Geophysical Research Abstracts
Vol. 13, EGU2011-9522, 2011
EGU General Assembly 2011

WRF simulations of the Atmospheric Boundary Layer over homogeneous terrain: representation of nocturnal processes

Juan Carlos Sánchez-Perrino (1), Jorge Navarro (2), Carlos Yagüe (3), Pedro A. Jiménez (2,4), Elena García-Bustamante (2,4), Ángela Hidalgo (4,5), and Jesús Fidel González-Rouco (4)

(1) AEMET, Madrid, Spain (jsanchezp@aemet.es), (2) CIEMAT, Dpt. Energías Renovables, Madrid, Spain, (3) Universidad Complutense de Madrid, Dpt. Geofísica y Meteorología, Madrid, Spain , (4) Universidad Complutense de Madrid, Dpt. Astrofísica y Ciencias de la Atmósfera, Madrid, Spain , (5) Global Forecasters S.L., Madrid, Spain

This work analyses the realism of the WRF 3.1 regional model in reproducing phenomena and processes typical of the Planetary Boundary Layer (PBL) in different synoptic situations, with emphasis on very stable anticyclonic nights . The model's ability to simulate nocturnal processes such as Low Level Jets (LLJs), the development of katabatic winds, or the occurrence of intermittent turbulence in situations of high stability will be shown. Three different PBL parameterizations have been used in the simulations in order to evaluate the simulation sensitivity to the selection of the physics involved in the PBL: Mellor-Yamada-Janjic (MYJ), Mellor-Yamada-Nakanishi-Niino (MYNN) and Quasi-Normal-Scale-Elimination (QNSE), which is especially designed for stable stratification situations. All the schemes allow the evaluation of the Turbulent Kinetic Energy (TKE).
The validation of the simulations was done with data from an extensive field campaign (SABLES98) developed at the Research Center for the Lower Atmosphere -CIBA- in Valladolid (Spain).
Results show that, in general, the three simulations reproduce a clear diurnal cycle of temperature at 2 m (T2m) and of wind at 10 m (V10m). All of them underestimate the maximum temperature and overestimate the minimum temperature. MYNN shows less bias in the maximum because it is designed to have a more effective entrainment during the day. QNSE produces more realistic results during the night due to a better simulation of cooling events. On average all the simulations overestimate V10m. QNSE is able to show greater variability in V10m and is more prone to detect LLJ situations.
Maximum diurnal turbulence is generally underestimated by WRF, except by MYNN that reproduces quite well the peaks during the anticyclonic period, probably due to the stronger entrainment developed. During the night, turbulence is overestimated by all the schemes, but QNSE is able to detect better than the other parameterizations sudden changes of TKE. This suggests that the selection of a given parameterization should be therefore conditional on the variable or process of interest to be analysed or that several simulations should be made to capture different aspects of reality.