EMS Annual Meeting Abstracts
Vol. 10, EMS2013-198, 2013
13th EMS / 11th ECAM

On the representation of stable conditions in the ECMWF model and the longstanding biases associated with it

i. sandu and a. beljaars
ECMWF, United Kingdom (irina.sandu@ecmwf.int)

In the framework of GABLS it was shown that operational NWP models have systematic biases in stably stratified boundary layers and are overall less skilfull in representing these conditions
than research models or large-eddy simulations. Typically, the stable boundary layers
are often too deep, the wind turning is underestimated, and the low level jets
are too week. These longstanding biases in key aspects of stable boundary
layers are mainly related to the use
of turbulence closures that maintain a level of diffusion in stable conditions which is well above levels that can be supported from
observations or large-eddy simulations. The diffusion in stable conditions is
indeed still enhanced to date, to various degrees, in operational weather forecast systems such as the ECMWF Integrated Forecast System (IFS), the MetOffice Unified System or
the NCEP Global Forecast System (GFS). Here we show that in the ECMWF model this enhancement of the diffusion in
stable conditions is needed to compensate for errors caused by some processes that are poorly represented such as the
surface drag over orography and the strength of the land-atmosphere coupling. We also demonstrate that the degree of diffusion maintained in stable conditions affects the large-scale performance of the model because it controls both the strength of the synoptic cyclones and anticyclones, but also the amplitude of the stationary waves.