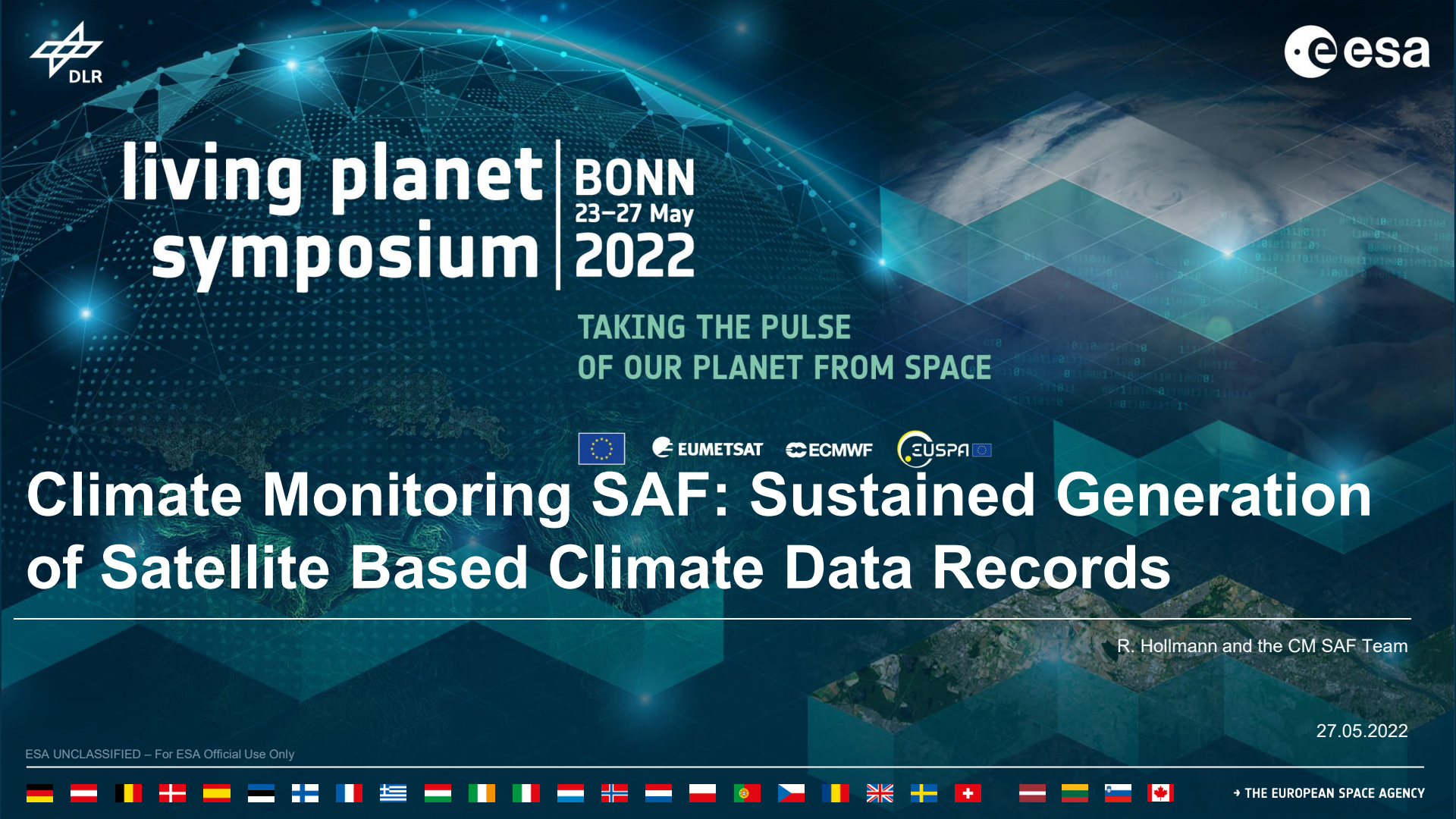
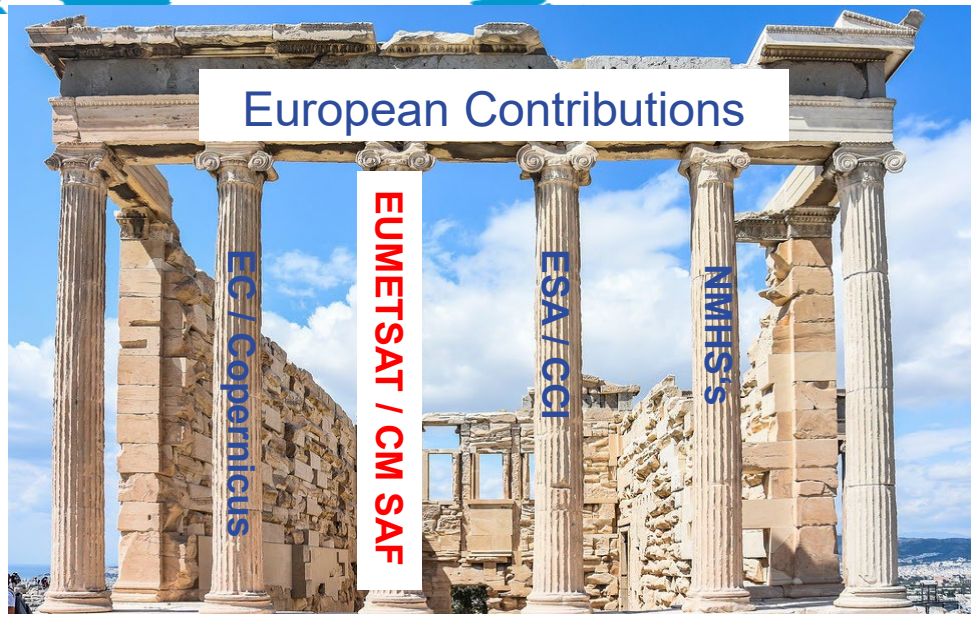



# Climate Monitoring SAF: Sustained Generation of Satellite Based Climate Data Records

R. Hollmann and the CM SAF Team

27.05.2022

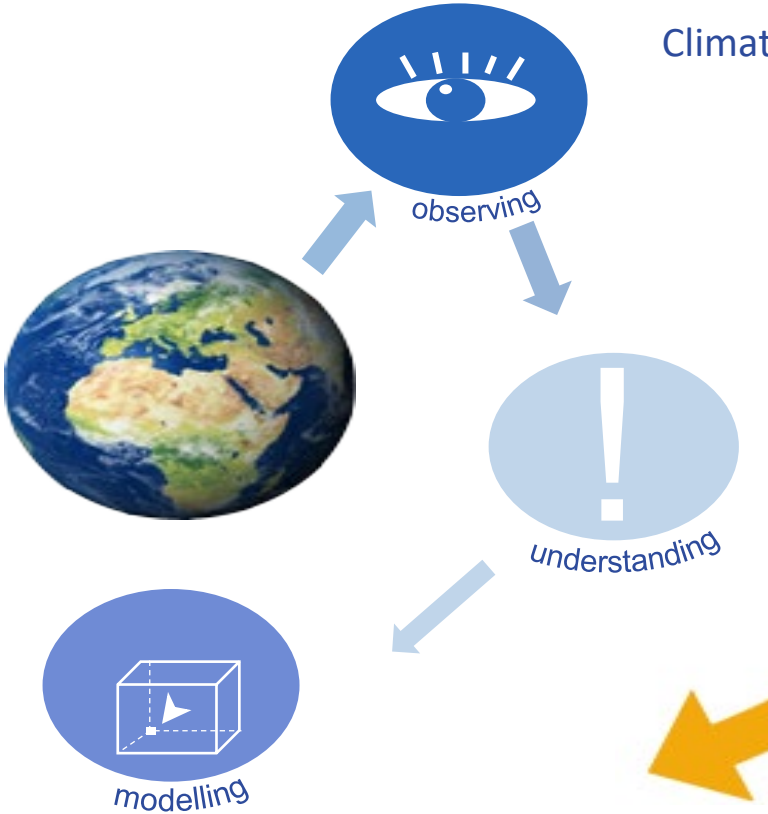
# Global Stakeholder in **Climate Monitoring**
## UNFCCC, IPCC, GFCS, GCOS, IPCC, CGMS, CEOS, WMO, GEO, …




FACTS

Images:
ɔs://pixabay.com/

# Climate Monitoring based on Satellites




Climate Data Record

climate trends, variability and process

validation and use of satellite simulators

**We provide**

- Essential Climate Variables
  - Climate Data Records
  - Interim Climate Data Records
- Fundamental Climate Data Records

We provide

- Training & capacity building
- toolbox
- Application examples

We support

- Process analysis
- Statistical analysis
- Climate assessments

We provide

- Validation data (Obs4MIPs compatible)
- Satellite simulators

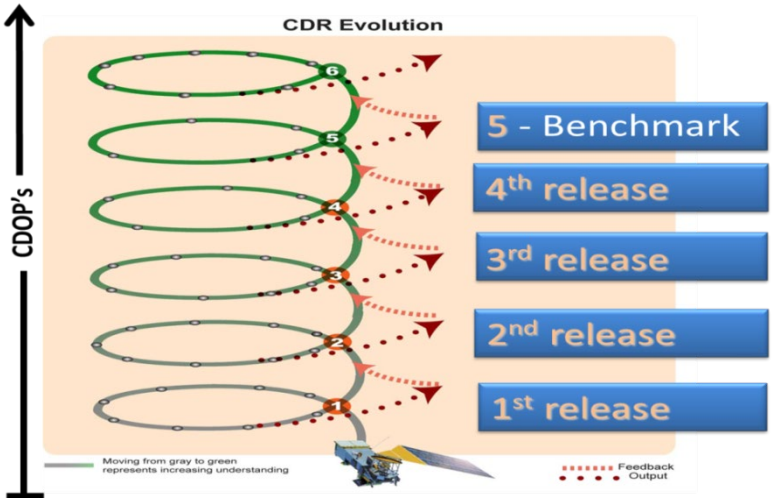
# Targeted Application areas CM SAF CDRs and ICDRs

- FCDR as input for Reanalyses & CDR's
- Climate Science
- Evaluation of (Climate) Models
- Climate Services / NMHSs operational climate monitoring
  - CDR + ICDR as important component is needed

# Sustainability – requirements & consequences

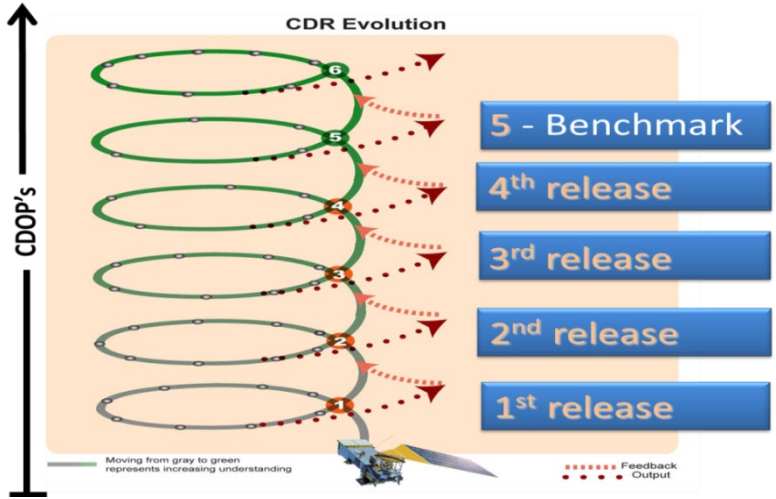
| PP 1999-2004 | IOP 2004-2007 | CDOP-1 2007-2012 | CDOP-2 2012-2017 | CDOP-3 2017-2022 | CDOP-4 2022-2027 | CDOP-5 2027-2032 | CDOP-6 beyond 2032 |
|---|---|---|---|---|---|---|---|

- Long-term commitment for funding
- Need for cyclic reprocessing of data
- Agile framework using opportunities and chances
- Access to high performance IT infrastructure (e.g. ECMWF, EWC, DWD)
- Web & data services for user & data access



# Reliable and high quality – consequences

| PP 1999-2004 | IOP 2004-2007 | CDOP-1 2007-2012 | CDOP-2 2012-2017 | CDOP-3 2017-2022 | CDOP-4 2022-2027 | CDOP-5 2027-2032 | CDOP-6 beyond 2032 |
|---|---|---|---|---|---|---|---|

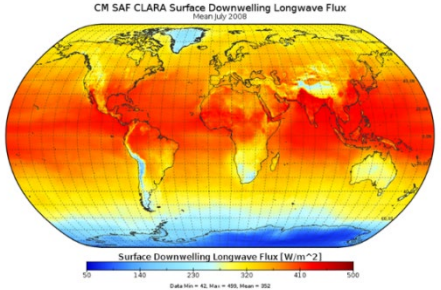



- External supported process: Review of
  - Product Requirements
  - Algorithms
  - Validation (EQC)
  - User Documentation
- Update and Uptake of changed Requirements
- Participation in independent assessments

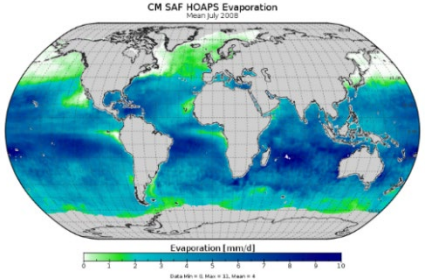
# CM SAF Climate Data Records

- ➔CM SAF provides a variety of global and regional climate data records on clouds, radiation, surface parameters (e.g., LST), precipitation (ocean only)
- ➔Availability: 1982 to the day before yesterday
- ➔Resolution: Daily, monthly / 0.05°, 0.25°, 1°
- ➔All data are freely available at www.cmsaf.eu

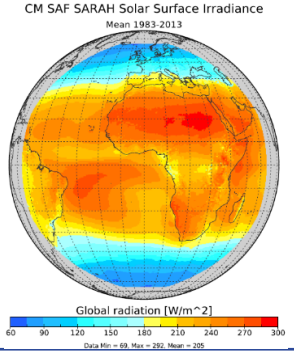
## CLARA-A2.1 / ICDR



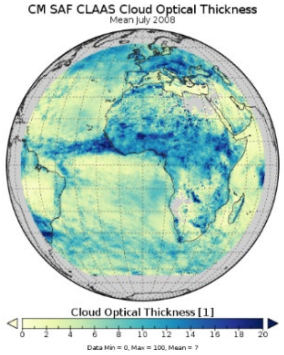

## HOAPS 4.0



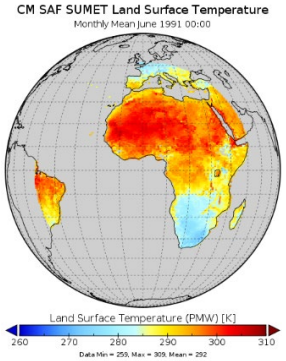

## SARAH-2.1 / ICDR



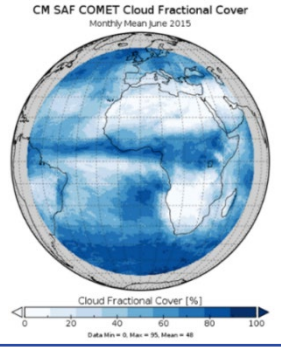

## CLAAS-2.1 / ICDR




## SUMET 1.0




## COMET 1.0



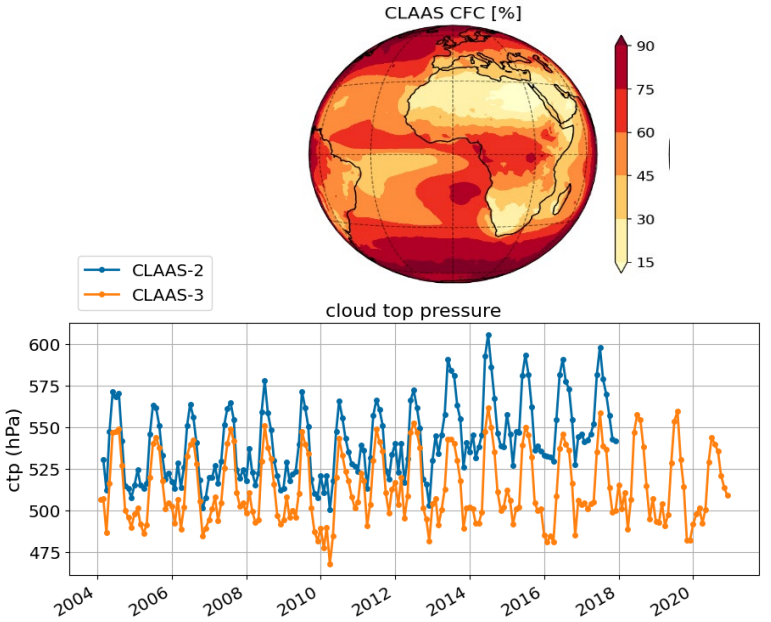
# Climate Data Records and Products

- Global Clouds and Radiation (CLARA-A3), *extended in time, new: ERB*
- Regional Clouds (CLAAS-3), *extended in time*
- Global Ocean Fluxes (HOAPS ), *extended in time*
- Global UTH, extended in time
- FCDR Microwave Imager, extended in time
- Regional Radiation (SARAH-3), *extended in time*
- Regional Land Surface Temperature, *extended in time*
- Regional Land Fluxes (e.g. budget, LST), *new*
- Global High Clouds from HIRS, *new*
- Global Precipitation, *new*

**WMO Reference Period 1990 – 2020 covered**

# CLAAS-3 data record

- SEVIRI-based cloud property data records, covering MSG 1-4 (2004-2020), including data levels ranging from high spatiotemporal resolution (15min, 3km) to monthly products (e.g. averages, histograms).
- This data record can thus serve multiple application areas, e.g. process studies, model evaluation, climate monitoring

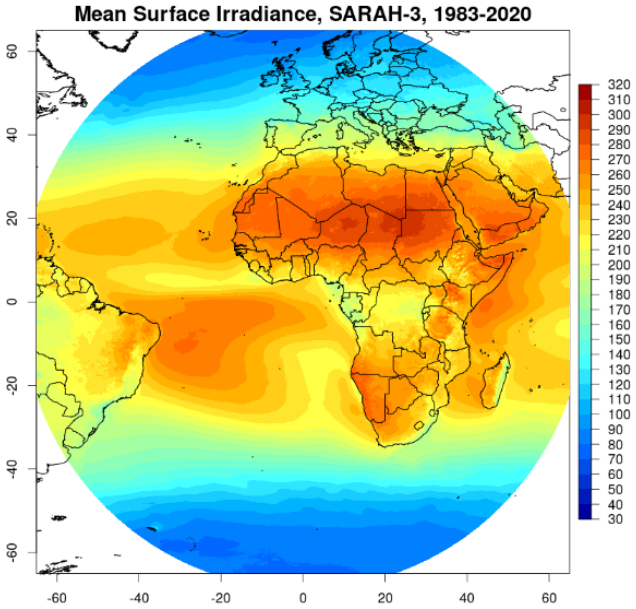



Production status: release in late summer 2022

CLAAS-3 is of high quality and enhanced temporal coverage compared to its precursor

# The SARAH-3 climate data record

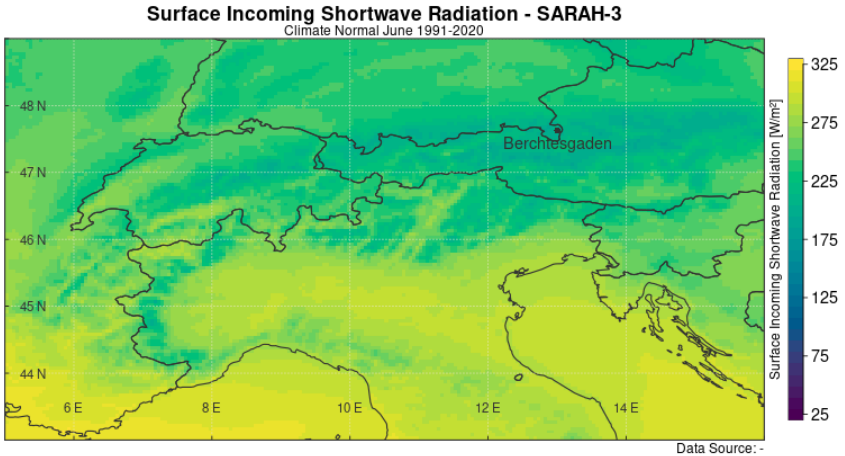
- Surface Solar Radiation Products (Irradiance, Direct Irradiance), Sunshine Duration, Photosynthetic Active Radiation, Daylight, Effective Cloud Albedo at 0.05° × 0.05° in 30-min, daily-, monthly mean temporal resolution




Application areas (a.o.): Drought monitoring, Solar Energy, Tourism, Climate monitoring,…

# WMO Climate Normal

- Climate Normal are used as Reference for latest observations and provide the basis for anomalies.
- Reference Period should cover 30 years to take into account the natural variability
- Calculation according to WMO Guidelines „Calculation of Climate Normal" - (WMO, 2017)
- Caveat: Guidelines have been developed for station data and their characteristics
- Reference period: 1991-2020
- Example for Alpine area

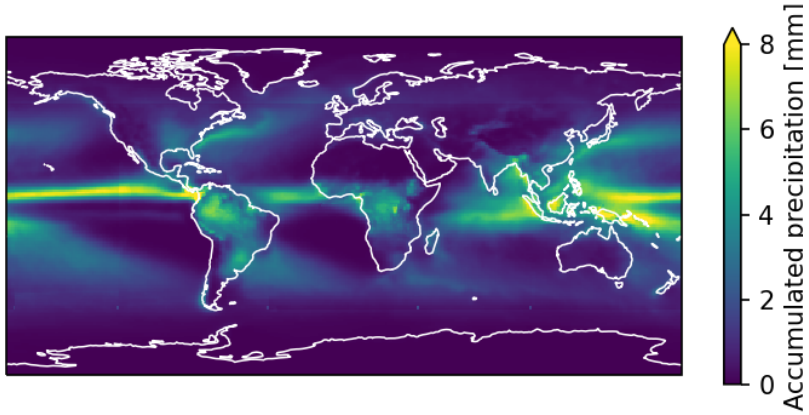



Solar Radiation (surface) for August

WMO Climate Normal is now available

# Global Interpolated RAinFall Estimation (GIRAFE) CDR

- Global satellite-based precipitation product, called Global Interpolated RAinFall Estimation (GIRAFE).
- Based on 11 satellites with microwave imagers & 9 satellites with microwave sounders
- Global coverage at 1°, 2002-2020
- Daily accumulation of rainfall
- Uncertainty estimates

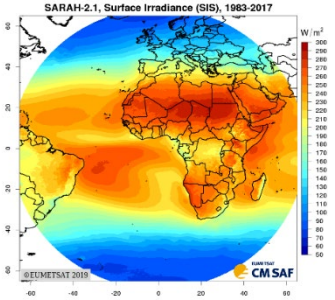



Status: Release of v1.0 expected in early 2023

# Operational Climate Monitoring with satellites

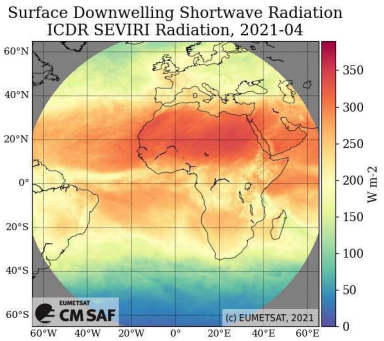
➔ **A Reference CDR**

*e.g. SARAH 2.1*



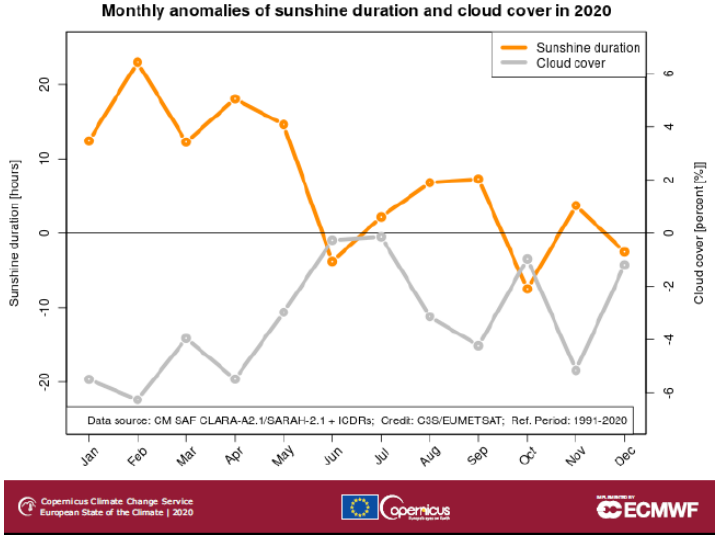

➔ **An ICDR as continuation**

e.g. MSG radiation ICDR



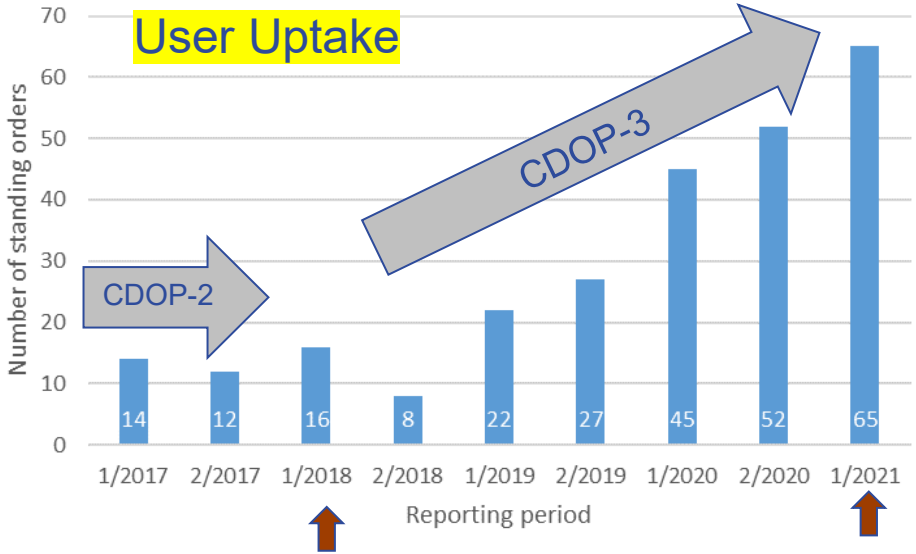

➔ **Assessment**

e.g. last year sun shine duration



# Operational Climate Monitoring with satellites

- **Currently 3 ICDR's are operational**
  - Surface Radiation (**Meteosat**)
  - Cloud Properties (**Meteosat**)
  - AVHRR surface radiation, surface albedo and cloud properties (**Global**)




1/2018: switch from EDR SEVIRI to ICDR SEVIRI (EDR stopped on 5 March 2018)

1/2021: Introduction of ICDR AVHRR, parallel processing with EDR until Sep 2021

# CM SAF Plans 2022 - 2027

**Updates and temporal Extensions of its CDR's:**

- ➔ CLARA A3.5 to include VIIRS
- ➔ CLAAS 4.0 incl. first MTG data
- ➔ Global UTH 3.0
- ➔ HOAPS 5.0
- ➔ FCDR on Microwave Imager (SSMI/SSMIS)

**New CDRs:**

- ➔ GeoRing Surface Radiation
- ➔ GeoRing Demonstrator LandFluxes

**Contination and Updates for ICDRs:**

- ➔ ICDR global AVHRR
- ➔ ICDR Meteosat Cloud properties
- ➔ ICDR Meteosat Surface Radiation

**New ICDRs:**

- ➔ Precipitation

# Conclusion

- ➔ Since more than 20 years CM SAF is contributing / pioneering to climate monitoring with satellites
- ➔ CM SAF performs sustained CDR generation in an operational environment
- ➔ CM SAF is taking benefit from research using relevant opportunities
- ➔ CM SAF provides extensive services, training, support to User
- ➔ CM SAF data are freely available
- ➔ CM SAF Web User Interface provides an easy direct data access

**Contact data:**

www.cmsaf.eu

Contact.cmsaf@dwd.de