Online coupled meteorology and chemistry models in the U.S.

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The climate-chemistry-aerosol-cloud-radiation feedbacks are important in the context of many areas including global/regional climate modeling, global-through-urban air quality/atmospheric chemistry modeling, numerical weather and air quality forecasting, as well as integrated atmospheric-ocean-land surface modeling. Accurately simulating those feedbacks requires fully-coupled meteorology, climate, and chemistry models and presents significant challenges in terms of both scientific understanding and computational demand.

This review will focus on history and current status of development and application of online models in the U.S. Several representative online coupled meteorology and chemistry models such as GATOR-GCMOM, WRF/Chem, CAM3, and MIRAGE will be included. Major model features, physical/chemical treatments, as well as typical applications will be evaluated with a focus on aerosol microphysics treatments, aerosol feedbacks to planetary boundary layer meteorology, and aerosol-cloud interactions. Recommendations for future development and improvement will be provided.

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