

Short-range Stratosphere-Troposphere coupling in a data-assimilation cycle and its benefit for numerical weather prediction

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The middle atmosphere in the Japan Meteorological Agency Global Spectral Model (JMA GSM), the operational global model of the JMA, has been greatly improved in the past 10 years. During the process of model developing efforts in JMA, it has been realized that improving the middle atmosphere in a model is beneficial for accurate numerical weather predictions (NWP) in the Troposphere through a data-assimilation cycle, not just for improving representation of the middle atmosphere in long-integrations. Among the changes applied to the GSM in the past 10 years, an introduction and subsequent updates of a non-orographic gravity wave (NGW) parametrization which represents unresolved momentum transfer explain the breakthrough in the representation of the middle atmosphere. The NGW parametrization enabled the GSM to represent the Quasi-Biennial oscillation (QBO), middle atmosphere jets and meridional circulation realistically. Furthermore, NWP-type evaluations comprised of a set of forecasts and data-assimilation cycles revealed that accurate predictions of the middle atmosphere allowed the GSM to assimilate much more observation data around there. Reduced discrepancies between observation data and 6-hour forecasts as first guess in the middle atmosphere were prominent in AMSU-A, radiosonde and GNSS-RO observations. The quality of analysis fields was enhanced throughout the atmosphere because the observational information propagated spatially depending on observational types. By initializing from more accurate initial states, the accuracy in short to medium-range forecasts was increased in the Troposphere as well as in the middle atmosphere.

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