SAB Work Plan Topic 2: Review the Use of Observing System Simulation Experiments (OSSEs)

Brad Colman, EISWG Co-Chair
Eugenia Kalnay, University of Maryland and SAB Member

Activities since July Update on Topic 2

- EISWG Face to Face meeting (26/27 July 2018)
  - OSSE's were a central focus of the meeting
  - Presentations on the topic included:
    - Fred Carr, University of Oklahoma
    - Bob Atlas, NOAA AOML
    - Eugenia Kalnay, NOAA SAB
    - Susan Avery, NOAA SAB

- Identified a working group to develop the Work Plan for Topic 2
    - Xubin Zeng, lead
    - Bill Hooke, AMS
    - Fred Carr, University of Oklahoma
    - Eugenia Kalnay, NOAA SAB
    - Bob Atlas, NOAA AOML

- Delivered Work Plan to SAB on 31 August 2018

- Per SAB request, also reviewed and updated Topic 2 description

SAB ask to Review and Update Topic Description

Topic 2: Review the Use of Observing System Simulation Experiments (OSSEs)

An OSSE is a modeling experiment used to evaluate the impact of new observing systems on operational forecasts when actual observational data are not available. OSSEs are done: 1) to find out if a new observing system will add value to NWP analyses and forecasts; 2) to make design decisions for a new observing system; and 3) to investigate the behavior of data assimilation systems in an environment where the system's behavior is known (paraphrased from Prive & Errico PPT, 2015). NOAA has a Quantitative Observing System Assessment Program that uses OSSEs for a number of purposes related to NOAA's observing and modeling activities for both the atmosphere and ocean. These OSSEs are mandated by Section 107 of the Weather Act and follow the rigorous methodology for performing OSSEs that was established by (Atlas et al., 1984) and described in detail by Hoffman and Atlas (2016) in the Supplement to their article on future OSSEs in the Bulletin of the American Meteorological Society.

Topic 2 Work Plan

- Objective:
  - Review the use of OSSEs in NOAA, Navy, NASA, and elsewhere
  - Develop options for NOAA to consider current and future research and development (R&D) work in this area, such as the combination of OSSEs with EFSO (which is being carried out at AOML with UMD collaboration, and is expected to strongly enhance and accelerate the current abilities of OSSEs).

- PROPOSED Team:
  - Bill Hooke, Xubin Zeng, + ocean / private sector
  - SAB members: Eugenia Kalnay and Susan Avery (SME)
  - Climate Working Group members: 1-2 members are expected (need to contact CWG co-chairs)
  - NOAA liaison: Lidia Cucurull, NOAA AOML (CONFIRMED)
  - Domain experts: Fred Carr (note that other people mentioned here, such as Bob Atlas and Eugenia Kalnay, are also domain experts) Navy liaison: Nancy Baker NASA liaison: Mike Bosilovich (GSFC) and Derek Posselt (JPL)

- Deliverables:
  - A short white paper that will review the use of OSSEs in NOAA, Navy, NASA, and elsewhere; and develop recommendations for NOAA to consider and provide rationales for each recommendation made.
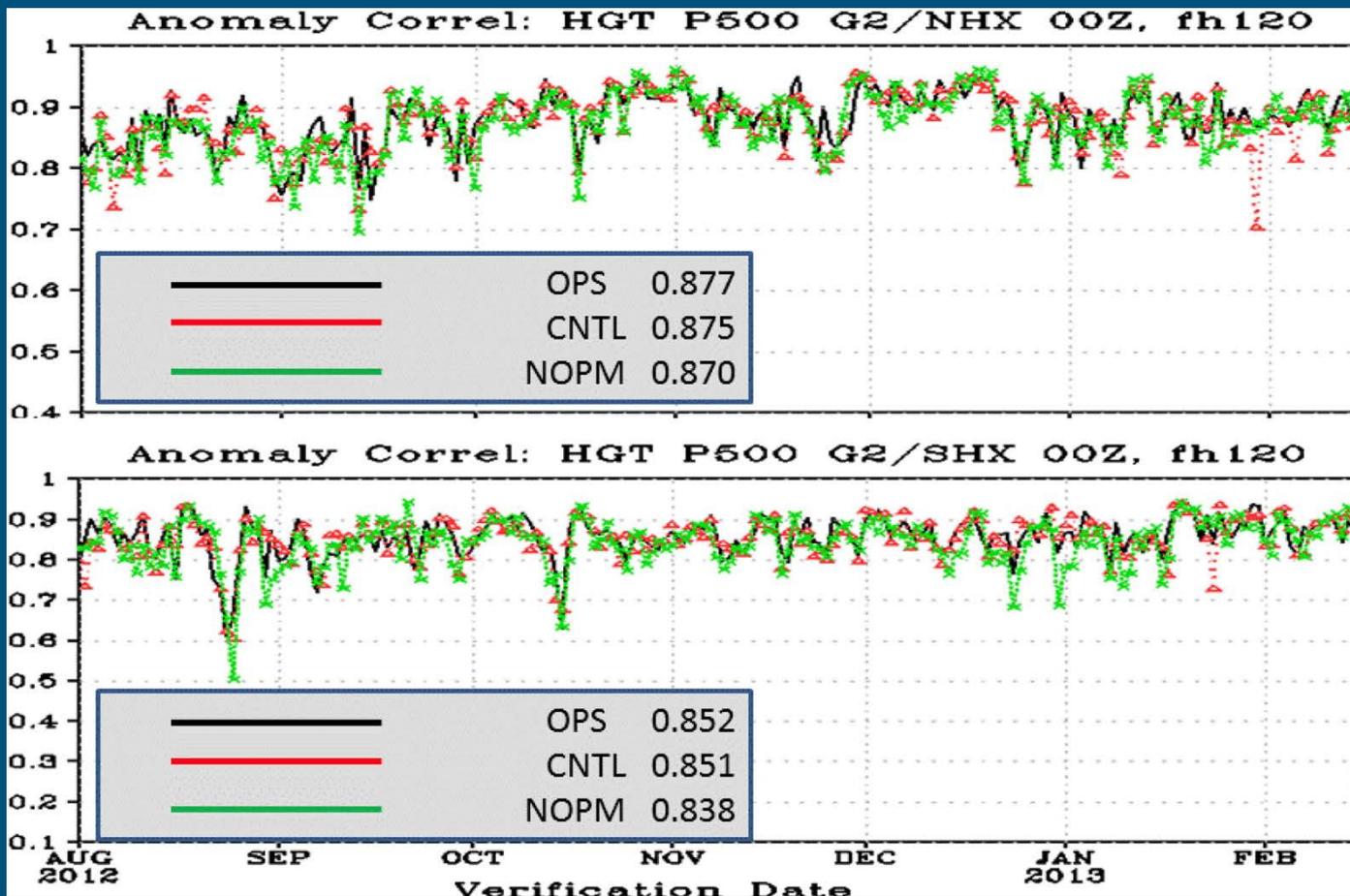
Topic 2 – Timetable Way Forward

- **31 August 2018: submit the EISWG OSSE work plan to SAB 30 September 2018: Finalize the team membership**

- 31 October 2018: Review the use of OSSEs in NOAA, Navy, NASA, and elsewhere

- 31 December 2018: Develop recommendations for NOAA to consider; finish the draft white paper

- 31 January 2019: Revise the white paper based on EISWG and other inputs

- Mid-February 2019: Finalize the white paper for submission to SAB

Some thoughts on discussion and findings

- OSSEs have a lot of potential, but cannot separate the impact of the different observing systems on the forecasts.

- Ensemble Forecast Sensitivity to Observations (EFSO) can evaluate during the 6hr forecasts whether each observation is beneficial or detrimental.

- Combining OSSEs with EFSO (Chen and Kalnay, 2018) will provide much more information about each observing system as shown in the next two slides.

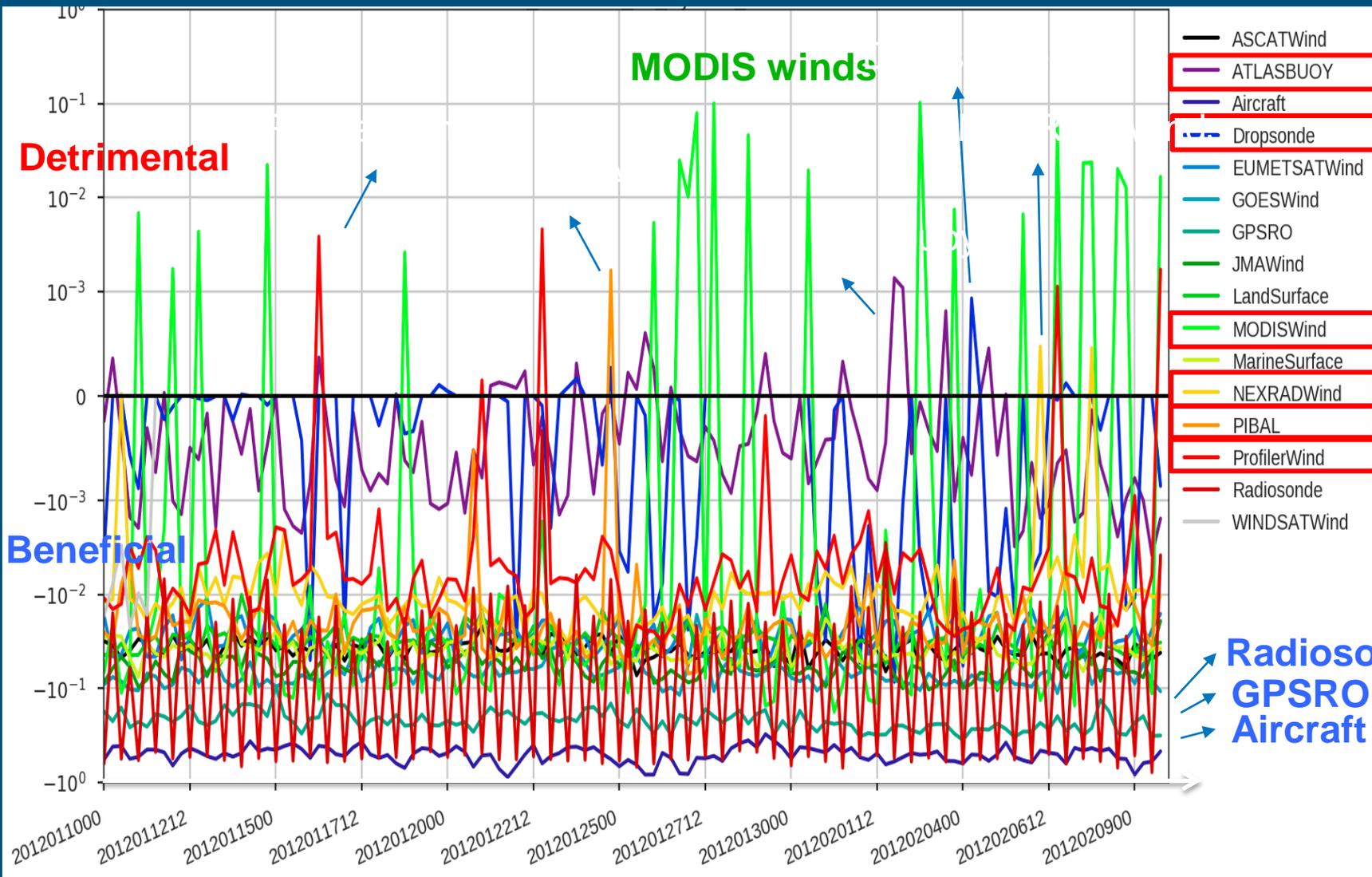- This will make OSSE+EFSO much more effective and useful.

In OSSEs or OSEs the forecast impact of all the instruments are mixed together

Lord et al., BAMS, 2016: OSE simulating failure of JPSS (all PM satellites)

OSSE+EFSO: Monitors the impact of every instrument

06hr System Total Error Impact for each instrument (J/kg)

OSSEs+EFSO show which instruments are detrimental, when and where!

Discussion