**Impacts of observational nudging with sounding data on WRF performance in simulating vertical profiles and cloudiness in Uintah Basin – case study Jan 31- Feb 4, 2013.**

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**Abstract**

Four-dimensional data assimilation was applied in WRF model sensitivity tests to study the impact of observational nudging on model performance in simulating inversion layers in the Uintah Basin, Utah, U.S.A. in winter 2013. Our previous study showed that surface observational nudging substantially improved WRF model performance in simulating surface wind fields, correcting a 10°C warm surface temperature bias, correcting overestimation of the planetary boundary layer height and correcting underestimation of inversion strengths produced by regular WRF model physics without nudging; yet, likely amplified the overestimation of warm clouds during inversion days. In this study, we added sounding data (e.g., temperature, T and relative humidity, RH) at the lowest site in Uintah Basin (e.g., Ouray) into nudging input data for WRF simulations to examine if sounding nudging improves model performance in simulating cloudiness in Uintah Basin. Our results showed that when well tested setups of nudging strengths and radius of influence were applied, sounding nudging notably improved WRF performance in simulating: (i) vertical profiles of T and RH at few other sites in the basin at which data were not used for nudging, (ii) basin-wide cloudiness, downward shortwave radiation as consequence and (iii) basin-averaged surface T, RH and wind speed. We are testing how these improvements affect ozone concentrations in CMAQ simulations.