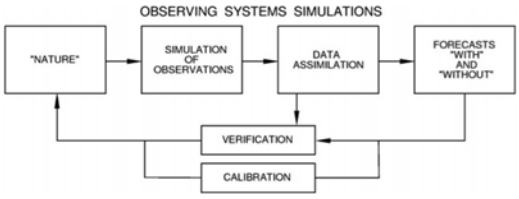
Earth System Research Laboratory (ESRL)
Global Systems Division (GSD)

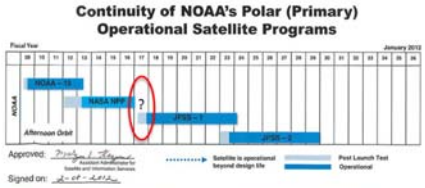
We Make Forecasts Better

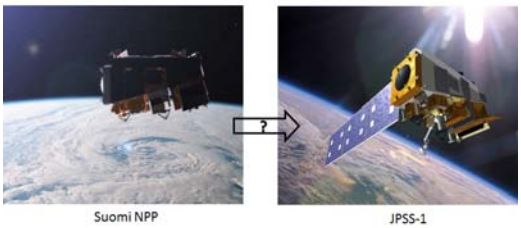
Design of Cost-Effective Future Observing Systems

GEOSS has an array of observing systems to monitor the status of the atmosphere, ocean, land surface and other Earth systems. GEOSS is the response of 60 nations, the European Commission, and nearly 40 international organizations to the need for timely, accurate, long-term global information as a basis for international cooperation and sound decision making.



Schematic illustration of how OSSEs in a numerical laboratory simulate reality, create synthetic observations using characteristics of new, planned instruments, as well as the current operational observing systems, ingest the observations and run numerical forecasts with and without the use of the planned instruments/platforms.





A carefully planned and executed OSSE can allow us to 1) evaluate the probable impact of the loss of NOAA Polar Orbiting data on weather forecasts for a year or more, and 2) evaluate alternatives to mitigate the loss.

What is the Global Earth Observing System of Systems (GEOSS)?

The Global Earth Observation System of Systems (GEOSS) is an international effort led by the intergovernmental Group on Earth Observations (GEO) to coordinate the monitoring of the Earth using information derived from an array of observing systems placed on satellites, manned and unmanned aircraft, ships and buoys, and land.

An important part of GEOSS is aimed at monitoring atmospheric, oceanic, and land surface conditions in support of weather and climate prediction.

Designing improved and cost-effective future observing systems is a challenge as these systems often serve multiple users.

What is an Observing System Simulation Experiment (OSSE)?

An OSSE is a computer experiment that allows us to estimate the impact that a proposed atmospheric, ocean, or land surface observing system will have on operational weather or climate forecasts before it is actually built or even fully designed.

An OSSE is an economical and low-risk way to answer the question: does the probable benefits of a proposed observing system outweigh its probable costs?

An OSSE is also a cost effective way to evaluate alternate observing system strategies to address specific problems.

For example: How can the negative effects of a couple of years gap between the anticipated failure of the JPSS Pathfinder (Suomi NPP, ~2015) and the planned launch of the first operational spacecraft in the Joint Polar Satellite System (JPSS-1, ~2017) be mitigated?

Prepared by
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For Further Information on GSD's OSSE Work, Visit…

http://www.esrl.noaa.gov/gsd/gosa/

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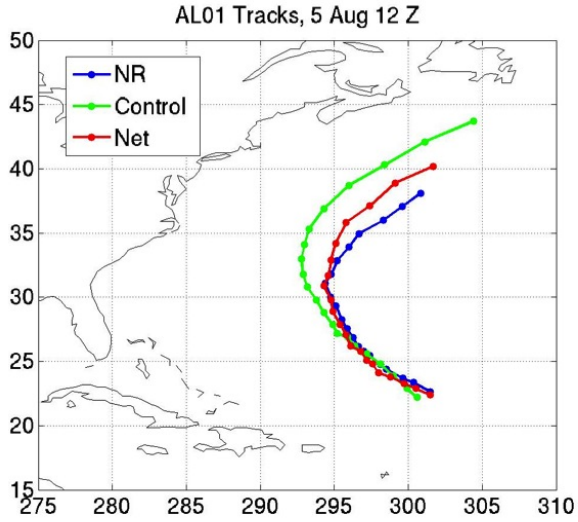
NOAA's Unmanned Aerial System (UAS) program explores the use of such platforms for filling observational gaps with "targeted observations" when and where they are needed most. OSSE's carried out at NOAA's Earth System Research Laboratory help find optimal strategies for the use of these emerging assets.



An OSSE example demonstrating the value of UAS observations in improving hurricane track forecasts. The simulated forecast with the existing observing system (green) is much improved (i.e., closer to the simulated reality, blue) when UAS observations are also used to assess the state of the atmosphere at the time the forecasts are initialized (red).

What is being proposed to fill the gap between SUOMI NPP and JPSS-1?

Japan is planned to launch six geostationary communications satellites from which most of Earth (except the poles) will be continuously visible.

There is room to place a commercially-financed hyperspectral sensor on each of these satellites that should provide data that is comparable to what we expect to lose in the 2017 time frame if JPSS-1 is delayed or cancelled.

A carefully planned and executed OSSE can allow us to: 1) evaluate to probable impact of the loss of NOAA Polar Orbiting data on weather forecasts for a year or more; and 2) evaluate alternatives to mitigate the loss of these observations.

Proposed OSSE

Assess the impact of losing the data from Suomi NPP and not replacing it.

Investigate the ability of the proposed commercial hyper-spectral sensors in geostationary orbit to mitigate the loss of these observations on short- and long-range weather forecast accuracy.

Provide a sound scientific basis for determining if the cost of the data is justified by its benefits in terms of impact on weather forecasts and warnings at time scales ranging from minutes to weeks.

How can an OSSE save the taxpayer money?

By simulating observations made by planned instrument on future observing platforms before anything is built or deployed, numerical forecast models can be operated with and without the new simulated data. Differences in forecast performance with and without the proposed new observations tell us the degree to which the new data will be of significance in the forecasts.

In the case of expensive satellite remote sensing systems, an OSSE can be conducted for a tiny fraction of the cost needed to build and launch a prototype. Once the potential benefit is demonstrated, there is a sound technical basis for cost/benefit or trade-off analyses.

Using well-designed OSSEs, NOAA can optimally design future observing systems for the monitoring and prediction of the atmosphere, ocean, and land surface, for improved global and national weather and climate predictions, at the lowest cost possible. The OSSE simulations will provide guidance to decision makers for cost-effective observing system solutions for the nation.