REQUEST FOR A SPECIAL PROJECT 2017–2019

MEMBER STATE: ITALY

Principal Investigator[1]: Luciana Bertotti

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Project Title: The different effects of heavy rain on the development of ocean waves

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** __ITWM_____	
Starting year: (Each project will have a well-defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2017	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2017-2019: (To make changes to an existing project please submit an amended version of the original form.)		**2017**	**2018**	**2019**
High Performance Computing Facility	(SBU)	500000	600000	600000
Accumulated data storage (total archive volume)[2]	(GB)	200	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): 20 June 2016

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.
[2] If e.g. you archive x GB in year one and y GB in year two and don't delete anything you need to request x + y GB for the second project year.

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Extended abstract

It is expected that Special Projects requesting large amounts of computing resources (1,000,000 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.

In the previous project we have explored some of the effects of rain in the development and attenuation of ocean waves. We have established that indeed rain, if sufficiently intense, alters the state of the sea surface cancelling the high frequencies tail of the wave spectrum. This changes the drag on the surface, hence the wind vertical profile, hence the transfer of momentum and energy to waves. We have also seen, at least as a first attempt, that rain does dissipate wave energy (the theory was given by Le Mehaute' and Khangaonkar (1990)), but no one managed to measure this effect in the field. Following what done last year, we plan to prove this in the field with extended runs and cross-comparing the ECMWF wind and wave models performance in rainy and non-rainy areas.

Parallel to this, but still concerning the rain, we will consider the various effects of rain in the development of a storm, up to the case of hurricanes. The effect cited above of smoothing the surface, hence reducing the wind input to the ocean system, must be considered in the light of the extreme conditions in a hurricane. At wind speed of 200 Km/h or more the sea surface may lose its meaning, transformed into a continuous layer of water bubbles and foam. Hence the effect of rain must be considered as opposite to that of the wind that disrupts the usual structure of the surface. All this has effects also on the temperature of the sea surface. We plan to explore all this with devoted experiments, changing the various boundary conditions (state of the surface, surface temperature, smoothing) to explore the sensitivity of the coupled model results to the parametrization of the various mentioned processes.

Given that the results will likely vary with the conditions of the hurricane, we plan to explore the cited sensitivity in different cases with different intensities of the event. In practice we will consider both strong and weak hurricanes. This will also help to better understand the limits of the present approach, i.e. exploring how the performance depends on the class of the hurricane, and implicitly on the conditions (the physics) of the sea surface.