Air Quality Forecasts using the NASA GEOS Composition Modeling and Data Assimilation System

Katherine Emma Knowland (1,2), Christoph Keller (1,2), Bryan Duncan (3), Melanie Follette-Cook (3,5), Junhua Liu (1,3), Julie Nicely (3,6), Brad Weir (1,2), Krzysztof Wargan (2,4), Lesley Ott (2), Emily Saunders (2,4), and Steven Pawson (2)

(1) USRA/GESTAR, Columbia, Maryland, United States, (2) NASA/GSFC Global Modeling and Assimilation Office, Greenbelt, Maryland, United States, (3) NASA/GSFC Atmospheric Chemistry and Dynamics Laboratory, Greenbelt, Maryland, United States, (4) Science Systems and Applications, Inc., Lanham, Maryland, United States, (5) Morgan State University, Baltimore, Maryland, United States, (6) USRA, Columbia, Maryland, United States

We present a new high-resolution global composition forecast system produced by NASA's Global Modeling and Assimilation Office. The NASA Goddard Earth Observing System (GEOS) model has been expanded to provide global near-real-time 5-day forecasts of atmospheric composition at a horizontal resolution of 0.25 degrees ($\sim$25 km). This composition forecast system (GEOS-CF) combines the operational GEOS weather forecasting model with the state-of-the-science GEOS-Chem chemistry module (version 12) to provide detailed analysis of a wide range of air pollutants such as ozone, carbon monoxide, nitrogen oxides, and fine particulate matter (PM2.5). Satellite observations are assimilated into the system for improved representation of weather and aerosols (e.g., smoke from fires). The assimilation system is currently being expanded to include three chemically reactive trace gases: ozone, nitrogen dioxide, and carbon monoxide. We discuss current capabilities and limitations of this new chemical data assimilation system to improve atmospheric composition modeling, as well as future directions for incorporating new observations (TROPOMI, geostationary satellites) and machine learning techniques.