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WRF simulations of the atmospheric boundary layer evening transitions during the BLLAST field campaign

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The Planetary Boundary Layer (PBL) is mainly ruled by both mechanical and thermal turbulence, and shows an evident diurnal cycle. In the evening transitional period, decay in turbulent kinetic energy occurs, but all the mechanisms behind this decay are still not well understood. In this framework, the BLLAST (Boundary Layer Late Afternoon and Sunset Turbulence) project aims to improve the knowledge on the physical processes taking place during the late afternoon and evening transition in the lower troposphere.
The BLLAST field campaign was organized in Lannemezan (France) from 14th June to 8th July 2011 [1]. Both in situ measurements (i.e. with meteorological towers, surface based instruments, tethered balloons...) and remote sensors (i.e. SODAR, scintillometer...) were used for this purpose, and two different approaches were developed: vertical structure of the boundary layer and spatial heterogeneity.
Besides, Numerical Weather Prediction (NWP) models have exhibited substantial difficulties to properly simulate the diurnal cycle in the atmosphere and also the PBL afternoon and evening transition. Typically, some errors are found in air temperature and wind speed close to the surface.
Regarding this fact, the main goal of this work is to study how the mesoscale model WRF (Weather Research and Forecast) performs simulations of the evening transition during the BLLAST field campaign. In particular, it is tested for permutations of different PBL and Land Surface Model (LSM) schemes. We try to understand why some differences in model results appear.
A comparison between observations and combinations of PBL and LSM parameterizations is shown, testing the sensitivity to these options. We specifically evaluate the surface radiation budget (out- and incoming long- and shortwave radiation), and the surface energy budget variables (latent and sensible heat fluxes, as well as soil heat flux). Furthermore, the vertical profiles of some key variables (such as potential temperature or wind velocity) are investigated and connected to surface variables values.

[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.