

**National Oceanic and Atmospheric Administration (NOAA)
Response to:**

Use of Observed System Simulation Experiments (OSSEs) at NOAA

A report prepared by the
Environmental Information Services Working Group
of the NOAA Science Advisory Board
April 2019

December 16, 2019

Background

On July 3, 2019, the National Oceanic and Atmospheric Administration (NOAA) Science Advisory Board's (SAB) Environmental Information Services Working Group (EISWG) submitted their annual Report to Congress to the SAB, as required by the Weather Research and Forecasting Innovation Act of 2017. The SAB approved this report at its July 10-11, 2019 meeting, and the report was transmitted to NOAA on August 8, 2019.

(c) ANNUAL REPORT.—Not less frequently than once each year, the Working Group shall transmit to the Science Advisory Board for submission to the Under Secretary a report on progress made by National Oceanic and Atmospheric Administration in adopting the Working Group's recommendations. The Science Advisory Board shall transmit this report to the Under Secretary. Within 30 days of receipt of such report, the Under Secretary shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a copy of such report.

The EISWG Report to Congress contained a set of recommendations on the use of Observing Systems Simulation Experiments (OSSE) in NOAA. NOAA provided the following response to these recommendations on December 16, 2019.

Recommendations on Potential NOAA Actions Related to OSSEs

Recommendation 1: “OSSE, OSE, FSO, EFSO research efforts should be coordinated nationally (e.g., sharing of software tools) to avoid duplication of effort (e.g., via the QOSAP program). These methods each have their pros and cons, and should all be used to assess the relative benefit of different observing systems. Besides full-scale OSSE experiments, simple experiments could also be very powerful (e.g., for sampling strategies and data value evaluation).”

NOAA Response: NOAA concurs with this recommendation and will work through appropriate mechanisms to avoid duplication.

Recommendation 2: “The OSSE development for earth system models (e.g., for sea ice prediction) needs to be accelerated. Furthermore, global 5 km (and preferably 3 km) Nature Run based on earth system models should be developed as the basis for a variety of OSSEs. This may require the purchase of new high-performance computers or the partnership with other agencies.”

NOAA Response: NOAA concurs with the recommendation to accelerate OSSE development and increasing the Nature Run resolution to 5 km. However, the agency notes that this activity will be well suited for cloud computing and may not require adding additional high performance computing capacity to existing NOAA assets.

Recommendation 3: “NCEP data assimilation and prediction system will continue to improve. OSSEs are used to evaluate the observational network likely decades ahead. Therefore, the choice of observations and investment decisions based on OSSEs need to explicitly consider the potential impact of deficiencies in the current data assimilation and prediction system.”

NOAA Response: NOAA concurs with this recommendation.

Recommendation 4: “Besides existing OSSE activities at NOAA, OSSEs should also be used to:

- assess the value of NOAA partnership in satellite remote sensing with foreign agencies (e.g., India) and the private sector (e.g., purchasing data from privately-launched satellites),
- assist the exploration of strategies for the most effective and efficient way to do sea ice prediction (observations, models, data assimilation). Should NOAA request ice-breakers? How many?
- compare the value of (polar, geostationary, small/cube) satellite network strategy (e.g., small number of large satellites versus large number of small and cube satellites) for weather and climate prediction, and
- do a gap analysis in NOAA; i.e., what are the greatest new observational needs? What combination of old and new systems will work best?”

NOAA Response: NOAA agrees with this recommendation.

Recommendation 5: “OSSEs have been primarily used to evaluate the impacts of observing systems and/or observation denial on forecast performance per se, that is, on the physical parameters, and treating all forecast locations, times, and circumstances as equal. But this idea should be extended to societal impacts, whether monetizable, or in terms of lives at stake, etc. In other words, there are national priorities (e.g., saving human race) where money does not matter, and there are priorities depending upon the constraint of financial resources. This could be a possible additional avenue of research. In an Earth system model where social systems and the built environment are included, one can imagine collecting human data or propagating just the physical earth system information through the social systems as well.

Indeed, while OSSEs provide quantitative analyses of future observing system impacts for a specific model, the effects on products that rely on that model can only be estimated qualitatively. The NOAA/NESDIS Technology, Planning and Integration for Observation (TPIO) division has developed a qualitative tool for assessing supporting investment decisions, called the NOAA Observing System Integrated Analysis (NOSIA-II), also known as NOAA’s Value Tree. This Value Tree is based on a survey of subject matter experts across all NOAA Line Offices to gauge the impacts of Earth observation investments on NOAA’s key products and services. Therefore the aforementioned OSSE, OSE, FSO, EFSO and PQC tools should be used in concert with the current NOSIA-II system to determine NOAA’s future observing needs.”

NOAA Response: As the EISWG report states, an OSSE modeling experiment is used to evaluate the impact of new observing systems on operational forecasts when actual observational data are not available. While NOAA acknowledges the value of OSSEs as a quantitative analysis tool, there are certain assumptions made when using a simulated dataset, and the agency is concerned that extending this tool to also evaluate societal impacts could potentially compound any assumptions or errors in the simulated dataset.

However, observing system investments can be assessed by combining Observing System Experiments (OSE)/OSSE results with NOSIA model data to assess mission service impacts such as hurricane warnings and fisheries stock assessments. Using OSE/OSSE and NOSIA data in concert facilitates decision making before acquiring substantial observing systems to minimize risk, manage costs, and maximize impact. Additionally, economists have used NOSIA mission service impacts to estimate the return-on-investment from NOAA observing systems.