

USWRP

Joint Observing System Simulation Experiments (OSSE) Testbed (JOT)

Terms of reference

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1. Mission Statement

The mission of the USWRP **Joint** OSSE Testbed (JOT) is to provide a numerical model environment suited to both the rapid and in-depth evaluation of proposed advanced sensors (orbital, sub-orbital and surface-based), sensor deployment strategies and data assimilation schemes related to the improvement of Numerical Weather Prediction (NWP). Access to this testbed should be as open as possible, especially to academia and the hosting agency of the JOT.

2. Overview

The U. S. Weather Research Program (USWRP) is sponsoring the development of an OSSE capability to evaluate proposed observing systems and their potential impact on analyses and forecasts. The JOT will emphasize orbital, sub-orbital and surface-based sensor platforms, targeted observations, global and regional scale models, and a hierarchy of OSSE-like experiments. This JOT initiative recognizes the need for a capability to perform rapid “screenings” of instrument and data utility concepts, as well as the higher fidelity (and more costly) full OSSEs. The JOT will be distributed with components at each of the participating organizations and its management housed at the Atlantic Oceanographic and Meteorological Laboratory (AOML). The use of existing OSSE components (Nature Runs, instrument simulation code, diagnostic packages, etc) will be highly encouraged as will the participation of academia and other researchers in evaluating the extensive outputs from the simulation experiments.

2.1. Primary Objectives

The primary objectives are to establish a numerical test bed that would enable an hierarchy of experiments to: 1) Determine the potential impact of proposed space-based, sub-orbital and surface-based observing systems on analyses and forecasts, 2) Evaluate tradeoffs in observing system design, 3) Assess proposed methodologies for assimilating new observations, in co-ordination with the Joint Center for Satellite data Assimilation (JCSDA), and 4) provide a place to evaluate impacts of changes in observing system capabilities due to either system degradation or proposed capabilities.

2.2. Sub-objectives

To define both the advantages and limits of an hierarchy of OSSEs that includes rapid prototyping of instrument or data assimilation concepts. Some examples from previous efforts include Quick OSSEs, Rapid Response OSSEs (RROSSEs), and Partial OSSEs (POSSEs).

To generate an OSSE process that invites participation by the broad community of agency planners, research scientists and operational centers.

2.3. Motivation

OSSEs require significant funding for set up. This is best done with “core” support from more than one line office or agency since the experiments often crosscut multiple line office and agency interests. A major investment for OSSEs is a Nature Run. Nature Run assessment, adjustments, data simulation for current observing systems and checks on realism of the simulated observations on analyses and forecasts are “core” functions. In contrast, individual experiments have much more reasonable incremental costs.

Some redundancy between agencies is desirable, but should be by design. There is a need for coordination to optimize the national investment in OSSEs for instrument design, data utility studies and model development efforts. There is a particular need for a recognizable point of contact for academia, industry and government agency inquires into how to access the OSSE test bed.

2.4. Potential partnering and hierarchical capabilities

A key element of the proposed effort is to define the hierarchy of OSSE-like experiments (lower resource investment) that may complement or lead up to full OSSEs. It is to the advantage of both the instrument and modeling communities to have access to rapid prototyping and “screening” experiments that do not require the resources needed for the more rigorous full-up OSSEs. However, it is critical to define how these OSSE-like experiments are to be conducted and how the results of these screening experiments should be used (trusted). A major focus of the planning effort will be to provide such definition and utility guidelines.

3. Concept of Operations

The JOT is an activity to be funded initially by the USWRP and is modeled, in part, after other testbeds such as the JHT, HydroMet Testbed (HMT), the JCSDA OSSE initiative and the WRF Developmental Test Center. Coordination with other testbeds and oversight will be provided by the USWRP Executive Committee (NUEC). The NUEC will facilitate outreach, the proposal process, interaction with the oversight board, funding, and other tasks common to the USWRP test beds. The JOT will work with the NUEC to accomplish those tasks appropriate for administration of the OSSE test bed.

The JOT mission will be accomplished by the following:

- assessing technology and instrument platform breakthroughs and new techniques for advanced, real-time, data-analysis techniques, forecast models, and observational systems that have potential for significantly improving forecast guidance;
- evaluation of Nature Runs, instrument observation simulation code, forward models and data assimilation systems (DAS);
- preparing documentation, training materials, and evaluations of performance characteristics of successful sensors and sampling strategies to facilitate their use by operational centers.

An annual Announcement of Opportunity (AO) inviting projects will be the initiation for JOT proposal-driven OSSEs, pending sufficient funding. The AO will be prepared by the JOT Director with help from the JOT Steering Committee. The AO will be open to the U. S. scientific community, including the NOAA Line Offices, Navy, NASA, NCAR, universities, and the private sector. Proposals will be reviewed under the purview of the SC. Salaries and expenses to support researcher participation in the OSSEs can then be negotiated. Funded projects become a JOT activity. Nature runs to be utilized by the JOT may be generated by both research community and operational models. In general, the data assimilation and forecasting experiments will utilize operational systems. Computing infrastructure is expected to be provided by USWRP and participating organizations.

4. Locations and Organization

4.1. Facilities

The JOT will have both in-situ elements with dedicated physical space and distributed elements. Whereas a small administrative staff and a core of facilitators will be housed at AOML, the researchers and their associated facilitators may be distributed both geographically and organizationally.

4.2. Management

Administration for the JOT will include a Director and a part-time Administrative Support Assistant. Other than salaries, additional operating expenses include supplies, short-term visitor travel, publications, and possibly office space rental for the permanent staff. A Steering Committee (SC) will serve to aid the JOT Director in making decisions.

4.2.1. Director

The Director shall be selected and approved by the NUEC. The responsibilities of the JOT Director are to:

- Provide scientific leadership and develop programs that facilitate the evaluation of proposed observational systems and the potential impact of their data products on NWP.
- Work with the SC to prepare an annual AO and provide to the NUEC for distribution.
- With the SC conduct a review process on submitted proposals;
- Work with the operational center directors, and the SC to determine final disposition of favorably reviewed proposals;

- Negotiate the needs, milestones, and timelines with the funded principal investigators;
- Supervise the administrative assistant and internal facilitators, and coordinate external facilitator activities to achieve transition schedules;
- Manage and administer the JOT staff in a manner consistent with agency policies and guidelines;
- Identify, in conjunction with the SC and the operational forecast centers, observational needs and coordinate with the NUEC and other test-bed directors to design and execute appropriate OSSEs;
- Prepare the Annual Operating Plan (AOP) for OSSE activities, infrastructure, deliverables, schedule, and budget for the NUEC; and
- Prepare the annual report summarizing yearly activities and present to the NUEC.

4.2.2. Administrative support

This role includes a part time Administrative Support Assistant whose role is aimed at supporting the JOT Director.

4.2.3. Facilitation Team

A team of on-site and off-site facilitators, who may be permanent staff or contractors, will work directly with the operational centers and with JOT-funded researchers and their staff. The team may also include off-site facilitators from universities, laboratories, or other test beds who are temporarily assigned to the JOT to work directly with the researcher and/or remotely access JOT systems. This group may also include long-term post-doctoral fellows associated with various projects interested in the technology transfer process. Given the nature of JOT tasks, the successful facilitator must have a suitable combination of scientific background, computer coding and display creation skills, knowledge/experience in operations, knowledge/experience in instrumentation and an ability to collaborate.

4.2.4. Researchers and Staff

These include the principal investigators with funded proposals and their support staff. Some responsibilities are the following:

- Coordinate with JOT staff;
- Complete applied research and transition activities on time, while alerting JOT Director of any problems;

- Provide regular (at least semi-annual) reports;
- Aid in setting up OSSE system and evaluation procedure;
- Monitor scientific integrity of experiments; and
- Provide documentation and training materials for forecast and maintenance efforts.

4.2.5. Steering Committee

The SC advises the JOT Director on all activities. It is made up of internally and externally researchers, with expertise in OSSEs, data assimilation, and modeling, and forecasters, and administrators, who make use of OSSE results. Participation from other agencies (eg. NASA and DOD) would be coordinated with the JCSDA.

4.3. Observing System Evaluation

Under the direction of the JOT Director, the internal facilitators (employees of the JOT) serve as links between the researcher and the operational centers. The researcher may have a team of external facilitators who are part of the research staff who work closely with the JOT. External facilitators may also be associated with other external locations (e.g., other test beds) that are providing assistance in some specific JOT task.

The OSSE test bed activity can run the gamut from new uses of existing observing systems to future instrument/platform combinations. The facilitator may be called upon to create links to existing data, to configure new products from simulated observations, statistical methods, and numerical forecasts, and to convert research code to testable quasi-operational applications.

When a “screening OSSE” has successfully demonstrated a potential positive impact for a new observing system or DAS scheme, a decision may be made for a “full OSSE”. This latter activity will stress the highest reasonable fidelity in simulating observations as that done at the JCSDA. The JOT Director will coordinate with the AOML staff and Director on hardware requirements, software readiness and OSSE scheduling.

The researcher’s role in preparation for an OSSE is to provide examples and documentation to the facilitators at AOML for inputs to the OSSE.

4.4. Proposal Process

The evaluations will be initiated by a proposal and review process. The JOT proposal process will be fair and unbiased and open to all interested researchers in the US scientific community. The proposal cycle will begin with an informal review by the JOT staff to determine needs and shortfalls evident in the current observing systems. The SC will identify new emerging research and coordinate these opportunities with the JOT and NUEC. From the resulting statement of need and opportunities, the JOT Director and SC will draft an AO. When all groups are satisfied, the AO will then be issued to the community with a specified submission deadline. Instructions for

drafting project proposals will be given in the AO. The SC may choose to distribute some proposals to external reviewers familiar with research and operational needs. Once the reviews have been returned, the SC will provide comments on the proposals and rankings to the JOT Director for their comments and endorsements. Any differences in rankings will be negotiated between Directors and the SC before being provided for final approval.

A special review procedure is used for consideration of the second-year proposals prior to opening the new competition via the AO process. Given satisfactory progress on the first year milestones as reflected in the progress reports and the JOT Director's assessment, the SC will provide an accelerated review of the second-year milestones, timelines, and budgets as updated by the researchers. Given the SC endorsement that the second-year proposals should be funded, and continued endorsement of the project goals by the JOT Director, the JOT Director will submit the funding requests to the NUEC for final approval. Having then established the remaining funding for that fiscal year, a new AO is prepared via the process described above. The combined funding needs for the continuing and new projects will be defined in the JOT operating plan and passed to the NUEC.

4.5. JOT Projects

Once operational, the JOT will undertake a number of well-defined OSSEs annually. Each project will have a well-defined metric for success and a time line for completion, which will be coordinated with the JOT Director prior to project initiation.

Upon acceptance and scheduling of the OSSE project, JOT facilitators (on-site or off-site) will be assigned the task and one or more point(s) of contact will be appointed by the center Director. When the OSSE has met the agreed-upon level of conclusion, the JOT Director will make the decision for any additional OSSEs.

Codes resulting from JOT work accepted for quasi-operational implementation will be the property of the U. S. government and will be in the public domain.

4.6. Relationship to Other Testbeds

Within the USWRP a number of test beds with themes relevant to the JOT will have ongoing parallel activity. It is important that the JOT Director work closely with the other test bed directors and advocate projects that may have a direct bearing on improving observing systems and their utility within NWP.

The JOT is expected to coordinate its activities with those of other centers such as the NOAA Labs and Cooperative Institutes, NCEP, the Naval Research Labs, and NCAR. Experiences gained and advances at other centers should be shared to the mutual benefit of improving weather forecasts and warnings.