REQUEST FOR A SPECIAL PROJECT 2014–2016

MEMBER STATE: ITALY

Principal Investigator[1]: Luciana BERTOTTI

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Other researchers:

Luigi CAVALERI

Project Title:

Effect of heavy rain on the development of tropical cyclones

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project. For projects started before 2009, please state 2009 as the start year.)	2014	
Would you accept support for 1 year only, if necessary?	YES X	NO ☐

Computer resources required for 2014-2016: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2012.)		**2014**	**2015**	**2016**
High Performance Computing Facility	(units)	400000	500000	500000
Data storage capacity (total archive volume)	(gigabytes)	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):

13 June, 2013

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.

Principal Investigator: Luciana BERTOTTI

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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 the Centre's objectives. - Descriptions of all accepted projects will be published on the ECMWF website.

The growth of wind waves is due to the two-way interaction between the sea surface and the lowest layer of the atmosphere This interaction happens on a wide range of frequencies, hence of wavelengths, the latter varying between a few centimetres and a few hundreds of metres. According to present theories, each frequency interacts on itself with the atmosphere, the specific interaction depending on the wavelength. The shortest waves, of the order of centimetres, that are also the relevant ones for remote wind sea measurements, are the ones that carry most of the momentum transfer, but they are extremely sensitive to rain that, if heavy, can destroy the energy of these short waves, making the satellite wind data useless.

The absence of this high part of the wave spectrum has strong implication for the interaction between wind and waves and the development of a wind sea. A lower flux of momentum by the wind to the waves implies an accekleration of the surface wind, hence a higher effect, via the Miles-Janssen mechanism, to the existing wave fields. We hypothesize that under a heavy rain exisiting waves in the midlle and low frequency range will grow faster than in absence of rain. During the present Special Project we have explored in this direction the situation in the Northern Atlantic ocean. As reported in the corresponding yearly report, we have found some evidence of this effect. However, the rain in the open ocean is too sparse and in general not strong enpugh to lead to macroscopic effects.

We paln to focus our attention on the tropical cyclones for two reasons. On one hand the associated strong wind fields enhamce the supposed effect leading to more macrospcopic results. On the other hand tropical cyclones come most of the times with heavy rain. The combination of the two facts, stronmg wind - high waves and heavy rain should make the rain effect much more conspicuos. If, as we expect, the effect is truly present in these situation, this should lead to enhanced maximum wave heights in the modelled tropical cyclones, in so doing correcting, partly at least, the frequent underestimate found when simulating the associated wave heights. We plan to focus on a number of tropical cyclones, repeating their simulation with and withoutthe rain damping effect on the tail of the wave spectrum. The intercomparison and the further comparison with measured data (by wave buoys and altimeters) will show if the effect is indeed relevant for the development of a tropical cyclone.