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## How Using NASA's Observations Affects the Balance Among Spatial Resolution, Ensemble Size, and Physical Complexity in the GEOS-S2S System

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NASA's Global Earth Observing System (GEOS) model and data assimilation system can be configured for several applications in NASA's Global Modeling and Assimilation Office (GMAO). The GMAO performs model-based studies to enhance NASA's Earth observations, including (among others) the provision of: auxiliary information to space observations; forecasting support for aircraft field missions; quantitative information to the design of new space missions; demonstrations of the value of NASA's observations in Earth System analysis and prediction.

This presentation addresses the GEOS S2S (subseasonal to seasonal) prediction system. It focuses first on the decisions made in refining the system from Version 2 to Version 3, which will go into production by early 2020, emphasizing how data used impact the model configuration. Looking forwards, a pathway towards a coupled analysis capability is outlined, that emphasizes NASA's unique observations. GMAO intends to include NASA's remote sensing information from altimetry, sea-surface temperature and salinity, land- and sea-ice distributions alongside in-situ data and other satellite observations.

One aspect that impacts the use of research observations, that typically exist for short periods, is to use anomalies computed from multiple years of hindcasts: this approach can be detrimental to assessing the impacts of new data types that may induce physical perturbations in such a system. A second aspect of adding some new data types is that their meaningful implementation necessitates extra computation cost: for instance, atmospheric aerosols and ozone require complex and costly enhancements to the model. This in turn raises new issues about balancing compute resources: choices must be made about the balance between the physical complexity of the model and the "traditional" factors of spatial resolution and ensemble size. These aspects will be discussed in this presentation.

**Primary author:** PAWSON, Steven (NASA GSFC)

**Co-authors:** MOLOD, Andrea (NASA/GMAO); HACKERT, Eric (NASA)

**Presenter:** PAWSON, Steven (NASA GSFC)

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