Development, Validation, and Application of OSSEs at NASA/GMAO

Ronald Errico
Nikki Privé

Goddard Earth Sciences Technology and Research Center
at Morgan State University

and

Global Modeling and Assimilation Office
at NASA Goddard Space Flight Center
Outline:

1. Impacts of 4x daily radiosondes everywhere
2. Impacts of Micromas CubeSat
3. Estimate of analysis error characteristics
4. Examination of the “NMC Method”
5. Effects of model and observation errors
6. Examination of predictability
Impacts of 4x daily radiosondes everywhere

Average over July 20N-60N 312 hPa

**Analysis Error**

**Background Error**
Average over
July
20N-60N
312 hPa

Control Error
Extra RAOB Error
RMSE for control – RMSE for extra RAOBs at forecast hour 24 for 3 regions

Dashed = Combined results for 0z and 12z

Solid = Combined results for 6z and 18z

Dark = Pass at 95% significance
Impacts of Micromas CubeSat

Proposal under review
The MicroMAS CubeSat

- **MicroMAS Spacecraft**
  - Electronics Stack
  - Scanning Assembly
  - Reaction Wheels
  - Communications Radio

- **MicroMAS Payload**
  - Payload Interface Module
  - Antenna Assembly
  - Receiver Front End
  - Back End Processor
  - Power Conditioning
  - Thermal Management
  - Control & Data Handling

A high-resolution 118-GHz spectrometer provides all-weather measurements of atmospheric temperature and precipitation.
Fractional reduction of analysis error \(\frac{ea(\text{without}) - ea(\text{with})}{ea(\text{without})}\)
Estimate of analysis error characteristics

Temporal standard deviations of analysis errors for July-August.
Analysis error correlations for July-August for North-Pacific region
Vertical correlations of analysis error for July-August for various regions

CONUS = solid
North PAC= dashed
Trop PAC= dotted
South PAC = dot-dashed
Application: Characterization of analysis error
Power spectra of analysis and analysis error fields on eta-surfaces
Examination of the “NMC Method”

Application: Evaluation of “NMC Method”
Comparison of meridional correlation length scales for true Bkg error (solid) versus 48-24 hour forecast differences (dashed)

Effects of observation errors on analysis and forecasts

Effects of model and observation errors


Application: Effects of model and observation errors

Examination of predictability

Manuscript in preparation (Privé and Errico)