# H SAF Precipitation Products


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Geo-K

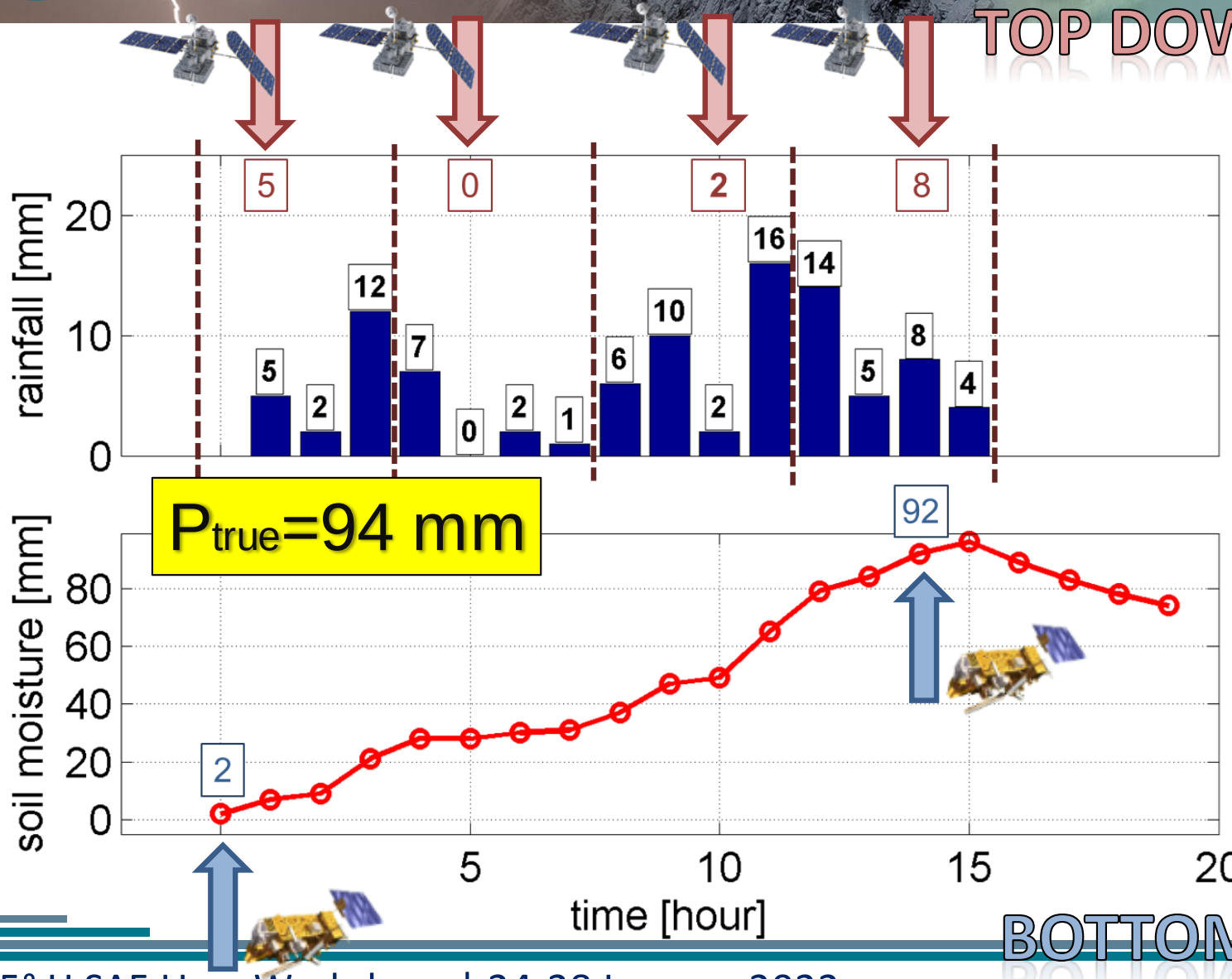
**H SAF Precipitation Products Quality Assessment Cluster**

Italian Civil Protection Department - DPC

Marco Petracca, Silvia Puca, Alessandra Mascitelli, and all PPVG

# Remote sensing of precipitation

## TOP DOWN PERSPECTIVE




The underestimation is due to the satellite overpasses in period with low rainfall

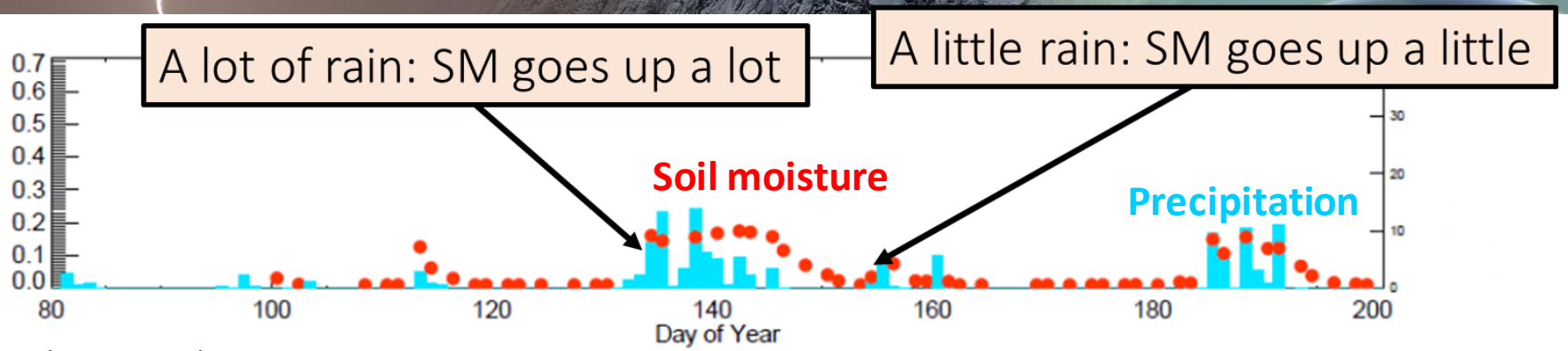
$P_{top\text{-}down}=(5+0+2+8)*4=$ 60 mm

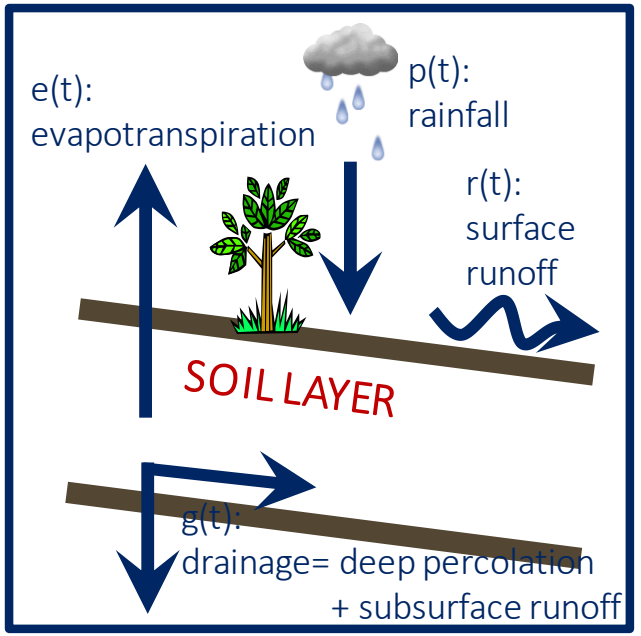
With only two overpasses the bottom up approach provides a better estimate of the accumulated rainfall

$P_{bottom\text{-}up}=(92-2)=$ 90 mm

## BOTTOM UP PERSPECTIVE

# SM2RAIN Algorithm



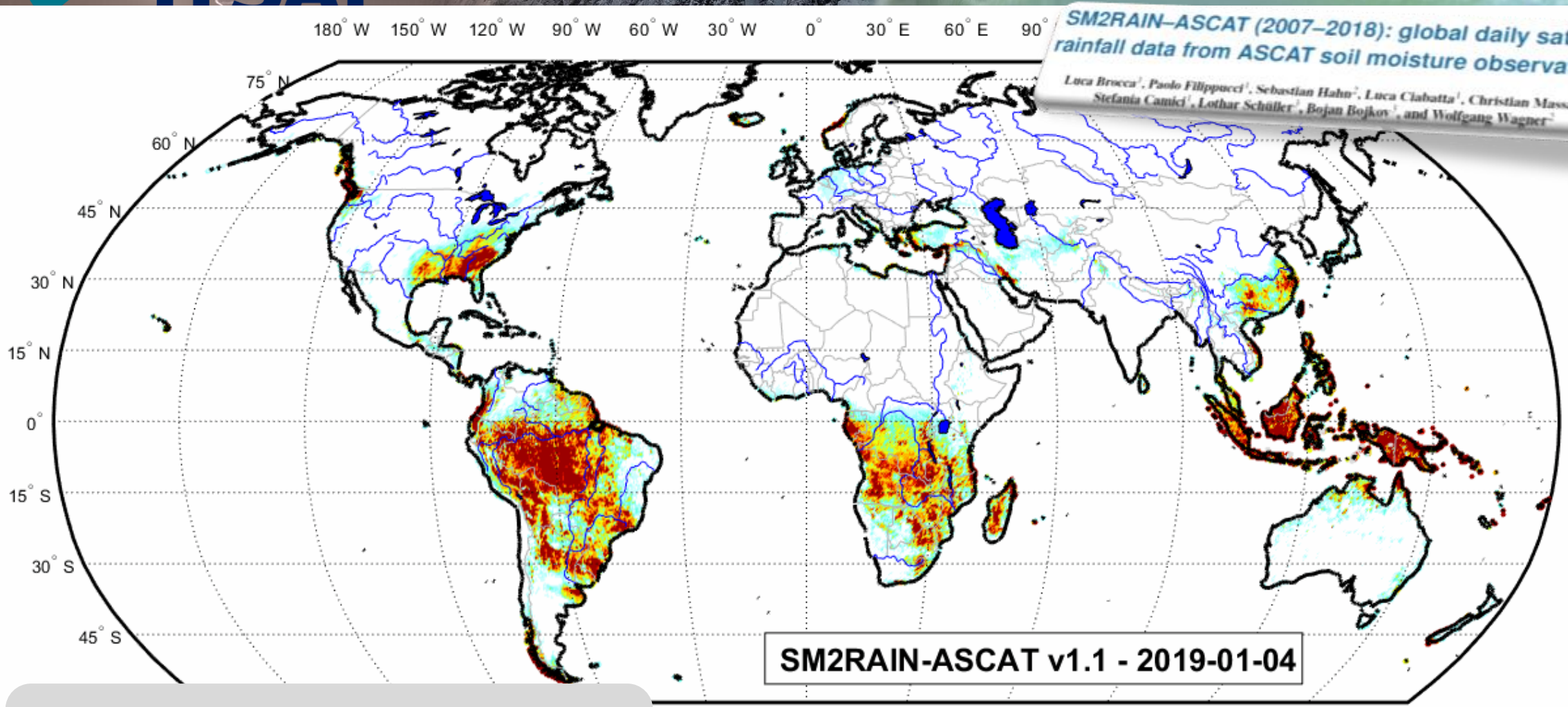

$$Z^*ds(t)/dt=p(t)-r(t)-e(t)-g(t)$$

- $Z^*ds(t)/dt$: soil water capacity = soil depth X porosity
- $p(t)$: precipitation
- $r(t)$: surface runoff
- $e(t)$: evapotranspiration
- $g(t)$: drainage

During rainfall, surface runoff and evapotranspiration are assumed to be negligible $g(t)=as(t)^b$ $r(t)=0$ $e(t)=0$

$$p(t)=Z^*ds(t)/dt+as(t)^b$$

# Global SM2RAIN project




SM2RAIN–ASCAT (2007–2018): global daily satellite rainfall data from ASCAT soil moisture observations

Luca Brocca[1], Paolo Filippucci[1], Sebastian Hahn[2], Luca Ciabatta[1], Christian Massari[1], Stefania Camici[1], Lothar Schüller[3], Bojan Bojkov[3], and Wolfgang Wagner[2]

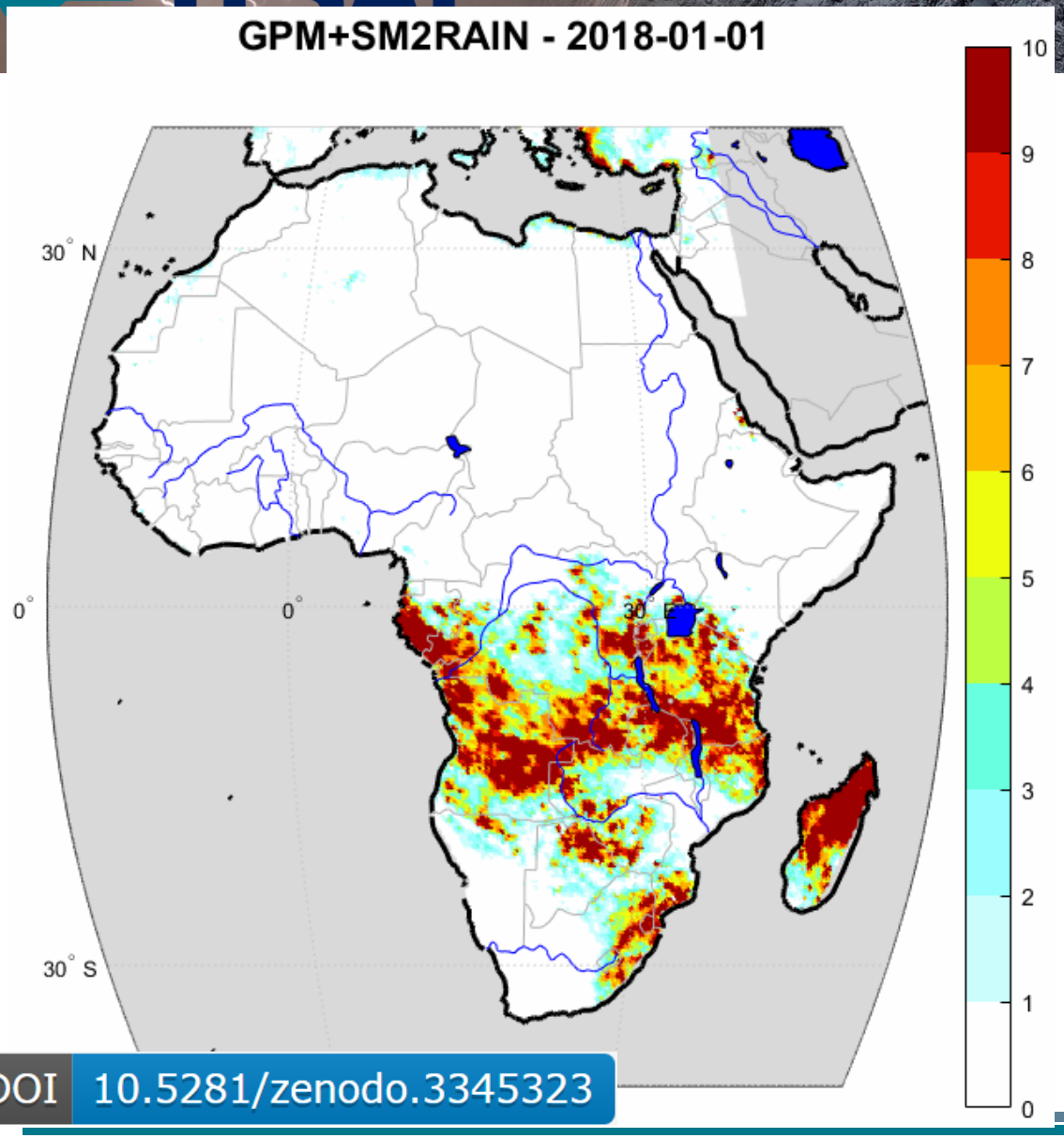
Earth System Science Data


Spatial\Temporal Resolution:
10 km\1 day

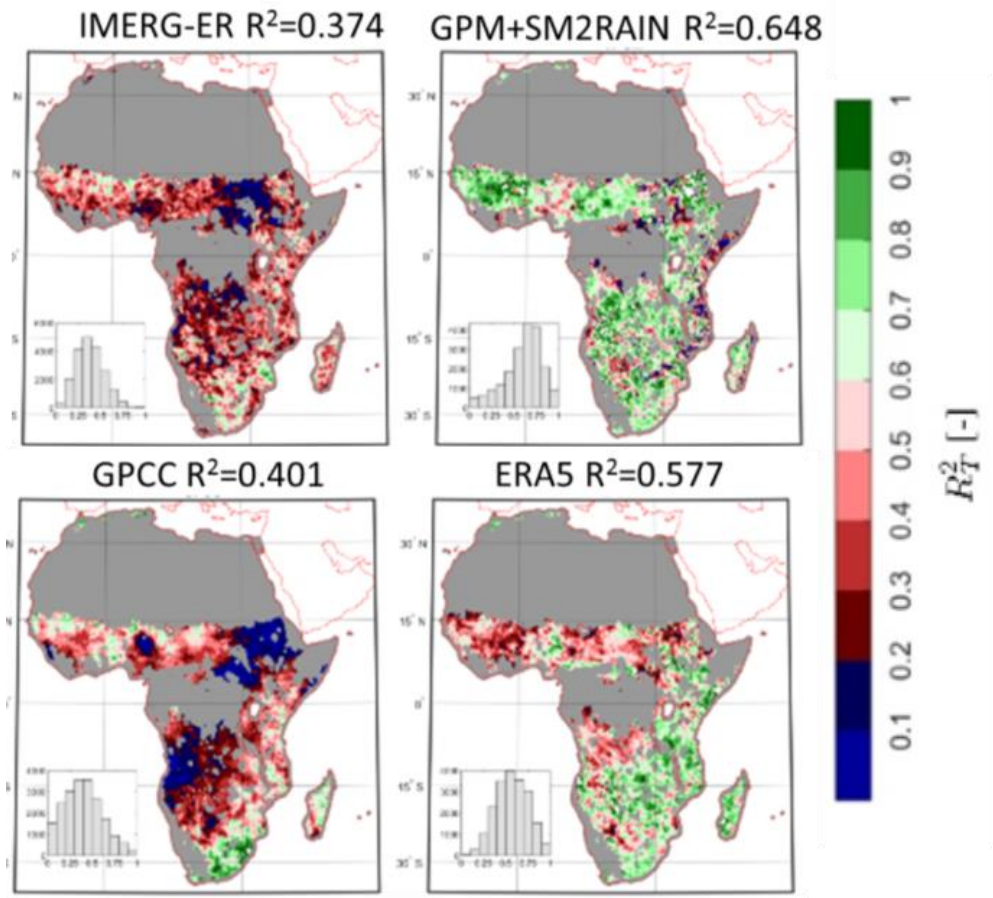
Freely available @ Zenodo
https://doi.org/10.5281/zenodo.2591214

Brocca et al. (2019 ESSD)
Ciabatta et al. (2017 JoH, 2018 ESSD)

# SMOS+Rainfall (GPM+SM2RAIN 2015-2018)




Spatial\Temporal Resolution:
25 km\1 day

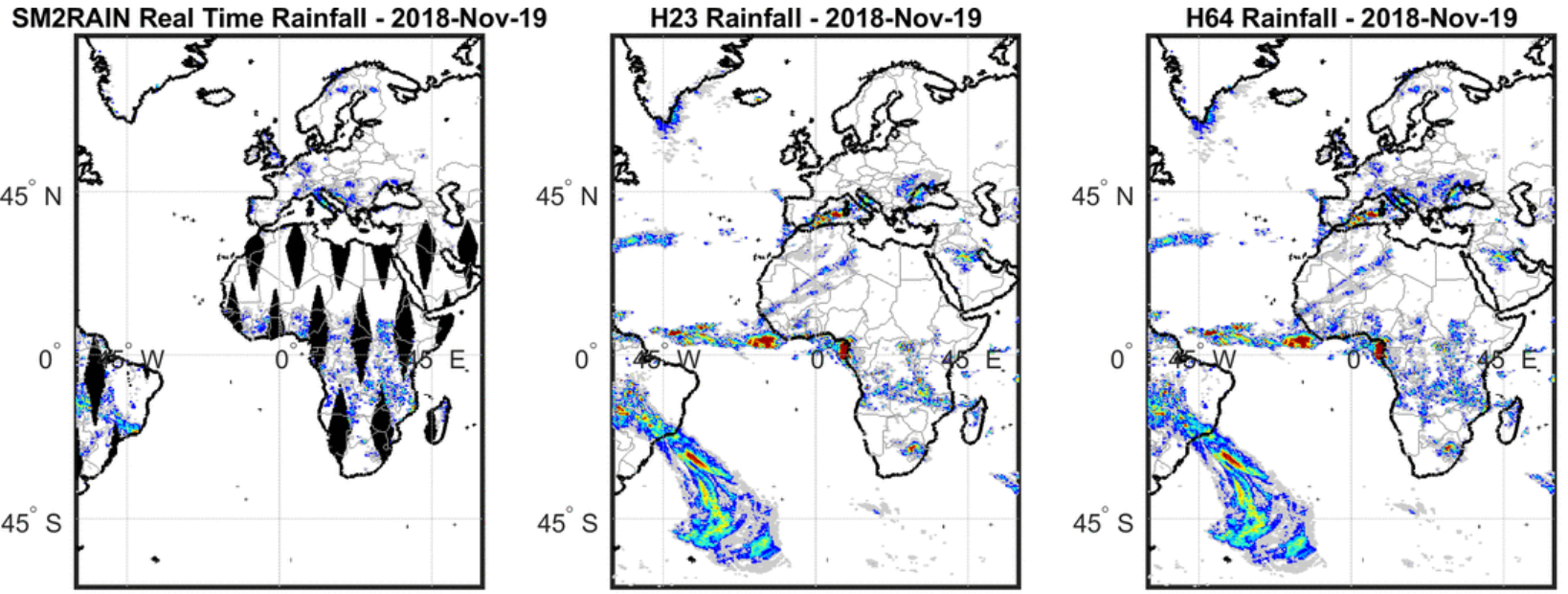



Freely available @ Zenodo
https://zenodo.org/record/3345323

Massari et al. (2020 HESS)
Brocca et al. (2020 SREP)

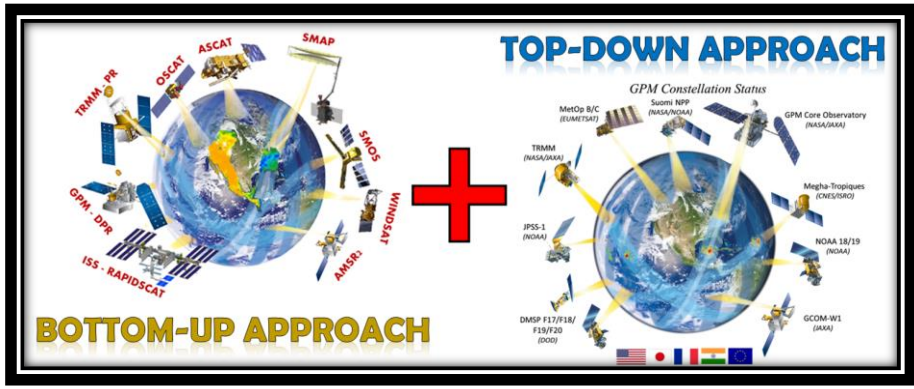
DOI 10.5281/zenodo.3345323

# H64 Product




## *P-AC-SM2R-PMW (H64)*

**The soil moisture-precipitation integrated product**




**Main Features:**

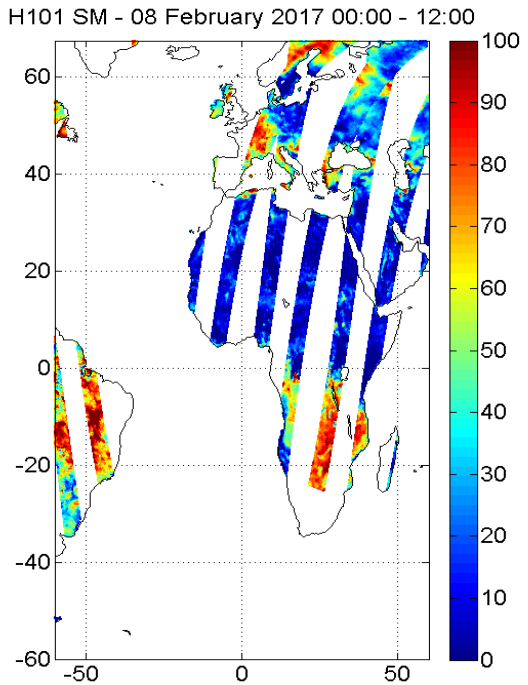
- Daily temporal resolution;
- 0.25° spatial resolution;
- Offline product (1 day latency);
- Format netCDF;
- Availability since 2019

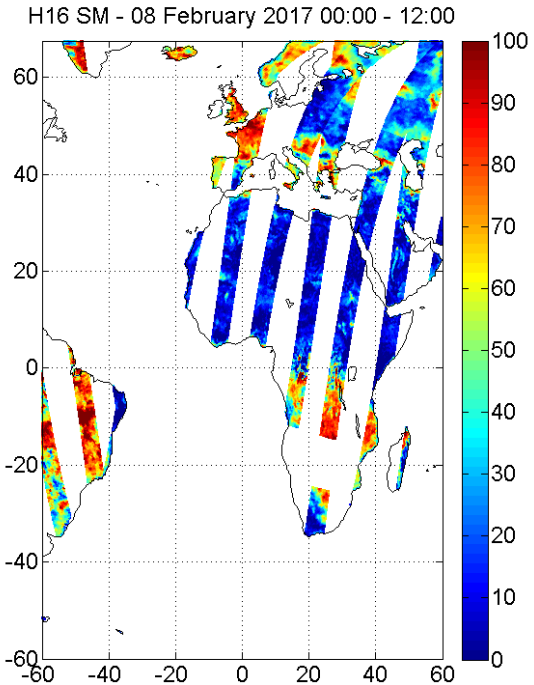
# H64 Product

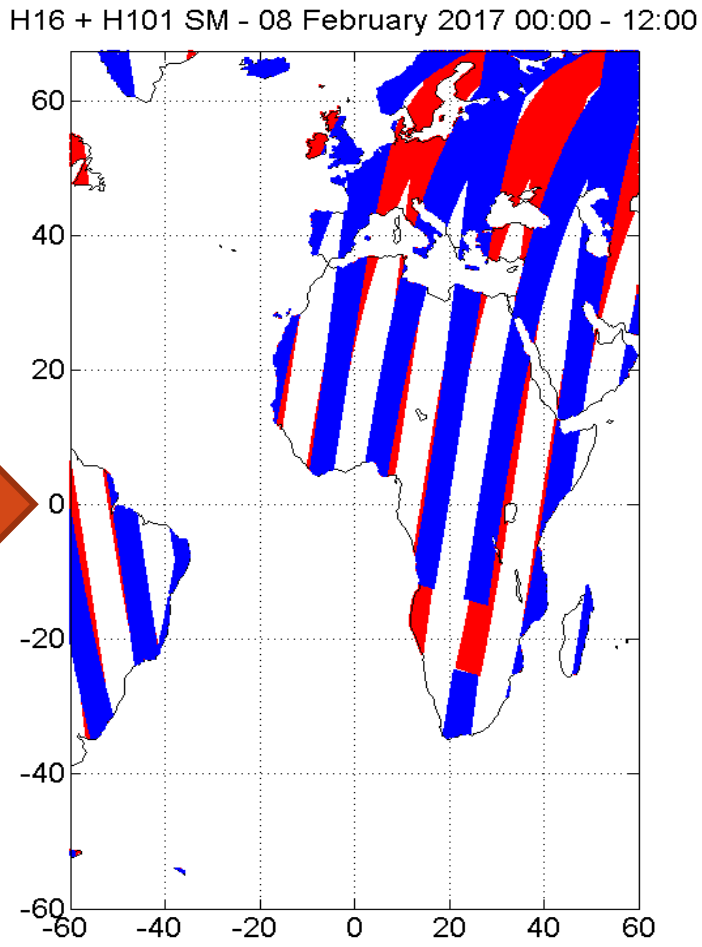
H101/ H104 → Swath Format → Daily composite

H16 → Swath Format → Daily composite

Daily composite → Daily SM maps

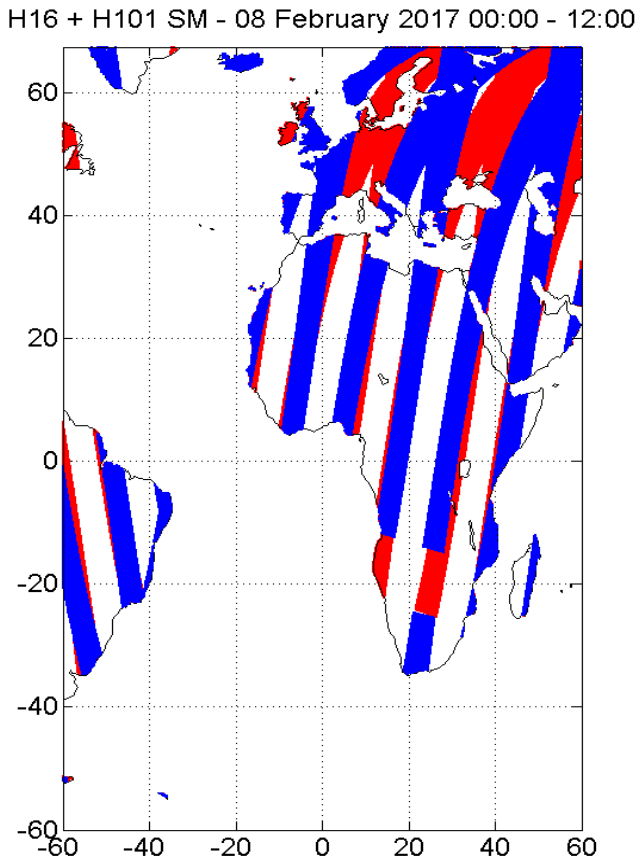


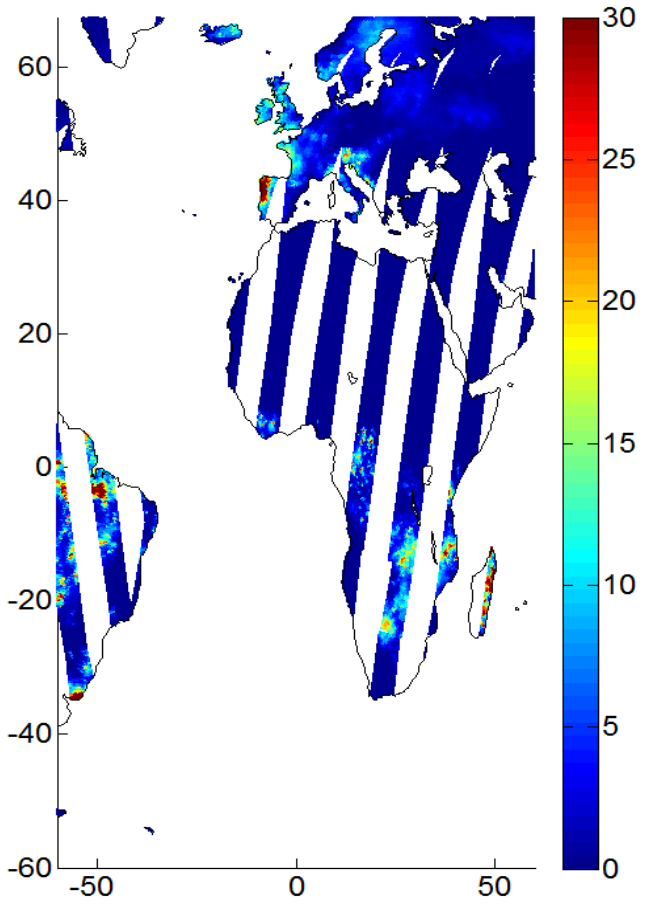



# H64 Product

**Daily SM maps** → **SM2RAIN** → **Daily SM derived rainfall maps (SM2RAIN_HSAF)**



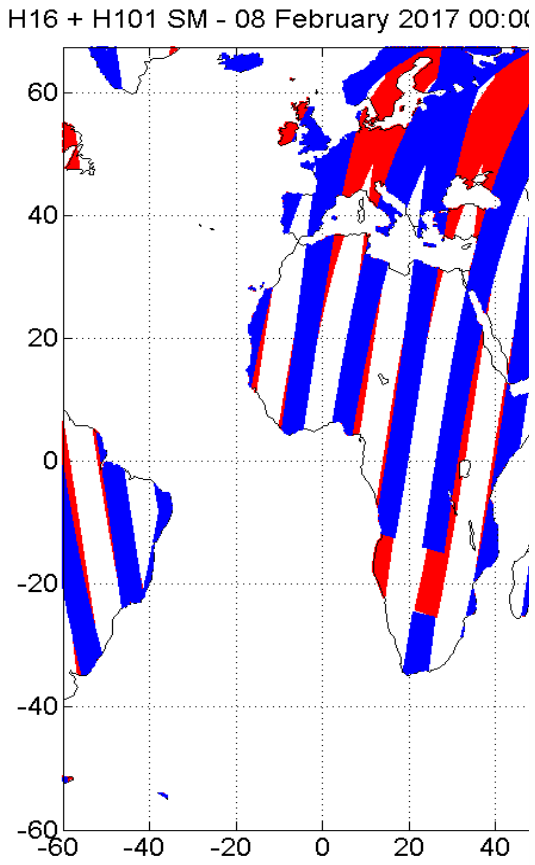

SM2RAIN

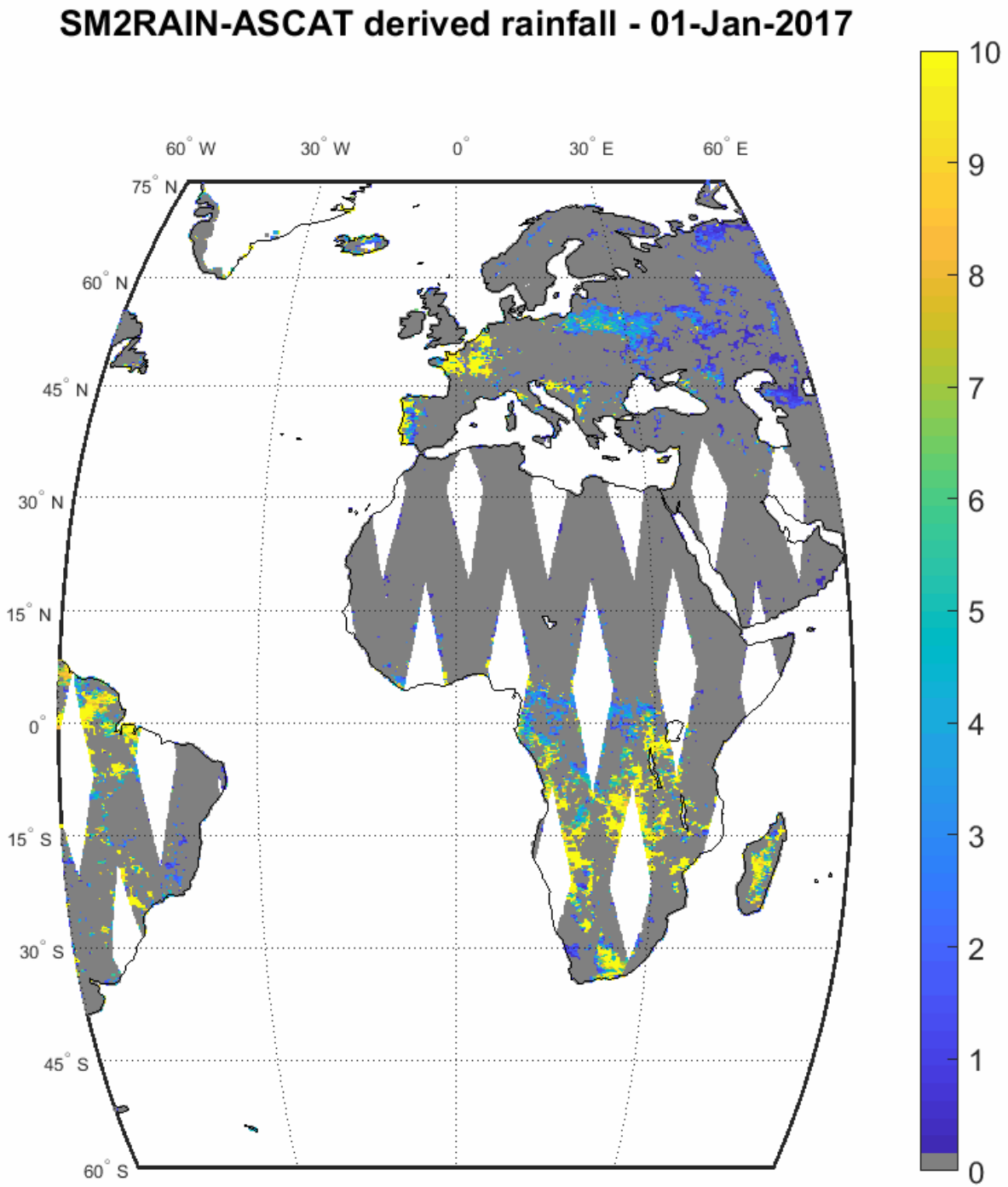



**SM2RAIN parameters calibrated through the use of H113 CDR product considering ERA5 rainfall as benchmark during the period 2007-2017**

# Product

## Daily SM maps

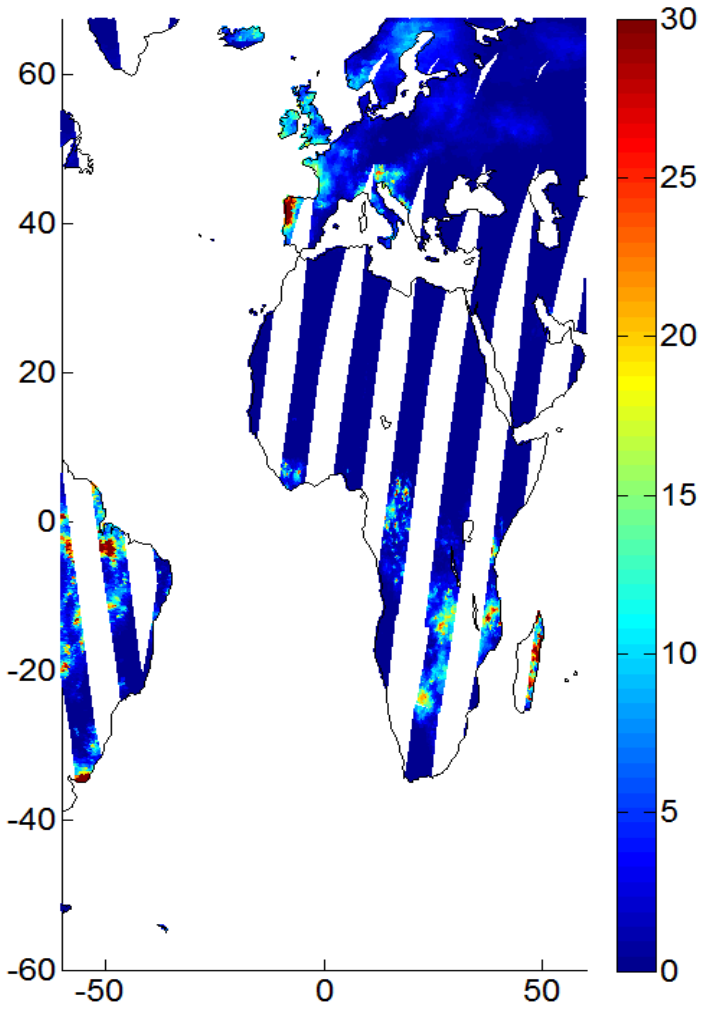


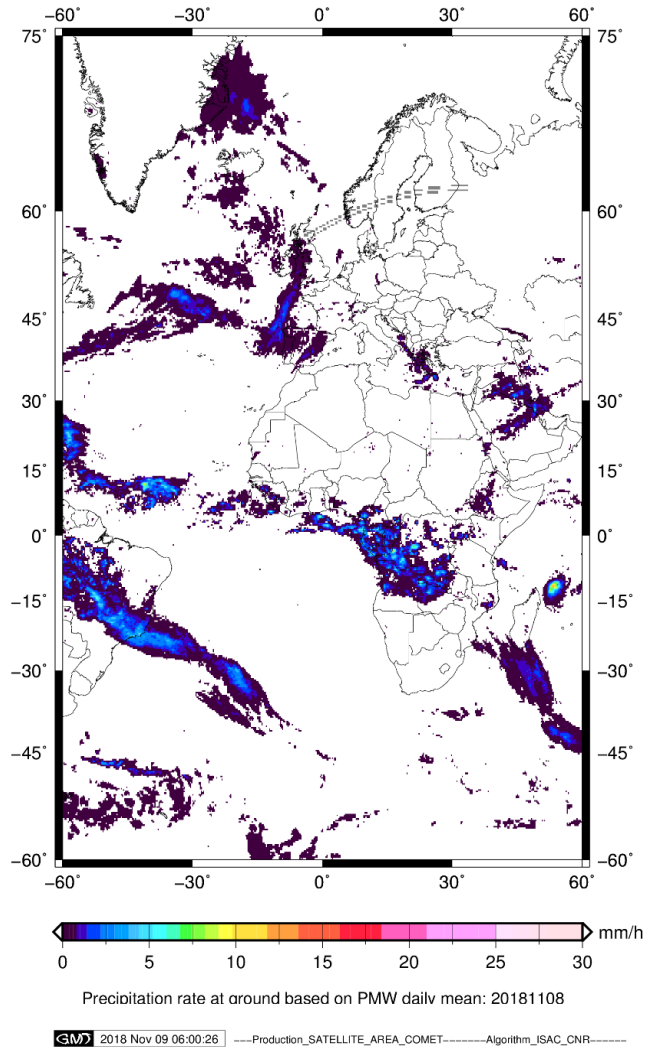




AIN parameters
ted through the use of
CDR product
ering ERA5 rainfall as
nark during the
2007-2017

# H64 Product

**SM2RAIN derived rainfall** → **Regridding over PMW grid** → **Integration with PMW** → **H64**



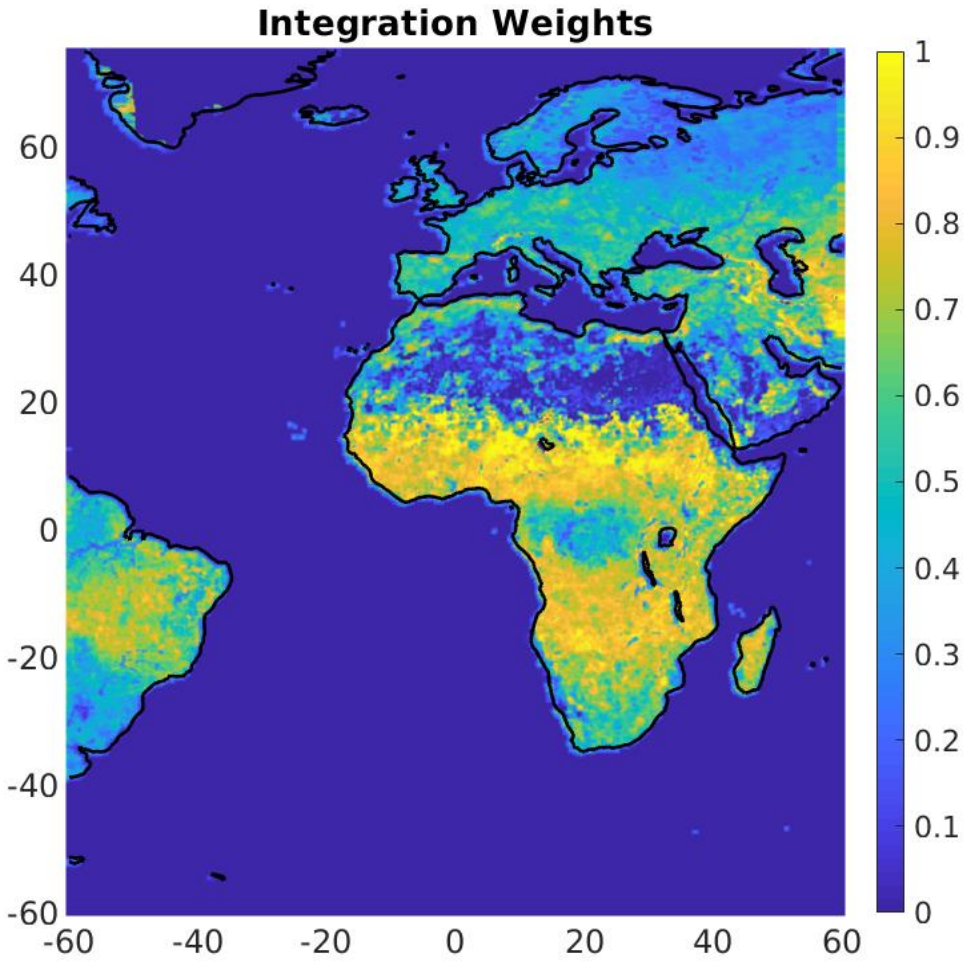

**The integration is performed only over land**

**If SM2RAIN-derived rainfall is missing, only PMW data are used and viceversa**

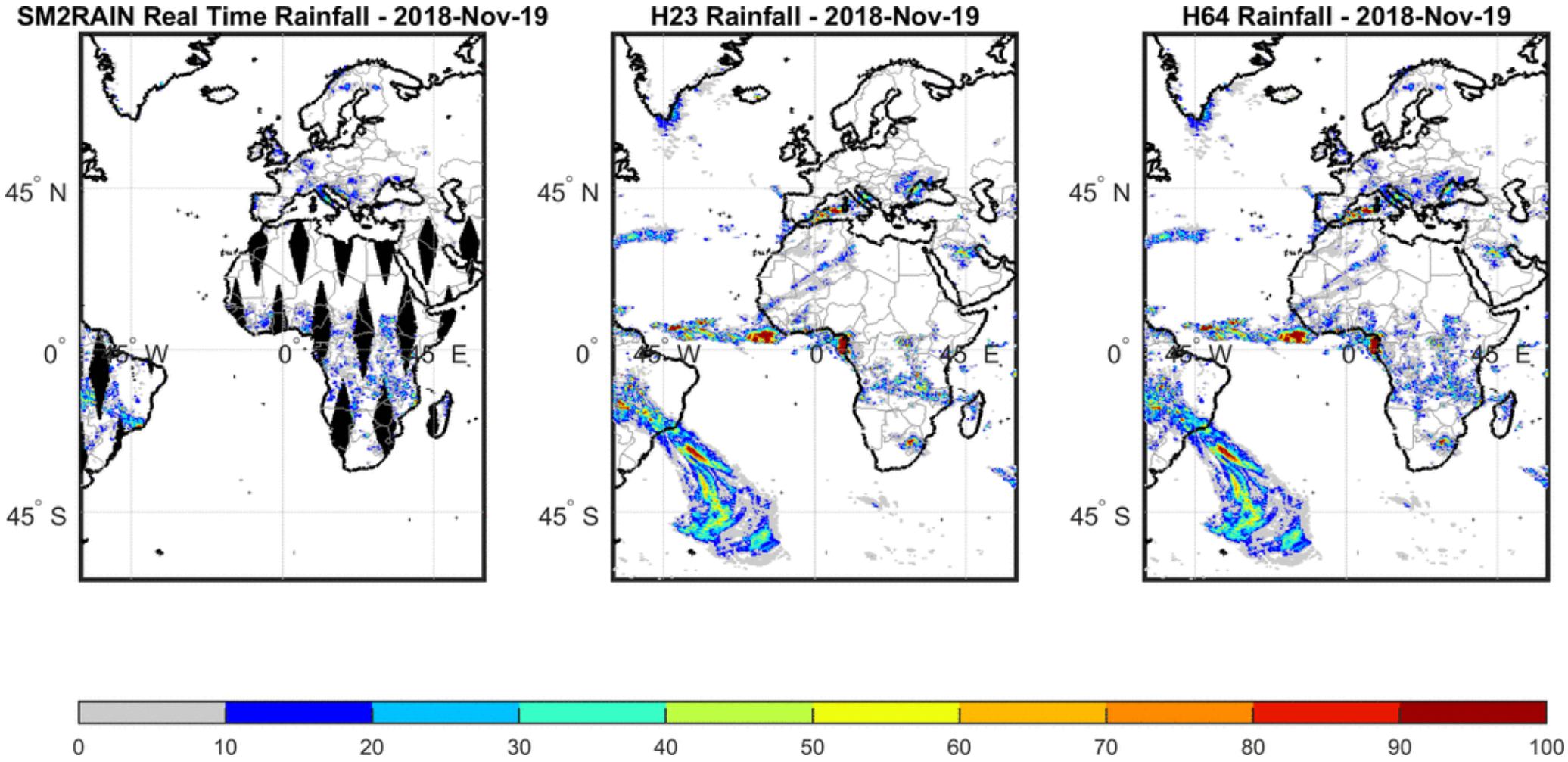
# H64 Product

$$P_{H64} = P_{H23} * (1 - W) + P_{SM2RAIN} * (W)$$

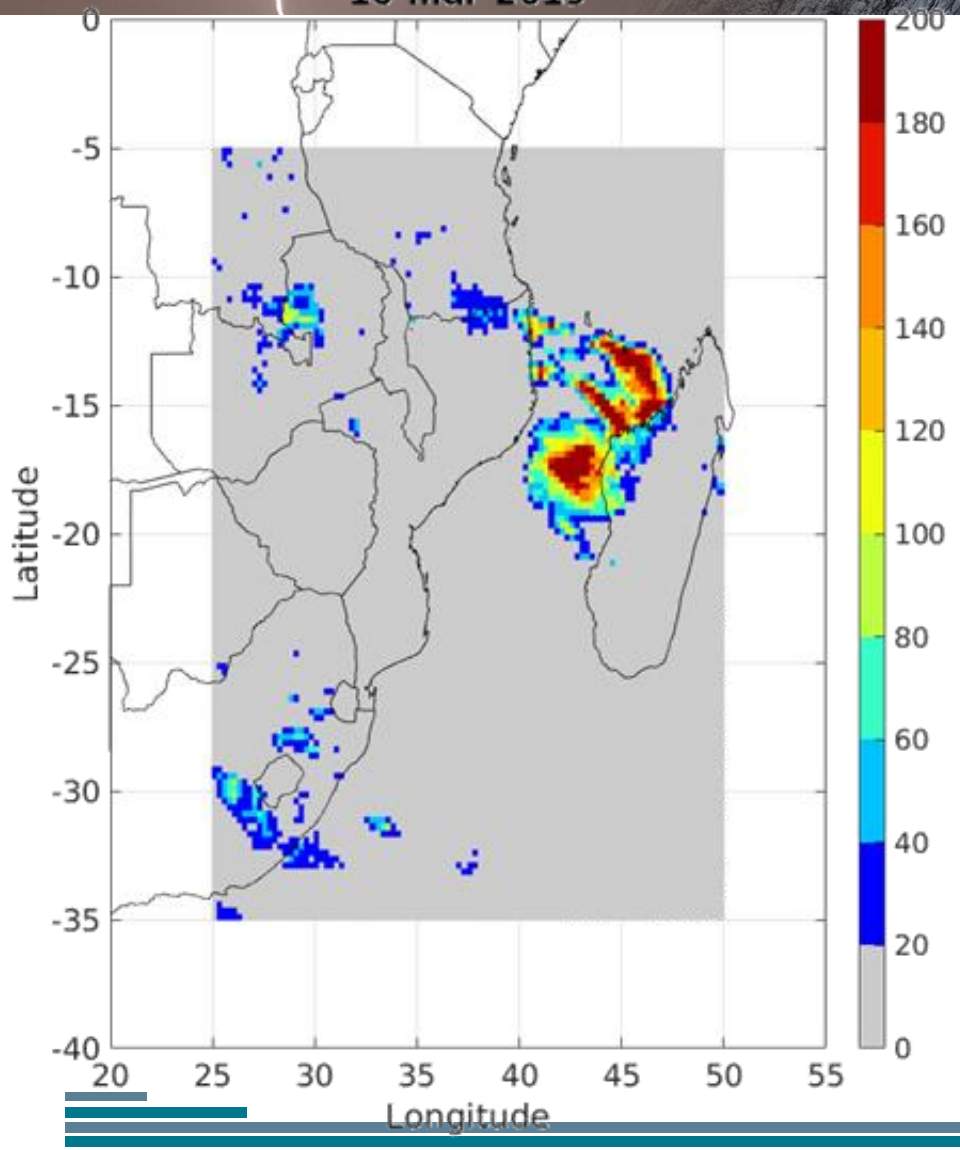
$$W = \frac{\sigma_2 * (\rho_{1R} - \rho_{12} * \rho_{2R})}{\sigma_1 * (\rho_{2R} - \rho_{12} * \rho_{1R}) + \sigma_2 * (\rho_{1R} - \rho_{12} * \rho_{2R})}$$

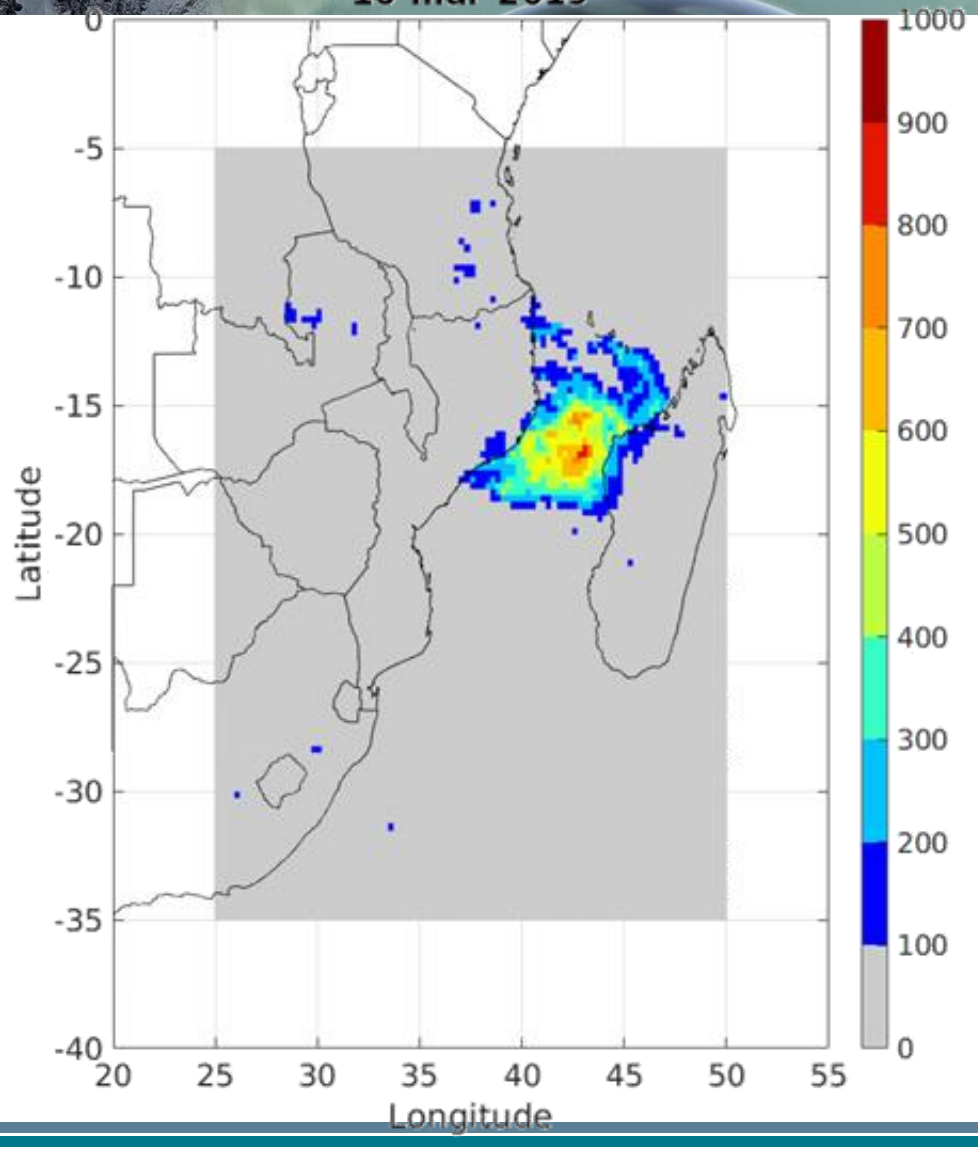


# H64 Product


SM2RAIN Real Time Rainfall - 2018-Nov-19
H23 Rainfall - 2018-Nov-19
H64 Rainfall - 2018-Nov-19
45° N
0°
45° S
45° W
0°
45° E
0
10
20
30
40
50
60
70
80
90
100

# H64 Product




## Cyclone Idai

Ciabatta et al. (2017 JoH)
http://dx.doi.org/10.1016/j.jhydrol.2016.12.057

# SM2RAIN-derived products portfolio

| Product ID | Product Acronym | Product Type | Coverage | Spatial resolution | Temporal Resolution |
|---|---|---|---|---|---|
| H64 | P-AC-SM2RAIN | Precipitation/Soil Moisture integrated product | Extended H SAF area (LAT 60°S – 75°N, LON 60°W – 60°E) | 0.25° | Daily |
| H75 | P-AC-SCA-SM2R | Soil Moisture-based product (SM2RAIN) for EPS-SG SCA | Global | 6.25 km | Daily |
| H79 | P-AC-SM2R-PMW-G | Precipitation/Soil Moisture integrated product | Global | 0.25° | Daily |
| H84 | P-AC-SM2R-PMW-G-L | Gauge adjusted Precipitation/Soil Moisture integrated product | Global | 0.25° | Daily |
| H87 | P-AC-SM2R-DR | SM2RAIN-only rainfall product | Global | 0.1° | Daily |

# Some Applications

| Session | Time slot | Presentation |
|---|---|---|
| 2 | Tuesday - 10:00 | Satellite-based rainfall estimation for river flow modelling in Morocco - Yves Tramblay |
| 3 | Tuesday - 13:00 | Satellite soil moisture and rainfall for yield prediction in water limited regions - Mariette Vreugdenhil |
| 3 | Tuesday - 13:45 | Drought analysis over the USA using long-term climatological SM2RAIN datasets - Hamidreza Mosaffa |
| 4 | Wednesday – 13:30 | Analysis of H SAF precipitation products for the Mediterranean cyclone Apollo - Leo Pio D'Adderio |
| 6 | Thursday – 10:30 | Benchmark data analysis of the intense weather event around Como Lake occurred in July 2021 - Alessandra Mascitelli |
| 6 | Thursday – 10:30 | High resolution satellite Earth observations improve hydrological modeling in the Po River Basin, Italy - Lorenzo Alfieri |
| Demo | Friday - 11:55 | Flood modelling with satellite rainfall data in Africa - Christian Massari |

# Thank you for your attention

For further information about SM2RAIN just contact us:
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