. We hope to increase our understanding of the role of the discontinuities and gradients of temperature across the coast line and of the role of the terrain slopes near the cost. These simulations are not computationally very costly.

All these exercises are analyzed in the perspective of improving our knowledge of the mechanisms that control the local barocline flows and also to understand better the different terms of the heat and mass budgets in the surface layer.