

Full OSSEs with International Collaboration

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Abstract

Data assessments using simulation experiments are able to provide a quantitative evaluation of future observing systems and instruments. These experiments are known as Observing System Simulation Experiments (OSSE). The OSSE results have often been different from theoretical explanations or speculation. The OSSE proxy of the true atmosphere is called a Nature Run (NR), and when a NR is produced by a free forecast run different from the forecast model used for the data assimilation system (DAS) it is called a "full OSSE". An internationally collaborative effort for full OSSEs, called Joint OSSEs, has been formed over the last three years.

Over the last 10 to 15 years, OSSEs have become widely accepted as the de facto standard for assessing the impact on numerical weather prediction (NWP) applications of new candidate systems. Even though the primary focus of this note is impact assessment for future observing systems, it should be pointed out that OSSEs have applications also in other areas, e.g. research and development in data assimilation methodology.

An internationally collaborative effort for full OSSEs, called Joint OSSEs, has been formed over the last three years. In Joint OSSEs common NRs will be used by the various DAS at many institutes. The first Joint OSSE NRs have been produced by the European Center for Medium-Range Weather Forecasts (ECMWF). A NR with a 13 month long period from May 2005-May 2006 with three hourly dumps, T511 horizontal resolution, and 91 vertical levels using daily SST was produced to study global data impacts. The T511NR showed remarkably good cyclone statistics and a realistic tropics. During hurricane season and the US severe storm season, two 35 days long runs with hourly dumps at T799 horizontal resolution and 91 levels (T799NR) have been produced for hurricane periods and spring storm period.

An extensive effort for simulation of observations was conducted at NASA/GSFC/Global Modeling and Assimilation Office (GMAO.) GMAO simulation software includes:

- ☐ Software for generating conventional obs (Observation type included in NCEP .prepbufr file)
- ☐ Software for simulating radiances
- ☐ Software for generating random obs. error

First existing instruments have to be simulated and tested in OSSE system. Calibration of data assimilation system are being conducted. Calibration are being performed using adjoint technique at GMAO and data denial experiments at ESRL and NCEP.

Currently various projects are emerging within Joint OSSE. Various experiments planned are:

- 1) Various DWL configuration proposed by both NASA and ESA will be tested by Joint OSSE.
- 2) Additional Radio Occultation observations

3) UnManned Air Craft System

4) Preparation for data assimilation system toward GOES-R and NPOESS instruments

5) Study of observational error

6) Comparison of various data assimilations system

7) Evaluation of targeted observation

Ideally, all new instruments should be tested by OSSEs before they are selected for construction and deployment. OSSEs will also be important in influencing the design of the instruments and the configuration of the global observing system. While the instruments are being built, OSSEs will help prepare the DAS for the new instruments. Developing a DAS to assimilate a new type of data is a significant task. However, this effort has traditionally been made only after the data became available. The OSSE effort demands that this same work be completed earlier; this will speed up the actual use of the new data and proper testing, increasing the exploitation lifetime of an innovative satellite mission.