Common Cloud-Radiation Errors
from 4-hour to 4-week Model Prediction

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Cloud-radiation representation in models for subgrid-scale clouds is a known gap from subseasonal-to-seasonal models down to storm-scale models applied for forecast duration of only a few hours. NOAA/ESRL has been applying common physical parameterizations for scale-aware deep/shallow convection and boundary-layer mixing over this wide range of time and spatial scales with some progress to be reported in this presentation.

The Grell-Freitas scheme (2014, *Atmos. Chem. Phys.*) and MYNN boundary-layer EDMF scheme (Olson / Benjamin et al. 2016 *Mon. Wea. Rev.*) have been applied and tested extensively for the NOAA hourly updated 3-km High-Resolution Rapid Refresh (HRRR) and 13-km Rapid Refresh model/assimilation systems over the United States and North America, with targeting toward improvement to boundary-layer evolution and cloud-radiation representation in all seasons. This representation is critical for both warm-season severe convective storm forecasting and for winter-storm prediction of snow and mixed precipitation.

At the same time the Grell-Freitas scheme has been applied also as an option for subseasonal forecasting toward improved US week 3-4 prediction with the FIM-HYCOM coupled model (Green et al 2017, MWR accepted with revision, and Sun et al 2017, MWR, submitted in Feb 2017).

Some progress has been made toward improved cloud-radiation with the Grell-Freitas scheme and with the updated MYNN-EDMF scheme (also planned for global testing). Use of similar evaluation for cloud and 2m temperature for 3km HRRR (and 13km RAP) forecasts at 3-6h duration and 30-60km FIM-HYCOM global forecasts out to 3-4 weeks are being used to guide continued development, along with interaction in the larger international boundary-layer/cloud modeling community.