Internationally Collaborative Joint OSSEs Progress At NOAA

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OSSE:Observing Systems Simulation Experiments
http://www.emc.ncep.noaa.gov/research/JointOSSEs/
Data impact on analysis and forecast will be evaluated.

A Full OSSE can provide detailed quantitative evaluations of the configuration of observing systems.

A Full OSSE can use an existing operational system and help the development of an operational system.

**Advantages**

- Data impact on analysis and forecast will be evaluated.
- A Full OSSE can provide detailed quantitative evaluations of the configuration of observing systems.
- A Full OSSE can use an existing operational system and help the development of an operational system.

**OSSE Calibration**

Calibration of OSSEs verifies the simulated data impact by comparing it to real data impact. In order to conduct an OSSE calibration, the data impact of existing instruments has to be compared to their impact in the OSSE.

Existing Data assimilation system and verification method are used for Full OSSEs. This will help development of DAS and verification tools.

**International Joint OSSE capability**

- Full OSSEs are expensive
  - Sharing one Nature Run and simulated observation saves costs
  - Sharing diverse resources
- OSSE-based decisions have international stakeholders
  - Decisions on major space systems have important scientific, technical, financial and political ramifications
  - Community ownership and oversight of OSSE capability is important for maintaining credibility
- Independent but related data assimilation systems allow us to test the robustness of answers
Joint OSSE Nature Run by ECMWF

Based on discussion with JCSDA, NCEP, GMAO, GLA, SIVO, SWA, NESDIS, ESRL, and ECMWF


ECMWF Nature run used at NOAA
Spectral resolution : T511
13 month long. Starting May1st,2005
Vertical levels: L91, 3 hourly dump
Daily SST and ICE: provided by NCEP
Model: Version cy31r1

Simulated radiance data,
with and without MASK in BUFR format for entire Nature run period
Type of radiance data and location used for reanalysis from May 2005-May2006
Simulated using CRTM1.2.2
No observational error added

Conventional data
Entire Nature run Period
Restricted data removed
Cloud track wind is based on real observation location
No observational error added

Note: This data must not be used for commercial purposes and re-distribution rights are not given. User lists are maintained by Michiko Masutani and ECMWF

NASA/NCCS
http://portal.nccs.nasa.gov/osse/index.pl
ID and Password required

http://portal.nccs.nasa.gov/josse/index.pl

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NCAR
Currently saved in HPSS
Data ID:   ds621.0
Contact:
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Archived in the MARS system at ECMWF
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Simulated observation
Control data: Observation type and distribution used by reanalysis for 2005.
Observational error is not added to the control data but calibration was performed to demonstrate the impact of observational error in control data.

Atlantic Hurricane in the nature run for the analysis period of 9/25-10/10

The coherent subsystem provides very accurate (<1.5m/s) observations when sufficient aerosols (and clouds) exist.

The direct detection (molecular) subsystem provides observations meeting the threshold requirements above 2km, clouds permitting.
Calibration and initial evaluation of DWL impact were conducted for the period 1\textsuperscript{st} July-15 August.

No observational were added to simulated control data.

Calibration experiments showed reasonable agreement in data impact of RAOB wind in real and simulated impact. (Fig.1 and Fig.2)

Fig.3 shows GWOS DWL may have more than RAOB wind.

Related presentations and a poster

Thursday, 26 January 2012: 1:45 PM
Impact of Different Wind Lidar Configurations on NCEP Forecast Skill
Room 340 and 341 (New Orleans Convention Center)
Zaizhong Ma et al.

Tuesday, 24 January 2012: 11:30 AM
Observing System Simulation Experiments in the Joint Center for Satellite Data Assimilation
Room 256 (New Orleans Convention Center)
Lars Peter Riishojgaard et al.

Wednesday, 25 January 2012
Joint OSSEs at NOAA, Evaluation of DWL, JPSS, and DWSS
Hall E (New Orleans Convention Center)
Michiko Masutani et al.

NOUV: NO RAOB wind, NONW: No wind data
DWL: CTL + GWOS type DWL

Fig.1: Average 500-hPa geopotential height anomaly correlation as a function of forecast range for the Northern (a) and Southern (b) Hemisphere. Tropical wind vector RMS errors (m/s) at 200 hPa (c) and 850 hPa (d) as a function of forecast range. CTRL shown in black, NOUV in red. All observations used were real. Lower plot of each panel shows difference between NOUV and CRTL with, error bars indicating differences that are significant at the 95% confidence level.

Fig.3: Average 500-hPa geopotential height anomaly correlation as a function of forecast range in the Northern (a) and Southern (b) Hemisphere. Tropical wind vector RMS errors (m/s) as a function of forecast range at 200 hPa (c) and 850 hPa (d). CTRL in black, NOUV in red, NONW in green, and DWL in blue. Lower plot of each panel shows differences between CTRL and the perturbation experiments (NOUV, NONW or DWL); error bars indicate differences significant at the 95% confidence level. All forecasts were verified against T511NR.
Minimum Mean Sea level Pressure
The verification period:
Sep28-Oct13, 2005
in 72 hour forecast
Evaluated at 00Z only

This display indicates the hurricane
track and intensity

Nature run
Truth

T126
With DWL

T170
With DWL

T254
With DWL

T382
With DWL
Evaluation of observational error in radiance

T170 with large obs error in radiance

Add DWL

Minimum Mean Sea level Pressure
The verification period Sep28-Oct13, 2005
72 hour forecast evaluated at 00Z only

Better radiance data help track and intensity forecast. DWL also will improve intensity forecasts even with perfect radiance data.

T170 No obs error in radiance

Add DWL

T170 no obs error in radiance

DWL added
**Impact of resolution vs. GWOS DWL**

Improvement by Increasing resolution

- T126 ➔ T170

Improvement by Adding GWOS DWL

- T126

- T170 ➔ T254

- T254 ➔ T382

Reduction of RMSE from NR in meridional wind

Zonal averaged

The verification period Sep28-Oct13, 2005 in 72 hour forecast

Evaluated at 00Z only

Add large error to radiance data

More verification planned.

Add forecast from 12z. Try DWL with other configuration.

Produce hurricane track diagnostics.
Initial Summary of Hurricane OSSE

◆ OSSE with control observation without observational error is useful to provide initial outlook of the data impact in large scale.
◆ Designing observational error is an important major project.
◆ DWL improves both intensity and location of a hurricane at all resolution even with perfect control observation.
◆ Adding DWL is more effective than increasing model resolution in Northern Hemisphere in Hurricane forecast.
◆ In hurricane season, increasing model resolution will be more effective in large scale forecast. Improvement due to adding DWL is mainly over hurricane.
◆ At least T170 resolution is required to utilize DWL data for hurricane forecast. Impact of DWL is larger in T254 than in T170 model forecast. T382 model for OSSE with T511 Nature run may not be the best.

Future Plans

Add various observational errors to control observations and study data sensitivity to the data impact.

More OSSEs to study detailed evaluation of configurations of DWL planned by NASA and compared with ESA DWL.

Prepare control data for OSSE period with 2011-2012 template.

Conduct OSSE to evaluate JPSS and DWSS.

Acknowledgement

The nature runs for Joint OSSEs were produced by Dr. Erik Andersson of ECMWF. We appreciate GMAO to providing initial satellite data for calibration at ESRL. GMAO also provided code to add random error to simulated data.