

PPS-MW STATUS AND FUTURE PLANS

B. RYDBERG, N. HÅKANSSON, S. HÖRNQUIST, I. KAUR, AND A. DYBBROE SWEDISH METEOROLOGICAL AND HYDROLOGICAL INSTITUTE

NWC SAF USER WORKSHOP, 25 - 27 FEBRUARY, 2025, MADRID



What is the NWC SAF PPS-MW package?

- Upcoming processing package for
 - near real time cloud water and precipitation products,
 - microwave sounding/imaging sensors related to EUMETSATs Metop-SG,
 - to be released after the launch of Metop-SG B satellite



PPS-MW products

Product	Main quantity	Platform/sensor	Coverage	Spatial resolution	Accuracy requirement (simplified)	Scientific responsibility
IWP	Ice water path	Metop-SG-B/ICI	Global	~16 km	${\sim}50$ % for IWP > 20 g/m²	NWCSAF
LWP	Liquid water path	Metop-SG-B/MWI	Global (ice free ocean)	~30 km	~50 % for LWP > 20 g/m²	NWPSAF*
PR-I	Precipitation rate	Metop-SG-B/MWI	Global	~10 km	200 % RSE for rates > 1 mm / h $$	HSAF
PR-S	Precipitation rate	Metop-SG-A/MWS	Global	~17 km (at nadir)	200 $\%$ RSE for rates > 1 mm / h	HSAF
PR-HL	Precipitation rate	Metop-SG-A/MWS* (AWS, ATMS)	High Latitude (Area around Baltic Sea)	~8 — 16 km	200 $\%$ RSE for rates > 1 mm / h	NWCSAF/HSAF



Why use PPS-MW products?

- Metop-SG sensors provide novel observations
 - pairing microwave and sub-mm measurements
 - penetrates cloud systems but is effected by hydro-meteors
- PPS-MW products developed and evaluated by SAFs
 - long term responsibility and support
- Precipitation products
 - provides a complement to other observation systems
 - extend coverage / fill in of gaps of ground based radar networks
- Cloud mass products
 - Can be used directly for nowcasting or to evaluate corresponding quantities of an NWP model
 - => model improvement



Timeliness

- Product generation time < few minutes
- But Metops & JPSS satellites provide irregular coverage throughout the day
 - average time to coverage: ~90 minutes
- Coverage would greatly improve with an EPS-Sterna constellation
 - EPS-Sterna would be a constellation of Arctic Weather Satellite like units in combination with Metop and JPSS satellites
 - average time to coverage: ~25 minutes
 - PPS-MW will naturally support EPS-Sterna



Sampling frequency of a point in central Sweden.



Precipitation products

- PPS-MW include several precipitation products
 - two global ones
 - and a specific one for high-latitudes (difficult area)



Estimated performance / precipitation

- PPS-MW package will include two products developed by HSAF:
 - P-IN-MWS and P-IN-MWI (corresponding to PR-S and PR-I in PPS-MW)
- Algorithms based on a neural network approach trained with observations, i.e. co-located passive microwave and space borne radar data:
 - ATMS / Suomi-NPP (P-IN-MWS)

.

- GMI / GPM Core Observatory (P-IN-MWI)
- Cloud Profiling Radar (CPR) / CloudSat
- Dual-frequency Precipitation Radar (DPR) / GPM Core Observatory
- The P-IN-MWS and P-IN-MWI algorithm includes 6 and 11 individual neural networks, respectively, that are run in a sequential order
 - See e.g. Sano et al., 2022, A Machine Learning Snowfall Retrieval Algorithm for ATMS, for an overview description of algorithm type



Estimated performance of the P-IN-MWS product, in terms of relative error compared to GPM-DPR 2B-CMB product. Figure from HSAF P-IN-MWS ATBD.



PR-HL example



Precipitation retrieval based on ATMS data and compared to BALTRAD composite (ground based radars). PR-HL data can for example extend the coverage and fill in possible gaps of the radar composite.



Cloud mass products

PPS-MW include cloud mass products and auxiliary data from MWI and ICI

MWI and **ICI** will both be hosted on Metop-SG-B satellite and **will** pair microwave and sub-mm observations and thereby **provide novel data**, and reduce uncertainties in global cloud mass estimates



Zonal means of ice water path derived from observations and reanalysis data-sets. Courtesy of Duncan, D. I. and Eriksson, P.: An update on global atmospheric ice estimates from satellite observations and reanalyses, Atmos. Chem. Phys., 18, 11205–11219, 2018.



Estimated performance

IWP, mean height, and mean particle size



Figure from May et al, 2024, The Ice Cloud Imager: retrieval of frozen water column properties



Status and plans

- Implementation
 - algorithms for all planned product implemented
- Validation plan
 - all products to be validated with actual data and best possible reference data
- Release plan
 - Preliminary in 2027 (beta release: autumn 2026)
- Future plans
 - To be decided/defined in CDOP5 proposal, but it is clear that a realization of EPS-Sterna would be game changer

