



MEMORANDUM FOR: The Record
FROM: Dr. Nicholas R. Nalli and Dr. Quanhua (Mark) Liu, JPSS Soundings Team Leads
SUBJECT: SNPP NUCAPS AVTP and AVMP EDR Product Validated maturity status and public release
DATE: 12/19/2016

Validated maturity status declaration for Atmospheric Vertical Temperature and Moisture Profile (AVTP and AVMP) Environmental Data Record (EDR) Products

Maturity Review Date: 09/03/2014
Effective Date: 09/05/2014
Operational System: NUCAPS Version 1.5

The JPSS Algorithm Maturity Readiness Review Board approved the release of the NOAA Unique Combined Atmospheric Processing System (NUCAPS) atmospheric vertical temperature and moisture profile (AVTP and AVMP) environmental data records (EDRs) to the public with a Validated maturity level quality as of 09/03/2014 (effective date), based on JPSS Validation Maturity Review held on 09/03/2014 (link to review artifacts: <http://www.star.nesdis.noaa.gov/jpss/AlgorithmMaturity.php>).

1. Maturity stage definition:

<http://www.star.nesdis.noaa.gov/jpss/documents/Status/DataProductMaturityLevelDefinitions.pdf>

2. Algorithm Description:

List of Products (Collection Short Name (CSN): 'NUCAPS-EDR')

- Atmospheric Vertical Temperature Profile (AVTP)
- Atmospheric Vertical Moisture Profile (AVMP)

Product requirements/Exclusions (L1RDS)

Table 1: JPSS L1 Requirements for AVTP

Attribute	Threshold	Objective
Geographic coverage	90% every 18 hours	> 90%
Vertical Coverage	Surface to 0.5 mb	Surface to 0.5 mb
Vertical Cell Size	0.2 ~50 mb	0.1 ~ 10 mb
Horizontal Cell Size	50 km at nadir	1 km at nadir
Mapping Uncertainty	5 km	0.5 km
Measurement Range	Propose 150 ~ 400 K	Propose 100 ~ 500 K
Measurement Uncertainty		
Cloud < 50%: Surface to 300 mb	1.6 K per km layer	0.5 K per km layer
300 to 30 mb	1.5 K per 3 km layer	0.5 K per 3 km layer
30 to 1 mb	1.5 K per 5 km layer	0.5 K per 5 km layer
1 to 0.5 mb	3.5 K per 5 km layer	0.5 K per 5 km layer
Cloud >= 50%: Surface to 700mb	2.5 K per km layer	0.5 K per km layer
700 to 300 mb	1.5 K per km layer	0.5 K per km layer
300 to 30 mb	1.5 K per 3 km layer	0.5 K per 3 km layer
30 to 1 mb	1.5 K per 5 km layer	0.5 K per 5 km layer
1 to 0.5 mb	3.5 K per 5 km layer	0.5 K per 5 km layer

Table 2: JPSS L1 Requirements for AVMP

Attribute	Threshold	Objective
Geographic coverage	90% every 18 hours	3 hrs
Vertical Coverage	Surface to 0.5 mb	Surface to 0.5 mb
Vertical Cell Size	20 ~50 mb	5 ~ 10 mb
Horizontal Cell Size	50 km at nadir	1 km at nadir
Mapping Uncertainty	5 km	0.5 km
Measurement Range	Propose 0.001 ~ 100 g/kg	Propose 0.001 ~ 100 g/kg
Measurement Uncertainty	Expressed as a percent of average ratio in 2 km layers	
Cloud < 50%: Surface to 600 mb	Greater of 20% or 0.2 g/kg	10%
600 to 300 mb	Greater of 35% or 0.1 g/kg	10%
300 to 100 mb	Greater of 35% or 0.1 g/kg	10%
Cloud >= 50%: Surface to 600mb	Greater of 20% or 0.2 g/kg	10%
600 to 300 mb	Greater of 40% or 0.1 g/kg	10%
300 to 100 mb	Greater of 40% or 0.1 g/kg	10%

Quality flags (Table)

Table 3: NUCAPS Quality Flags

Values	Definition	Notes
0	accepted	
1	IR+MW final physical retrieval failed at least one quality check	
2	MW regression failed at least one quality check	removed
4	rejected by NOAA (IR regression) file	removed
8 → 9	rejected by internal MIT (MW) file	becomes 9
16 → 17	IR regression failed at least one quality check	becomes 17 ⇒ Quality_Flag = 1
24 → 25	MW and IR+MW both failed at least one quality check	becomes 25 ⇒ Quality_Flag = 1
-9999	missing	

Product evaluation/validation

- Validation of the SNPP NUCAPS AVTP and AVMP EDRs was performed using collocated dedicated, reference and conventional radiosondes representative of the global latitude belts and land/sea surface types, along with global numerical weather prediction (NWP) model comparisons.
- Radiosonde data used for “truth” included dedicated radiosondes from NOAA-supported intensive campaigns (i.e., ARM, AEROSE, CalWater/ACAPEX; e.g., *Nalli et al.*, 2011), collaborative sites (i.e., PMRF, Beltsville), reference sites (GRUAN), and conventional land-based sites.

Product availability/reliability

- NUCAPS AVTP and AVMP EDR data have been operationally produced since 09/01/2013, but data before 09/03/2014 (validated maturity effective date) should not be considered reliable.
- Note that the Beta maturity was attained for the original IDPS “CrIMSS” algorithm AVTP/AVMP products in August 2012, but the NUCAPS algorithm superseded the “CrIMSS” algorithm as the operational CrIS/ATMS soundings algorithm in September 2013.

Algorithm performance dependence

- NUCAPS is dependent upon GFS surface temperature as ancillary input.
- The operational NUCAPS algorithm as a whole is dependent upon required sensor data



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record (SDR) inputs being validated and stable (i.e., CrIS SDRs and ATMS TDRs). An “IR-only” version of the algorithm is currently being developed and tested for mitigation against an ATMS instrument failure.

Known errors/issues/limitations

- NUCAPS algorithm vertical sensitivity is indicated by the retrieval averaging kernels which are generally coarser than the 100 layer RTA grid that the products are output on.

3. Changes since last maturity stage

- The original IDPS “CrIMSS EDR” algorithm was superseded by the SNPP NUCAPS algorithm.
- v1.5.1: Used a new rtaerr file: cris_rtaerr_v10b.asc
- v1.5.2: Uses the earlier v1.5 rtaerr file, but with the ascending/descending flag added in. All versions from here forward have the ascending/descending flag.

4. Review board recommendations

- The Team recommends algorithm Validated Maturity.

5. Path Forward/Future Plan

- Planned further improvements
 - Implement CrIS full-resolution SARTA model (delivered by STC)
 - Optimize CrIS full-resolution algorithm
 - Develop and test “IR-only” algorithm
 - Prepare for JPSS-1
- Planned Cal/Val activities / milestones
 - Apply averaging kernels, degrees-of-freedom, etc.
 - Publish peer-reviewed publication on SNPP validation (manuscript in preparation)
 - Prepare for J-1
 - Global Focus Day numerical model comparisons
 - Support intensive campaigns featuring dedicated radiosondes
 - Acquire and collect other radiosonde observations

6. Additional Items to note

Additional information is available in the NUCAPS algorithm theoretical basis document (ATBD) and validation maturity review briefing, which can be accessed at:

<http://www.star.nesdis.noaa.gov/jpss/Docs.php>

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