CNRM-GAME, UMR 3589

# SOUTENANCE DE THESE CNRM

**N° 2016_10**

***jeudi 15 décembre 2016 à 14h***

# STATISTICAL POST-PROCESSING OF DETERMINISTIC AND ENSEMBLE WIND SPEED FORECASTS ON A GRID


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**en salle de conférences Joël Noilhan**


Résumé :

Errors of numerical weather prediction (NWP) models can be reduced thanks to post-processing methods (model output statistics, MOS) that build a statistical relationship between the observations and associated forecasts. The objective of the present thesis is to build MOS for windspeed forecasts over France on the grid of several NWP models, to be applied on operations at Météo-France, while addressing the two main issues. First, building MOS on the grid of some NWP model, with thousands of grid points over France, requires to develop methods fast enough for operational delays. Second, requent updates of NWP models require updating MOS, but training MOS requires an NWP model unchanged for years, which is usually not possible. A new windspeed analysis for the 10 m windspeed has been built over the grid of Météo-France's local area, high resolution (2,5km) NWP model, AROME. The new analysis is the sum of two terms: a spline with AROME most recent forecast as input plus a correction with a spline with the location coordinates as input. The new analysis outperforms the existing analysis, while displaying realistic spatio-temporal patterns. This new analysis, now available at an hourly rate over 4, is used as a gridded observation to build MOS in the remaining of this thesis. MOS for windspeed over France have been built for ARPEGE, Météo-France's global NWP model. A test-bed designs random forests as the most efficient MOS. The loading times is reduced by a factor 10 by training random forests over block of nearby grid points and pruning them as much as possible. This time optimisation goes without reducing the forecast performances. This block MOS approach is currently being made operational. A preliminary study about the estimation of the continuous ranked probability score (CRPS) leads to recommendations to efficiently estimate it and to generalizations of existing theoretical results. Then 4 ensemble NWP models from the TIGGE database are post-processed with 6 methods and combined with the corresponding raw ensembles thanks to several statistical methods. The best combination method is based on the theory of prediction with expert advice, which ensures good forecast performances relatively to some reference forecast. This method quickly adapts its combination weighs, which constitutes an asset in case of performances changes of the combined forecasts. This part of the work highlighted contradictions between two criteria to select the best combination methods: the minimization of the CRPS and the flatness of the rank histogram according to the Jolliffe-Primo tests. It is proposed to choose a model by first imposing the flatness of the rank histogram.


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