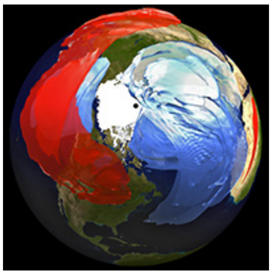

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Recent work at DWD to improve model dynamics and physics in the stratosphere and mesosphere

Wednesday, 20 November 2019 09:00 (30 minutes)

This presentation reports on recent and ongoing model development work at DWD to improve the dynamical core and the physics parameterizations for model tops above the middle mesosphere, and to reduce systematic model biases in the lower stratosphere.

In the framework of a research group on multi-scale dynamics of gravity waves funded by the German Science Foundation (DFG), the dynamical core of the ICON model has been extended by an option to solve the deep-atmosphere equations. Idealized dynamical core tests were successfully used to validate the correctness of the numerical implementation. In addition, the physics parameterization packages of ICON have been extended to account for processes becoming relevant above the middle mesosphere, e.g. molecular diffusion and frictional heating. The results available so far indicate that short-to-medium-range NWP applications may not sufficiently benefit from these extensions to warrant the additional computational expenses, but is expected that future applications considering seasonal or longer timescales will take advantage of them.

Recent work on reducing model biases in the lower stratosphere has focused on the cold bias right above the extratropical troposphere, which is particularly pronounced in northern hemispheric summer, and on biases in the tropical tropopause region, which exhibit a much more complex structure in space and time. We were able to reduce the extratropical cold bias by introducing a simple ozone-tropopause coupling, which is based on diagnosing the thermal tropopause at each radiation call and modifying the climatological ozone profile such as to introduce an ozone jump across the tropopause if it is well-defined. This was also found to have a beneficial impact on tropospheric forecast skills. Ongoing work focuses on reducing the numerical diffusivity of the moisture transport scheme, as verification against radiosonde data indicates a moist bias growing with forecast lead time in this region. In the tropics, switching to a more recent ozone climatology has reduced the annual cycle of the lower-stratospheric temperature bias. Ongoing work focuses on improving remote-sensing based diagnostics.

Primary author: Dr ZÄNGL, Günther (Deutscher Wetterdienst)

Presenter: Dr ZÄNGL, Günther (Deutscher Wetterdienst)

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Track Classification: Workshop: Stratospheric predictability and impact on the troposphere