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Developing a spectral coupling method for high resolution limited area models

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Some errors in limited area model's (LAM's) forecast have determined the study of the generally used treatment of lateral boundary conditions (LBC), the Davies flow-relaxation scheme for grid-point coupling of a high resolution model with a lower resolution one. The aim of the research was to find a solution for avoiding the LAMs failures in forecasting the fast propagating systems such as the Christmas storms of December 1999.

A method for joining the models in terms of LBC, based on the spectral representation of the fields, has been developed and tested. This approach was focused on the investigation of the capability of the proposed coupling method to provide the missing large-scale information to the high resolution model. The spectral coupling method was build to work together with the classic grid-point coupling one. The method has been implemented firstly in an uni-dimensional shallow-water model and in the ALADIN 3D model afterwards, the tests revealing substantial reduction of forecast errors. In order to validate the spectral coupling method, an objective verification of the results has been carried out for a month period by running an operational version of the ALADIN model with/without spectral coupling. Daily scores have been computed for all stations with the anticipation of 24 and 48 hours, for some parameters and monthly scores for each station were calculated as well by selecting a number of representative stations for the chosen integration domain. The results indicate an increased forecast performance.