FY16 Highlights
Joint Center for Satellite Data Assimilation

● JCSDA Observation System Assessment Standing Capability (JOSASC)
  ○ Improved tools to diagnose impact of observations in operational NWP, such as inter-center FSOI inter-comparison

● Improvements to Community Radiative Transfer Model (CRTM)

● Global Forecast Dropout Prediction Tool

● Improved Project Planning and Management Structure
FSOI International Comparison

24-h Observation Impact Summary
Global Domain, 00Z 06Z 12Z 18Z DJF 2014-15
Fractional Impact

Radiosonde
Ship
Buoy
Land Surface
Aircraft
PIBAL
GPSRO
Geo Wind
MODIS Wind
AVHRR Wind
AIRS
AMSPA
MHS
ATMS
CrIS
HIRS
IASI
Seviri
GOES

Fractional Impact (%)

-0.2 0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6

1e2
**Community Radiative Transfer Model**

**CRTM Mission** Satellite radiance simulation and assimilation for passive MW, IR, & Visible sensors of NOAA, NASA, DoD satellites, and others (200 sensors). Simulation of clear/cloudy/precipitating scenes

**Highlights**
- Generated CRTM coefficients for CubeSat MicroMAS2 and CIRAS; INSAT3DR IMGR and SNDR; JPSS1 VIIRS and GOES-S/T/U ABI; updated SSMI/S F16.
- Implemented CRTM-OSS alpha release for future unapodized radiance assimilation.
- Prepare CRTM Rel-2.3.0, including CrIS FSR, AIRS NLTE, MHS ACC coefficients, bug fixes, etc.

**CRTM On-going/Future Development**
- New sensors: CERES, EPIC-DISCOVR, JPSS-1
- Expand CRTM capability to CMAQ aerosols
- Implement CSEM surface emissivity model
- CRTM with cloud fraction capability

**Community Line-By-Line Model (CLBLM)**
- Refactor the LBLRTM in modern Fortran
- Redesigned, simplified and enhanced LBL algorithm to facilitate future expanded sets of spectroscopic parameters

**Community Active Sensor Module (CASM)**
-CAS(a) (Sim.) $Z_m$ [dBZ] @ Ku-band (14 GHz)
- GPM DPR (Obs.) $Z_m$ [dBZ] @ Ku-band (14 GHz)
Global Forecast Dropout Prediction Tool

Components of the GFDPT

- GFS analysis
- ECMWF forecast

DETECTION

- Grib-Extremes
  Sifts out and displays location of extreme difference

Community Observation Assessment Tool (COAT)
Enables independent analysis of GSI observations versus NWP.

DIAGNOSIS

- Forecast-Forecast (F-F) Correlations (ECMWF and GFS)
  Indicates warning of dropout potential

- Independent Assessment Tool (IAT)
  Evaluate the model performance using various verification metrics (AC scores, FIT2OBS, Innovation Stats, ...)

Multifaceted Capability

- Develop a monitoring system to analyze differences between the NCEP and ECMWF global models operationally and provide diagnostic tools to the NCEP Model Evaluation Group (MEG) and Weather Prediction Center (WPC).
- Determine if the “dropouts” are from QC problems in the assimilation.
- Evaluate dropout event(s) and automate diagnostics to determine if QC is responsible per particular Ob type both conventional and satellite. Implement an improved QC system.

5-Day Northern and Southern Hemisphere Forecast Skill at 500 hPa from multiple NWP center models

- EMCWF & UKMO did not dropout
- GFS Operational (T1534-T574 4D HYBRID-ENSVAR) SH dropout (20151215 00Z)
Top FY17 Highlights
Joint Center for Satellite Data Assimilation

● Prototype Unified Forward Operator (UFO) for JEDI
  ○ Capability to generate observation equivalent from multiple models and associated grids

● Preparation/Testing/Demonstration for New Sensors
  ○ JPSS Sounders, GOES-16, GPSRO (CWDP, COSMIC 2, etc.)

● Science/Technical improvements to CRTM
  ○ Examples – All-sky radiance and radiances over land
Joint Effort for Data assimilation Integration (JEDI)

STRATEGY

1. Collective path toward Nation Unified Next-Generation Data Assimilation
2. Modular, Object-Oriented code for flexibility, robustness and optimization
3. Mutualize model-agnostic components across
   - Applications (atmosphere, ocean, land, aerosols, etc.)
   - Models & Grids (regional/global, FV3)
   - Observations (past, current and future)

OBJECTIVES

1. Facilitate innovation to address next scientific grand challenges
2. Increase R2O transition rate
3. Increase science productivity and code performance
H8 AHI / GOES-16 ABI Assimilation

- Evaluate effectiveness of channel selection, spatio-temporal thinning, and super-obbing strategies for AHI L1B radiances. Extend to 4DEnVar. Perform forecast impact assessment (FSOI, OSEs)
- Preparing AHI radiance for RAP regional model ingestion
- Getting ready for GOES-R ABI initial assessment and assimilation

Significantly Improved bias after bias correction

Channel 10, O-A, bias corrected:
Assimilation of All-Sky Radiances

- MC6 “integrated database” delivered in March, 2016 from Texas A&M.
- Initial assessment of Community Hydrometeor Model (CHYM) shows potentially significant impact from modifying the cloud-coefficient file.
- Developed interface with CRTM and conduct long-run assimilation tests for sensitivity analysis, work with partners to coordinate GSI/GFS testing.
Satellite Radiances over Land

- Extend and improve efforts to assimilate satellite MW and IR radiance data over land and examine impact of emissivity first guess on analysis.
- Implement emissivity as a control variable in GSI.
- Perform Observation System Experiments to quantify the effectiveness of increased/improved assimilation of radiance data over land.
- Support the transition to operations of over-land MW and IR radiance assimilation and collaborate with researchers at JCSDA partner agencies to share methodologies and results.
Questions
Joint Center for Satellite Data Assimilation

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Joint Observing System Assessment Standing Capability (JOSASC)

- Methodology for impact studies on high-impact events
  - Remove spin-up period
  - Set up ensemble of DA experiments

- GPS-RO impact on GFS

GPSRO Denial lowers the Temp. A.C values over 500 & 250hPa.

The difference is significant till 96 hrs at 500hPa and till 120 hrs at 250hpa pressure level.
Goal Alignment in 2017

• **New and Improved Observations**
  – Prepare for the assimilation of JPSS, GOES-16, COSMIC-2, evaluate Satellite Commercial data
  – Assimilation of radiances over land and sea-ice with improved estimation of surface emissivity
  – Improved use of all-sky radiances

• **CRTM (Community Radiative Transfer Model)**
  – Release 2.3.0 and CRTM Users Workshop
  – Acceleration via software optimization
  – Improved scattering tables for clouds and precipitation

• **Observation Impact Assessment**
  – Extend international FSOI intercomparison capability
  – Improved set of diagnostics (FSOI, OSEs, etc.) for evaluation of NWP forecast skill
  – Satellite commercial data evaluation (CWDP project)
Goal Alignment in 2017 (cont.)

• **Dropout**
  – Integration of web display of all the final products
  – Final Delivery of the Integrated GFDPT tool to the NCEP Operations

• **JEDI (Joint Effort for Data assimilation Integration)**
  – Unified Data Assimilation Planning Workshop
  – Prototype of Unified Forward Operator
  – Requirements and initial prototype of standardized observation access

• **Ocean, Sea-Ice, Coupled Data Assimilation**
  – Build Sea-ice DA components following JEDI standardized observation access
  – Initial integration into unified forward operator

• **Program Management**
  – Annual Operating Plan with Quarterly reports
  – Reinstate Science Advisory Committee
  – “Critical path” project planning to optimize operational transitions