Air pollution forecasts using the NASA GEOS model: A unified tool from local to global scales

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We provide an introduction to a new high-resolution (0.25 degree) global composition forecast produced by NASA's Global Modeling and Assimilation office. The NASA Goddard Earth Observing System version 5 (GEOS-5) model has been expanded to provide global near-real-time forecasts of atmospheric composition at a horizontal resolution of 0.25 degrees ($\sim$25 km). Previously, this combination of detailed chemistry and resolution was only provided by regional models. This system combines the operational GEOS-5 weather forecasting model with the state-of-the-science GEOS-Chem chemistry module (version 11) to provide detailed chemical analysis of a wide range of air pollutants such as ozone, carbon monoxide, nitrogen oxides, and fine particulate matter (PM2.5). The resolution of the forecasts is the highest resolution compared to current, publically-available global composition forecasts.

Evaluation and validation of modeled trace gases and aerosols compared to surface and satellite observations will be presented for constituents relative to health air quality standards. Comparisons of modeled trace gases and aerosols against satellite observations show that the model produces realistic concentrations of atmospheric constituents in the free troposphere. Model comparisons against surface observations highlight the model's capability to capture the diurnal variability of air pollutants under a variety of meteorological conditions. The GEOS-5 composition forecasting system offers a new tool for scientists and the public health community, and is being developed jointly with several government and non-profit partners. Potential applications include air quality warnings, flight campaign planning and exposure studies using the archived analysis fields.