

SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year 2019

Project Title: NUMERICAL SIMULATION OF MOUNTAIN WAVES AND ICING CONDITIONS IN THE IBERIAN PENINSULA

Computer Project Account:SPESVALE.....

Principal Investigator(s): FRANCISCO VALERO

Affiliation: FACULTAD DE FÍSICA. UNIVERSIDAD COMPLUTENTE DE MADRID

Name of ECMWF scientist(s) collaborating to the project
(if applicable)

Start date of the project: 01/01/2019

Expected end date: 31/12/2019

Computer resources allocated/used for the current year and the previous one
(if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			300000	1600
Data storage capacity	(Gbytes)			10000	320

Summary of project objectives (10 lines max)

This project is the first special project that this team has in ECMWF. Our goal is to implement both Harmonie and WRF in ECMWF in order to simulate some mountain wave and icing episodes and compare differences between both kind of simulations, proposing finally the optimum model to diagnose and forecast these events. The key objectives in the project can be summarized as follows:

- Analysis of those synoptic environments and mesoscale factors related to mountain waves and icing conditions in the Iberian Peninsula.
- High-resolution simulations will be obtained with Harmonie and WRF models using different physical schemes on the preselected mountain waves and icing events.
- The high-resolution simulations will be analysed from both deterministic and probabilistic point of view. For some particular episodes, an ensemble will be obtained.

Summary of problems encountered (10 lines max)

The team has implemented the Harmonie and the WRF but some problems were found. Some episodes have been simulated with Harmonie but we have some errors. In particular, we have some problems in the forecast file when running Harmonie.

The team involved in this special project is the same team of the SPESMART. This team has also found some problems in compiling Harmonie and WRF. We are trying to solve these issues. As soon as the Harmonie and WRF models in SPESMART are fixed, it will be fixed in SPESVALE. We hope that in June we will be able to complete both model setting up in order to finish the previously mentioned tasks.

After contacting ECMWF's users support during 3rd week of June a WRF model, modules and compiler version software stack had been established. Our compilation test with the mentioned software stack have been successful. Due to the complexity of the compilation ECMWF has liberated a WRF version 4.0 as a software module under HPCF (<https://confluence.ecmwf.int/pages/viewpage.action?pageId=143050100>)

Summary of plans for the continuation of the project (10 lines max)

- As soon as the problems with the compilation of both models are fixed, the episodes of mountain waves and icing conditions, mentioned in the original request, will be simulated with both Harmonie and WRF.
- The simulated variables, key in the development of mountain waves and icing conditions, will be analysed and the similitude and differences between the outputs obtained from Harmonie and WRF will be studied.
- We proposed some *warnings* for the Guadarrama Mountain area for presence of mountain waves and icing conditions.

List of publications/reports from the project with complete references

Quitián-Hernández, L., J. J. González-Alemán, D. Santos-Muñoz, S. Fernández-González, F. Valero, M. L. Martín (2019): "A subtropical cyclone formation via warm seclusion development: The importance of surface fluxes". *Journal of Geophysical Research: Atmosphere* (submitted).

Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The

length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

The Harmonie model has been implemented in order to simulate mountain waves episodes and icing conditions (detailed in the original request). However, some problems are found in the *forecast file* when the model is running at 1 x 1 km. Moreover, we have some problems in compiling WRF model that are almost fixed.

We hope that throughout this month, both Harmonie and WRF models will properly compiled and an episode of mountain waves and icing conditions is simulated. As soon as this simulation is properly finished, we will be able to simulate more episodes taking into account both Harmonie and WRF model. In particular, we will focus in the Guadarrama Mountain area because it is near the Barajas International airport. In this area, we have identified several mountain wave episodes with MSG images that affect the aircrafts landing.

Differences and similitudes between key simulated variables (for Harmonie and WRF) in windward and leeward of the Guadarrama Mountains will be analyzed focusing on provide some mountain waves and icing conditions warning procedure to pilots.