Near Real-Time Sub/Seasonal Prediction of Aerosol and Air Quality at the NASA Global Modeling and Assimilation Office

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**Motivation**

NASA/GSFC’s Global Modeling and Assimilation Office (GMAO) uses coupled Earth-System models and analyses, in conjunction with satellite and in situ observations, to study and predict phenomena that evolve on seasonal to decadal timescales. A central motivation for GMAO is the innovative use of NASA satellite data to improve forecast skill.

GMAO’s GEOS S2S system Version 2 (GEOS-S2S-2, Molod et al., 2019) began running in Near-Real Time at the end of 2017. GEOS-S2S-2 includes an interactive aerosol model (GOCART, Chin et al., 2002, Colarco et al., 2010), and the seasonal prediction of aerosol-derived PM2.5 as a measure of air quality is evaluated here.

**Issues/Questions about Seasonal Prediction of Air Quality**

What is predictable at seasonal time scales and what can be predicted? Anomaly Correlation is the metric for assessing the skill of a forecast: e.g., will next month’s weather be characteristic of higher/lower “normal” conditions? How much? With what probability?

Aerosol models can predict AOD or PM2.5:

- AOD is better initialized. PM2.5 more useful.
- Why incur the expense of an interactive aerosol model?
- What is the contribution of aerosols to seasonal predictability?
- Evaluation of Aerosol Optical Depth (AOD)

**GMAO’s Near-Real-Time Sub/Seasonal Prediction Suite**

GMAO’s GEOS S2S coupled Ocean Data Assimilation system runs in near real time and is used to initialize our sub-seasonal forecasts. Results are generally examined in terms of anomaly from some climatology, derived from a series of retrospective forecasts.

**Summary**

- Dynamical predictions of PM2.5 on subseasonal scale can be skillful
- Bias in one component of PM2.5 can adversely impact skill if care is not taken to provide the proper forecast
- Predictive biomass burning model is needed
- Future work: Assessment of impact of interactive aerosol model on meteorological forecast skill, and to identify “forecasts of opportunity”