EDR Retrievals from CrIS and ATMS using CrIMSS operational algorithm

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Presentation Outline

1. Introduction to CrIMSS EDR OPS code and algorithm
2. Validating and tuning CrIMSS OPS algorithm using Metop-A proxy data
3. Retrieval results for 11-11-2011 Suomi NPP ATMS data
4. Retrieval results for 2-24-2012 (golden day) ATMS/CrIS data
5. Summaries and conclusions
Introduction the ported CrIMSS OPS code

- IDPS OPS code
  - ING, DMS, INF, PRO
  - (VIIRS, ATMS, CrIS ....)

- Select CrIMSS related portion and separate unnecessary portion

- Interface to read auxiliary, ancillary, and SDR data

- IPO svn repository

- Ported CrIMSS OPS code

- Interface to read science code data (F90 codes)

- CrIMSS Science Code
A brief description of the CrIMSS EDR algorithm

1. Start
2. Initialization
3. Pre-Processing
   - MW Radiance Available?
     - No: NWP First Guess
     - Yes: MW Retrieval
4. MW Retrieval
   - No: IR Radiance Available?
     - No: Quality Control
     - Yes: Scene Classification
5. Quality Control
   - No: MW+IR Retrieval
   - Yes: MW Retrieval
6. MW Retrieval
   - No: Postprocessing I (Slant-to-Vertical Conversion)
   - Yes: All FORs Processed?
     - No: Next FOR
     - Yes: MW Retrieval
7. Postprocessing I (pressure profile, vertical interpolation)
8. Stop
Algorithm tuning and validation performed using proxy data from IASI and AMSU/MHS

- Rigorous transformation of IASI spectra to CrIS proxy data
  - Results shown are for
- Great for algorithm tuning before the NPP launch this year
  - Bias, convergence, stability, quality control, parameter tuning …..
100 and 300 mb temperature retrieved from the CrIMSS EDR algorithm and comparison with ECMWF
300 and 500 mb water retrieved from the CrIMSS EDR algorithm and comparison with ECMWF
Bias Derived from ECMWF and Suomi NPP ATMS data
Example of Retrieved Temperatures EDR from the ported operational code using ATMS only for Nov. 11, 2011

- Retrieved 100 mb Temperature from ATMS
- ECMWF 100 mb Temperature
- Retrieved 500 mb Temperature from ATMS
- ECMWF 500 mb Temperature
Example of Retrieved H2O EDR from the ported operational code using ATMS only for Nov. 11, 2011

- Retrieved 300 mb H2O from ATMS
- ECMWF 300 mb H2O

- Retrieved 500 mb H2O from ATMS
- ECMWF 500 mb H2O
EDR statistics from the ported operational code using ATMS only data for Nov. 11, 2011

Ocean temperature

Land temperature

Ocean H₂O

Land H₂O
Apply CrIMSS algorithm to focus day (2-24-2012)
ATMS/CrIS data

\[ \chi^2 = \frac{1}{N_{\text{chan}}} \sum_{i=1}^{N_{\text{chan}}} \left( \frac{R_{\text{obs}} - R_{\text{calc}}}{R_{\text{noise}}} \right)^2 \]

MW retrieval \( \chi^2 \)  
MW+IR retrieval \( \chi^2 \)
Focus day H$_2$O EDR Product from ATMS only and from combined ATMS/CrIS retrievals

Retrieved 300 mb H$_2$O from ATMS

Retrieved 300 mb H$_2$O from ATMS/CrIS

Retrieved 500 mb H$_2$O from ATMS

Retrieved 500 mb H$_2$O from ATMS/CrIS
Focus day Temperature EDR Product from the combined ATMS/CrIS retrievals

ATMS/CrIS retrieved T ant 100 mb

ATMS/CrIS retrieved T ant 500 mb

ATMS/CrIS retrieved T ant 850 mb
Summary and conclusions

• CrIMSS EDR operational code has been ported to run on Linux/unix system
  – Provide flexible link to science code
  – Can be easily adapted to perform different functions
    • Reading different data sources
    • Perform forward radiance simulations for bias correction
    • Perform part of the functions such as post processing, database comparison etc

• Data from IASI/AMSU/MHS provide good SDR proxy data
  – Very useful for algorithm tuning and testing
  – Good EDR performance achieved

• The ported CrIMSS OPS code has been applied to
  – Suomi NPP ATMS only data for 11-11-2011
  – Suomi NPP ATMS/CrIS Golden day data (2-24-2012)

• Future work
  – Looking into details
  – Improve convergence
  – Further tuning
Overview of ATMS and CrIS sounders

<table>
<thead>
<tr>
<th>CHANNEL</th>
<th>CENTER FREQUENCY (GHz)</th>
<th>MAXIMUM BANDWIDTH (GHz)</th>
<th>CENTER FREQUENCY STABILITY (MHz)</th>
<th>STATIC BEAMWIDTH B (degrees)</th>
<th>QUASI-POLARIZATION</th>
<th>CHARACTERIZATION AT NAIRD (REFERENCE ONLY)</th>
<th>IASI</th>
<th>CrIS (LW)</th>
<th>CrIS (MW)</th>
<th>CrIS (SW)</th>
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<td>0.27</td>
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<td>water vapor</td>
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<td>0.8 cm</td>
<td>0.4 cm</td>
<td>0.2 cm</td>
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<td>window</td>
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<td>QH</td>
<td>surface air</td>
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<td>6</td>
<td>53.596 ± 0.115</td>
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<td>10</td>
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<td>0.33</td>
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<td>QH</td>
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<td>200</td>
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<td>H$_2$O 18mm</td>
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<td>30</td>
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<td>QH</td>
<td>H$_2$O 0.5mm</td>
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</table>

CrIS has 1317 spectral channel (unapodized)
CrIS has 1305 spectral channel (apodized)
9 Field of View (FOV) per Field of Regard (FOR)