EMS Annual Meeting Abstracts
Vol. 11, EMS2014-386-1, 2014
14th EMS / 10th ECAC

Boundary-layer and land-surface schemes in WRF for the evening transition during the BLLAST campaign

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The structure and properties of the planetary boundary layer (PBL) at a certain time has a major importance in land-atmosphere interactions as well as for exchange processes (i.e. pollutants concentration, humidity or different energy vertical fluxes). Transitional periods at the low troposphere are found difficult to properly interpret, considering that among all the processes which take place at that timing, it is not clearly stated the predominance of just one of them. Moreover, a drastic change in the motion scales present in the lower atmosphere is sometimes produced. Atmospheric global models fail at representing transition events in the PBL, mainly because of sub-grid scale phenomena. These micrometeorological processes require to be better represented.

The Weather Research and Forecast (WRF) mesoscale model has a wide amount of physical options and parameterizations, including different PBL and land surface model (LSM) schemes. This fact justifies a model experiment to evaluate its behavior and try to understand the differences in model performance for transitional periods in the atmosphere, specifically when it changes from a convective to a stratified stable structure at its lower region.

The Boundary Layer Late Afternoon and Sunset Turbulent (BLLAST) project organized and conducted a field campaign [1] during nearly four weeks in 2011 at Lannemezan (France), getting together a wide amount of meteorological instrumentation. The available extensive experimental dataset from that campaign offers an excellent opportunity for model validation.

Results of WRF tests are presented, comparing simulations among themselves and validating them with the observational data. Different atmospheric variables involved in the late afternoon and evening transition processes are considered, both at surface (i.e. energy balance) and at higher levels (thermodynamic vertical structure), in order to obtain a wider view of the problem.

[1] Lothon, M. and co-authors (2012): The Boundary-Layer Late Afternoon and Sunset Turbulence field experiment. Paper 14B.1, 20th Symposium on Boundary-Layers and turbulence, Boston, MA, Amer. Meteor. Soc., 12 pp.