Waving in the rain

Luigi Cavaleri*, Luciana Bertotti*, Jean-Raymond Bidlot†

* Institute of Marine Sciences, Arsenale – Tesa 104, Castello 2737/F, Venice, Italy
e-mail: luigi.cavaleri@ismar.cnr.it, luciana.bertotti@ismar.cnr.it,
web page: http://www.ismar.cnr.it

† European Centre for Medium-Range Weather Forecasts (ECMWF),
Shinfield Park, Reading, Berkshire RG2 9AX, U.K.
email: jean.bidlot@ecmwf.int - web page: http://www.ecmwf.int

ABSTRACT

Rain has been know for centuries "to calm the sea". Rain produces some small scale ripples and turbulence, the latter having a dissipation effect on short waves particularly. The cancelling of high frequency components due to intense rain leads to a much reduced number of breakers. Starting from the commonly accepted view of the exchange of momentum between atmosphere and a growing wind field, we investigate the effect of rain, i.e. of a reduced tail of the spectrum. It turns out that rain leads to higher wind speeds and, according to basic principle of generation, to higher long wave components. Numerical tests confirm this fact.

Further we investigate if the described effect is found in operational model data by comparing operational results with buoy and altimeter data as a function of rain. The results are ambiguous, in that buoy data seems to mildly confirm the described process, while altimeter data strongly point otherwise, even biasing the results in the opposite direction. We discuss the implications of these results that turn out rather profound. If the altimeter data are confirmed, some rethinking of the wave generation process and the coupling interaction between atmosphere and ocean will be required.