Advancements in CrIS Data Assimilation

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In Collaboration With

NCEP/EMC, NCEP/NCO, NESDIS/JPSS, NESDIS/STAR, NESDIS/ASPB, NASA/GMAO, NASA/NCCS, STC, JCSDA



Outline

- RARS/EARS Direct Broadcast Status
- CrIS Modifications in NCEP's Gridpoint Statistical Interpolation (GSI) software.
- Transition to CrIS-FSR

RARS/EARS/DB -> DBNet Status

- Direct Broadcast available from SSEC
- Regional ATOVS Retransmission Services (RARS) available via GTS
- Available Instruments:
 - CrIS (399), ATMS, IASI (500), AMSU, MHS, (HIRS)
- Latest NCEP Global Forecast System included:
 - RARS IASI (500), AMSU
 - DB CrIS (399), ATMS, IASI (500)
- RAP & HRRR parallel testing all instruments available from DB and RARS
- Need to validate / test CrIS-FSR (431 subset)

CrIS Modifications to the GSI

- Designed to work with the current CrIS and CrIS-FSR
- Exploits new GSI features (bias correction, removal of channel subset restrictions)
- Exploits VIIRS cloud height and amount information in the CrIS BUFR
- Is part of NCEP's software management system.
 - Currently under review by NCEP
 - To be reviewed by the GSI Review Committee (NASA, DTC, ESRL)

Scan Angle Modifications

- New bias correction routine able to accommodate non-fixed scan angles.
- Scan angle is computed for all FOVs within all FORs, vice FOV=5 only.
- Counterclockwise rotation of FOVs is accounted for.
- Using all FOVs increased the number of thinning boxes.



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VIIRS Cloud Information

- VIIRS cloud information now in BUFR files
- Use cloud height and cloud amount to determine clearest FOV in thinning box
- Improves "normal" distribution of observations.
- Defaults to warmest FOV when cloud information is missing.



Center of Box Criteria

- Relaxed "distance from center of thinning box" criteria
- Used only when more than one FOV is clear.
- Was most dominant constraint.
- Has the largest increase in observations used.



Transition to CrIS-FSR

- 431 channel subset derived by Andrew Collard and Antonia Gambacorta and was reviewed by several NWP centers.
- CrIS BUFR template was revised to contain a "FSR" flag and the 12 guard channels (Tom King, Yi Song, Jeff Ator, Dennis Keyser).
- DBNet will distribute CrIS-FSR 431 subset.
- Retrospective CrIS-FSR data were made available by Yong Han, Tom King, Yangrong Ling.
- NCEP's initial plans are to use 2211 channel data from NESDIS/OSPO and 431 subset from DBNet.

Transition to CrIS-FSR Cont'd

- VIIRS enterprise cloud information is only available after 1 May 2017.
- Used a low resolution (T670,254) version of the 4DEnsVAR Global Forecast System.
 - Operational framework, updated analysis software.
 - Scan angle, cloud information and distance relaxation is used in both control and experiment (<u>only testing channel selection</u>)
- Control uses current (82) CrIS channels and assimilation weights but from CrIS-FSR data set.
- Experiment uses 94 temperature and 8 water vapor channels with modified assimilation weights.

Water Vapor Statistics



Increased use of ATMS water vapor channel observations when using CrIS-FSR water vapor channels.

Blue – more observations pass initial QC Gold – more channels used during assimilation.



Average Relative Humidity difference from last 10 days.

Changes are evident in the analysis and forecasts out to 24 hours.

Forecast Sensitivity Observation Impact (FSOI) Total Moist Energy



Adding 20 channels and adjusting assimilation weights moved CrIS from 9th to 5th

Forecast Sensitivity Observation Impact (FSOI) Total Moist Energy per CrIS Channel



500 hPa anomaly correlations for the Northern and Southern Hemisphere





Summary

- Using all FOVs (instead of FOV=5)
- Using VIIRS cloud information
- Relaxing distance from center of thinning box
- First attempt at a new channel selection has 94 temperature and 8 water vapor channels.
- Adjusted assimilation weights/observation errors.
- Increased number of total observations from ~250,000 to ~500,000
- Improvements in humidity field
- CrIS FSOI ranking moved from 9th to 5th
- Minimal changes in 500 hPa anomaly correlations

Added ~ 100,000 observations

Added ~ 150,000 observations

Questions?

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