

# From the Top to the Bottom: Radiation- and Surface-related data records

Jörg Trentmann, Uwe Pfeifroth

Anke Duguay-Tetzlaff, Quentin Bourgeois

Aku Riihelä, Terhikki Manninen

Nicolas Clerbaux, Tom Akkermans

## Goals of Discussion Group

- Receive feedback from you on your experiences with CM SAF data
- Learn how can we improve our data / service for your requirements?

Provide recommendations to CM SAF for  
future developments

## Organization of Discussion Group

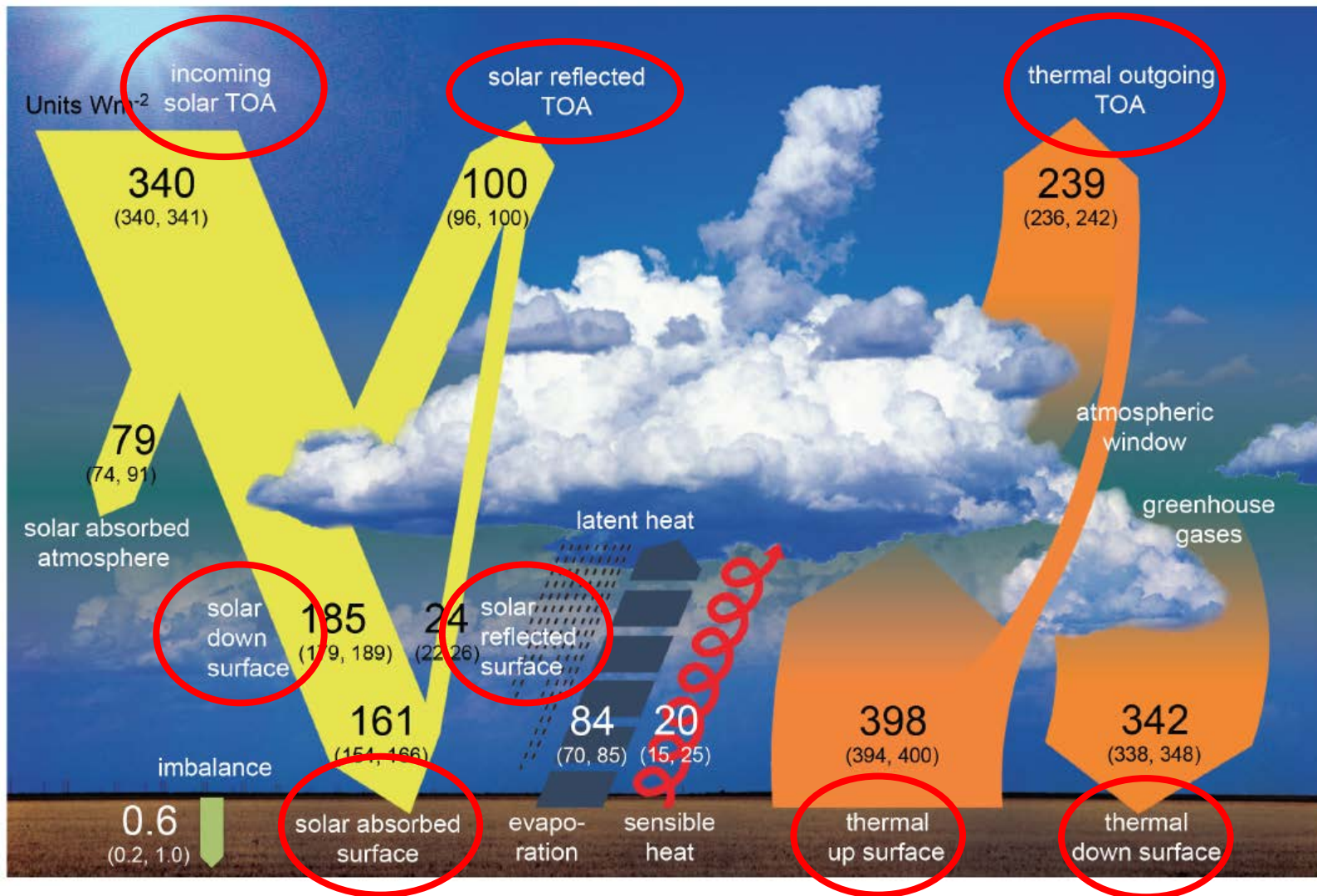
- Brief introduction on current and planned CM SAF radiation + surface data, discussion on general issues
- Product-specific discussions in smaller teams and feedback on discussion posters
  - top-of-the-atmosphere radiation (TRS, TET)
  - surface radiation (SIS, SDU etc.)
  - surface albedo (SAL)
  - Surface radiation budget (SRB) + Land Surface Temperature (LST)
- Final Words and Wrap-up

## Key Questions

- Which CM SAF data and services do you use for your application?
- What do you like/dislike about the current CM SAF data and services?
- Which data or services are missing for your application?
- How can CM SAF improve the service for your application (technically and scientifically)?

# The CM SAF 'Top-to-Bottom' Data Resords

# CM SAF Radiation



Wild at al., 2013

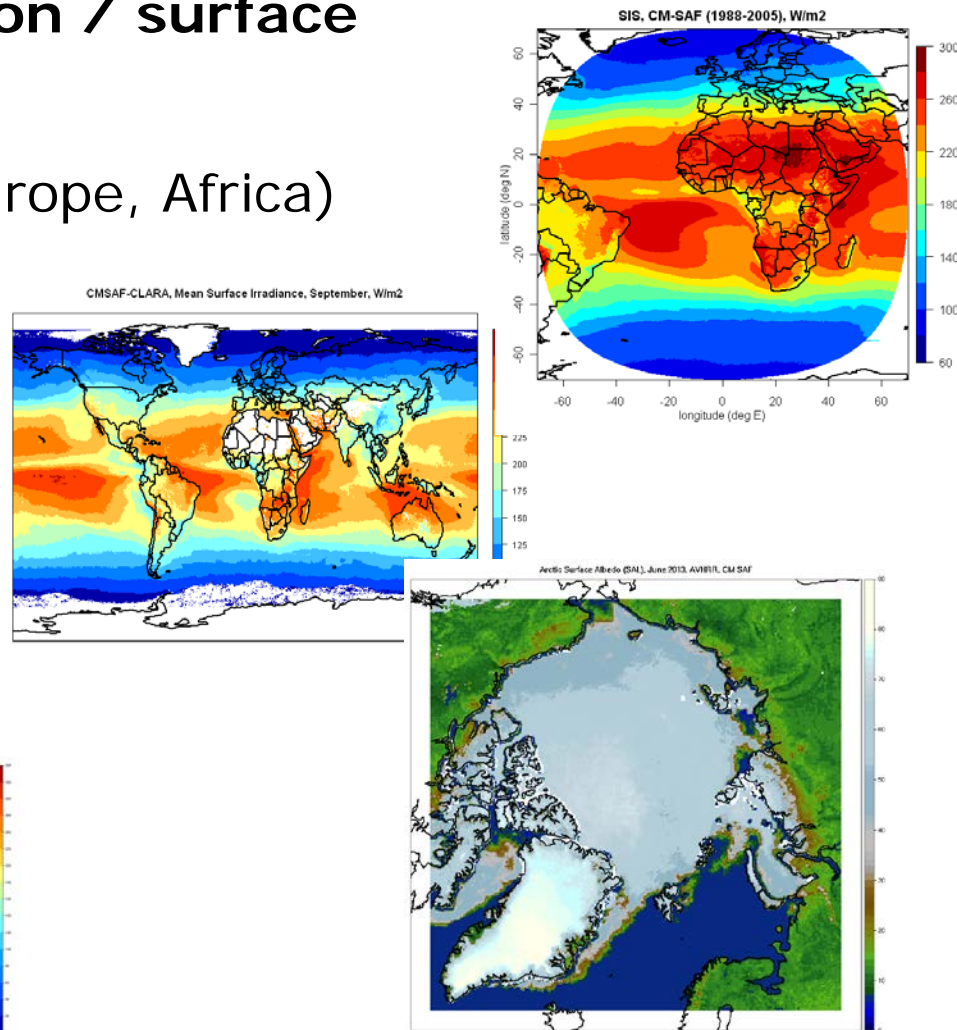
## Data Provision

- Web User Interface: [www.cmsaf.eu/wui](http://www.cmsaf.eu/wui)
  - Data format: netcdf (mainly netcdf4)
  - regular lon-lat grid (mainly  $0.05^\circ / 0.25^\circ$ ) + polar projections
  - temporally aggregated (e.g., monthly, daily, mean monthly cycle) and w/o aggregation; single file per day / month
- *What is your experience?*
- *Are you happy with the functionality or do you miss a feature?*
- *Do we need to include other data distribution services like OPeNDAP or Web Mapping Services?*



# Regions of CM SAF radiation / surface data

- Meteosat Full Disc (Europe, Africa)
- Global
- Polar projections
- Baseline (Europe)
- Meteosat + Arctic





## Satellite-based Climate Data Records

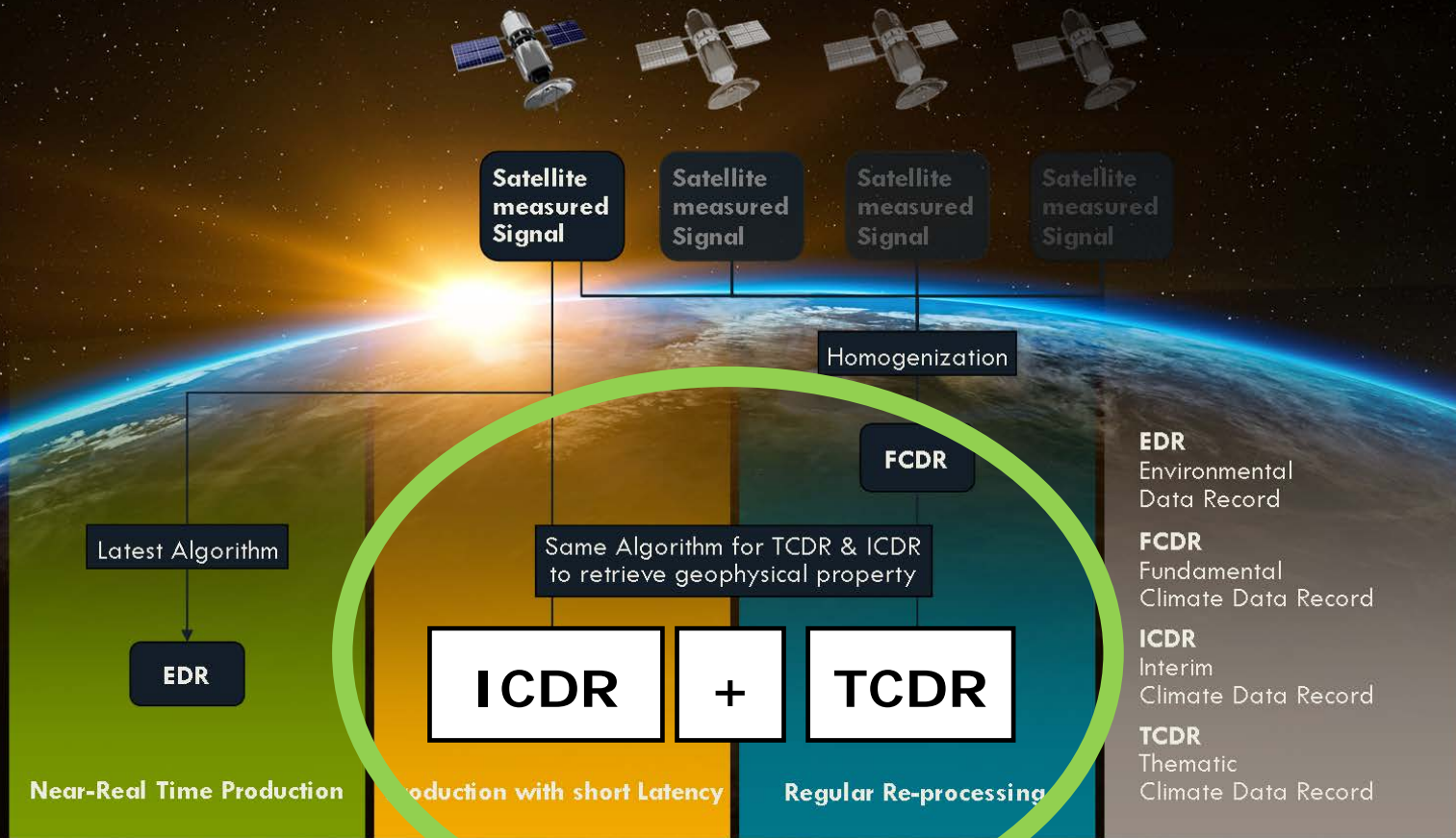
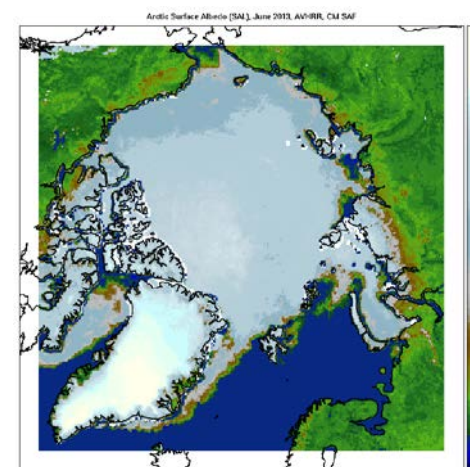
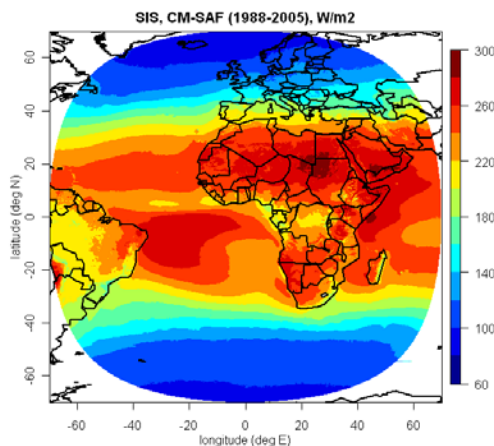
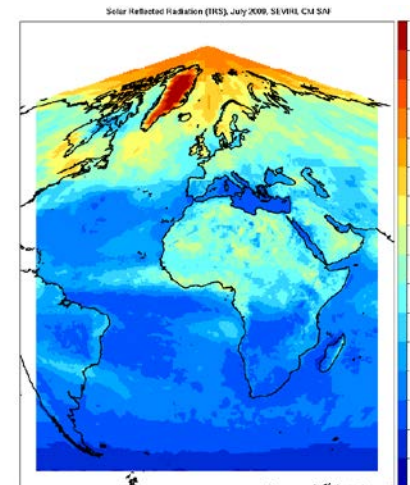


Image source: freestocking.com

➤ Which kind of data are you using? Any comments??

## Overview of the CM SAF radiation data

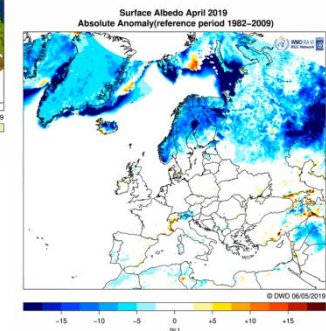
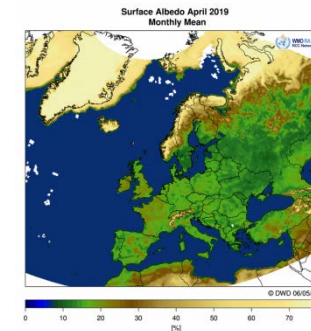
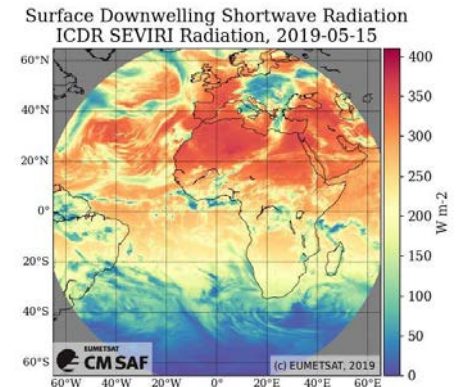
- Top-of-the-atmosphere Radiation
- Surface Radiation
- Surface Albedo
- Land Surface temperature
- Surface Radiation Budget



# Operational and ICDR Products

## Surface Radiation + Albedo

- *SARAH-2-ICDR*
  - SIS, SID, DNI, SDU
  - Daily, monthly mean; 30-min instantaneous
  - 0.05°, 2018 ff
- *AVHRR-based EDR data*
  - Surface Albedo (SAL), surface irradiance (SIS)
  - Baseline + Arctic
  - Daily, weekly monthly mean
  - 15 x 15 km (2005 – 2018)
  - Will be replaced by CLARA-A2-ICDR in 2020



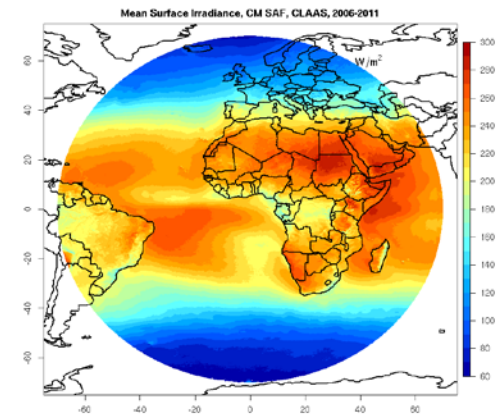
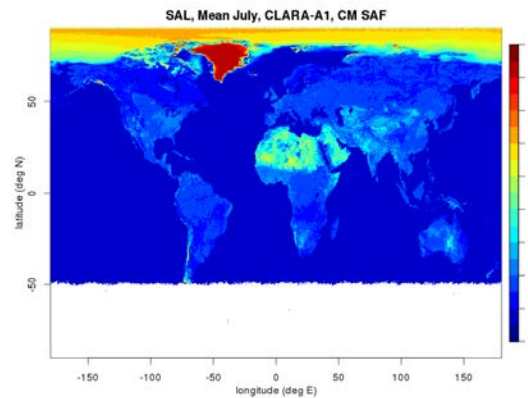
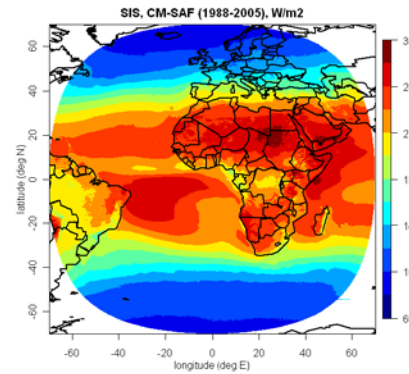
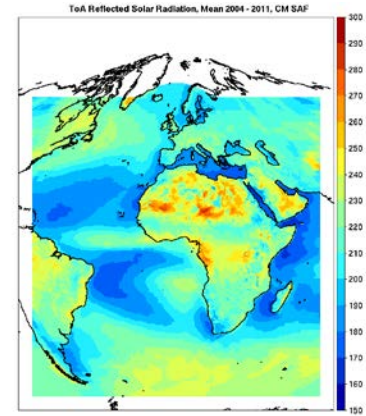
## Operational / ICDR Products, Discussion Items

- Are you using any of these operational products?
- Is the spatial / temporal resolution sufficient?
- Note that AVHRR-based ICDR will have lower spatial resolution than AVHRR-EDR (15 km vs 0.25°)! Causes this any problems, e.g, for SAL?
- Is the timeliness sufficient?
- Would you like to use other operational products (e.g., ToA radiation, LST, longwave radiation etc.)?

➤ *Any more comments??*

# Top-to-Bottom Climate Data Sets

- *ToA Radiation*
- *SARAH*
- *CLARA*
- *SUMET*



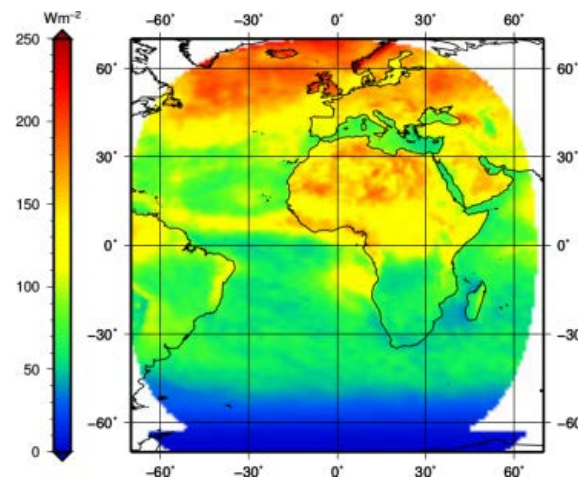
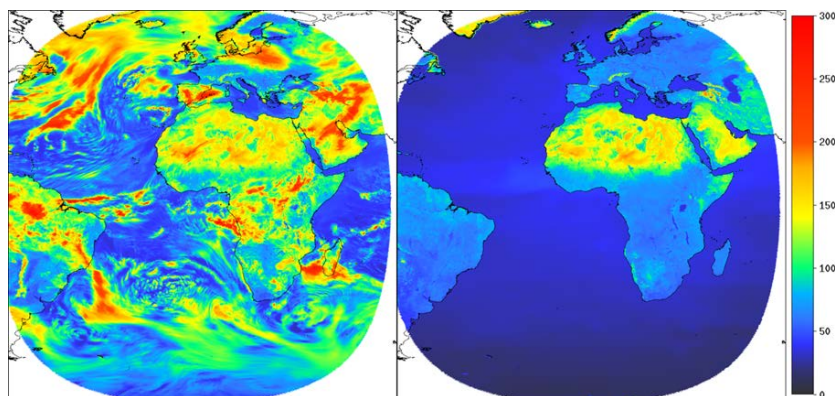
## “Top-of-the-atmosphere” Climate Data Records

### GERB / SEVIRI ToA Data Record

- TRS (incl. TIS), TET; also clear sky
- 2004 - 2015; Full Disc
- monthly/daily/monthly mean diurnal cycle;  $0.1^\circ$

### MVIRI / SEVIRI ToA Data Record

- TRS (incl. TIS), TET
- 1983 - 2015; Full Disc
- monthly/daily/monthly mean diurnal cycle;  $0.05^\circ$

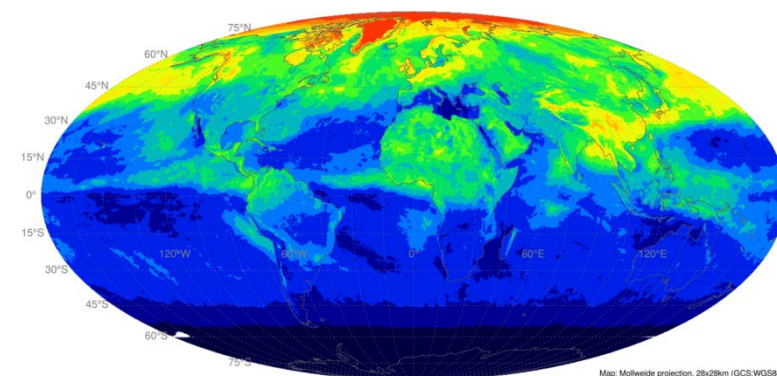


# Upcoming "Top-of-the-atmosphere" Data records

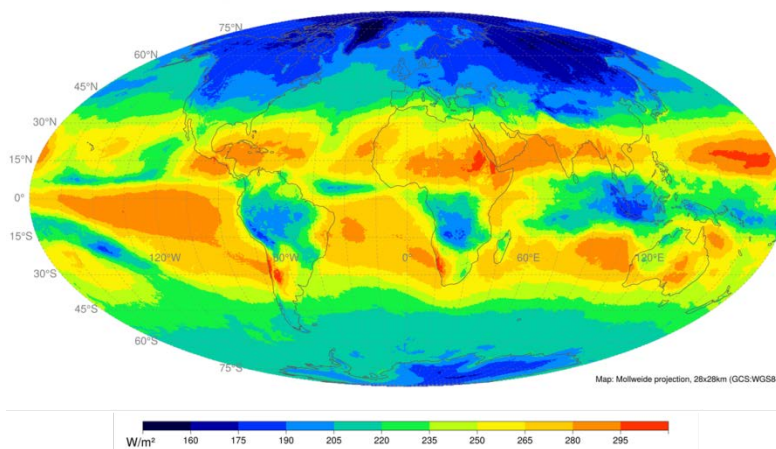
## CLARA-A3

- TRS, TET (all sky + clear sky)
- 1979 – 2020, global
- Daily and monthly means;  
0.25°

CLARA-A3 TOA SW radiation (201206) Mean=92.08 W/m<sup>2</sup>



CLARA-A3 TOA LW radiation (201212) Mean=233.87 W/m<sup>2</sup>



## Top-of-the-atmosphere radiation, Discussion Items

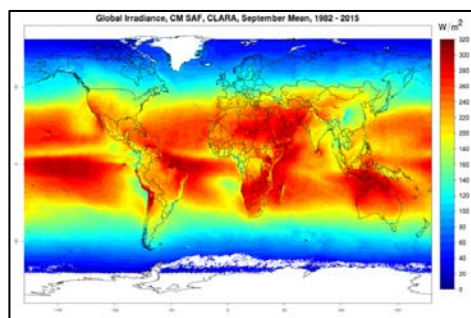
- Are you using the ToA radiation data set?
  - Is the spatial / temporal coverage sufficient?
  - Is the spatial / temporal resolution sufficient?
  - Is the aggregation to the mean diurnal cycle useful?
  - Is the accuracy sufficient?
  - What about extending the geostationary data sets in time / providing an operational data set?
- *Any more comments??*



# Surface Radiation Climate Data Records

Global radiation (SIS), Direct irradiance (SID, DNI), Sunshine Duration (SDU)  
 Downwelling Longwave (SDL), Upwelling Longwave (SOL) Radiation

**CLARA (Clouds, Albedo, Radiation based on AVHRR)**



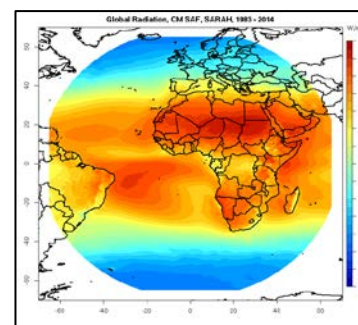
→ **Resolution**

- Spatial: 0.25° × 0.25°
- Temporal: daily, monthly means

→ **Coverage**

- Spatial: global
- Temporal: 1982 to 2015 (soon to 2018)

→ **Solar and longwave radiation**



**Surface Solar Radiation Dataset – Heliosat (SARAH)**

→ **Resolution**

- Spatial: 0.05° × 0.05°
- Temporal: 30-min, daily, monthly

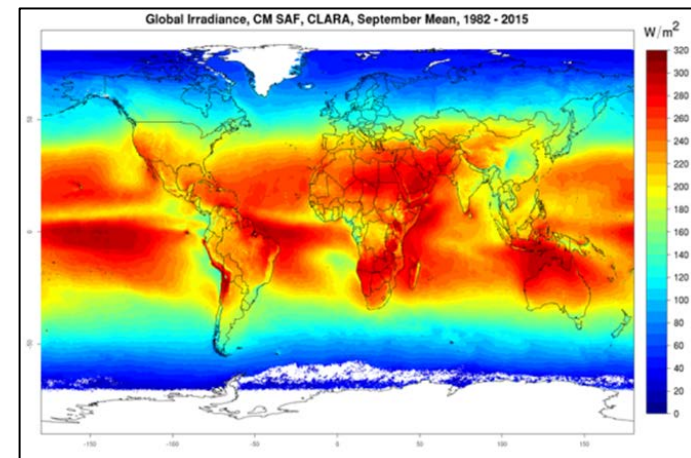
→ **Coverage**

- Spatial: Meteosat full disk
- Temporal: 1983 to 2017

→ **Solar Radiation, incl. direct and sunshine duration**

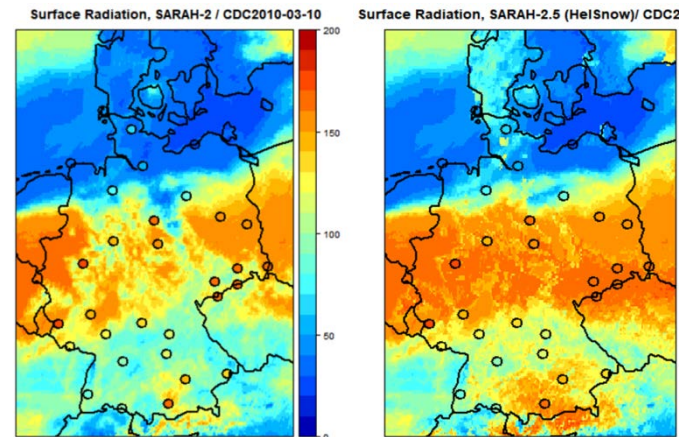
## Upcoming CLARA-A3 Surface Radiation Data records

- Full reprocessing, data available in Fall 2021
- Covering 1979 to 2019 / 2020
- Surface Irradiance (SIS), Longwave downwelling (SDL), Surface Radiation Budget (SRB)
- Improved / consistent retrieval scheme; ToA data used in the SIS algorithm
- Improved cloud detection
- Improved surface albedo, aerosol



## Upcoming SARA-3 Data record

- Full reprocessing, data available in summer 2021
- Covering 1983 to 2020
- New additional spectral parameters: DAL, PAR
- Improved treatment of water vapor / ozone (i.e., daily ERA-5)
- Improved surface albedo
- Improved consideration of snow-covered surfaces



## Surface Radiation, Discussion Items

- Any other spectral data sets wanted? UV, PV, Vitamin D?
  - How to communicate the uncertainty / accuracy, e.g., due to limited number of observations?
  - Is 'complete' data with mixed accuracy useful?
  - Do you want to use regional (polar) projections?
  - Masking / flagging
  - Accuracy vs Stability vs Consistency
  - Instantaneous data: interpolate to fixed times? Higher frequency? More high-res data needed? (so-called "Georing")
- *Any more comments??*

# Surface Radiation Climate Data Records: LST

## Land Surface Temperature (LST)

### SUMET

#### → LTP + LTS

→ Physical + statistical LST  
(clear-sky conditions)

#### → Resolution

→ Spatial:  $0.05^\circ \times 0.05^\circ$

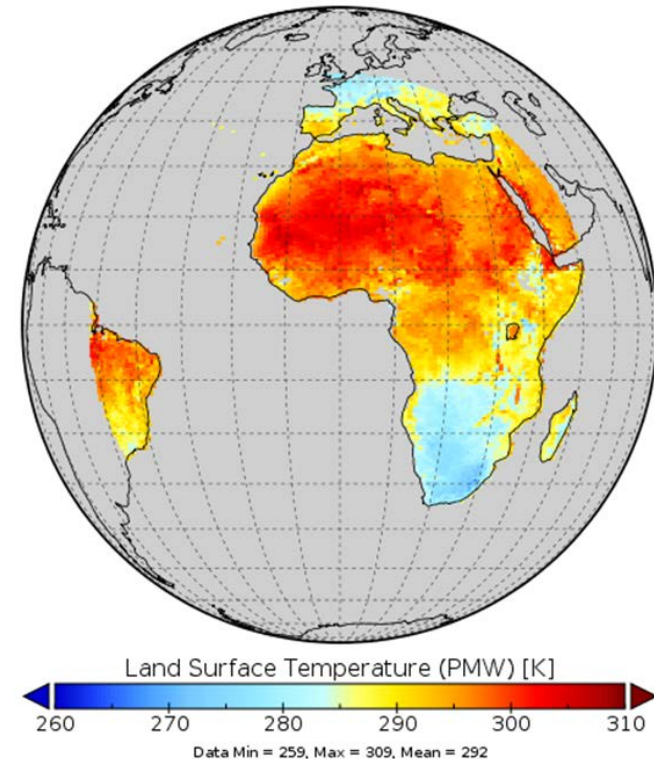
→ Temporal: 60-min, monthly  
diurnal cycle

#### → Coverage

→ Spatial: Meteosat full disk (<  
 $60^\circ$  scanning angle)

→ Temporal: 1991 to 2015

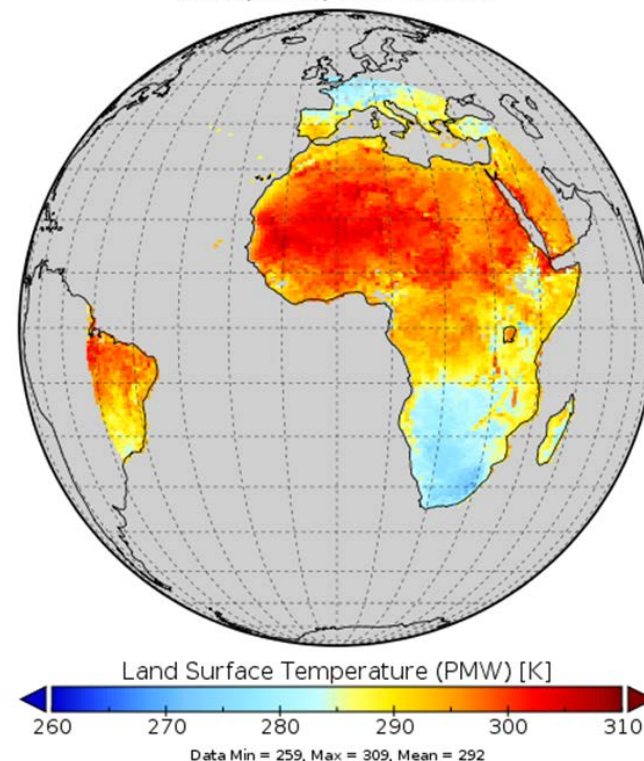
CM SAF SUMET Land Surface Temperature  
Monthly Mean June 1991 00:00



## Upcoming SUMET Data record

- Full reprocessing, data available in summer 2021
- Covering 1983 to 2020
- **New:** Consistent Surface Radiation Budget SRB (Cloud Fraction also consistently available as part of COMET)
- SRB provided as hourly / daily / monthly mean + monthly mean diurnal cycle

CM SAF SUMET Land Surface Temperature  
Monthly Mean June 1991 00:00



## SUMET Discussion Items

### Land Surface Temperature (LST)

- Would an ICDR be useful? If yes, which parameter?
- Do you require other averaging intervals?
- Is the 60° scanning angle-limitation problematic?
- Are you also interested in all sky LST?

### Upcoming Surface Radiation Budget (SRB)

- What is the benchmark in terms of accuracy and precision?
- Are the individual components of SRB also of interest?
- Surface Outgoing Longwave Radiation: Output from Land Surface Model? Based on clear sky LST?

## Surface Albedo Climate Data Records

### Black-sky albedo (SAL) as part of CLARA-A2

#### → Resolution

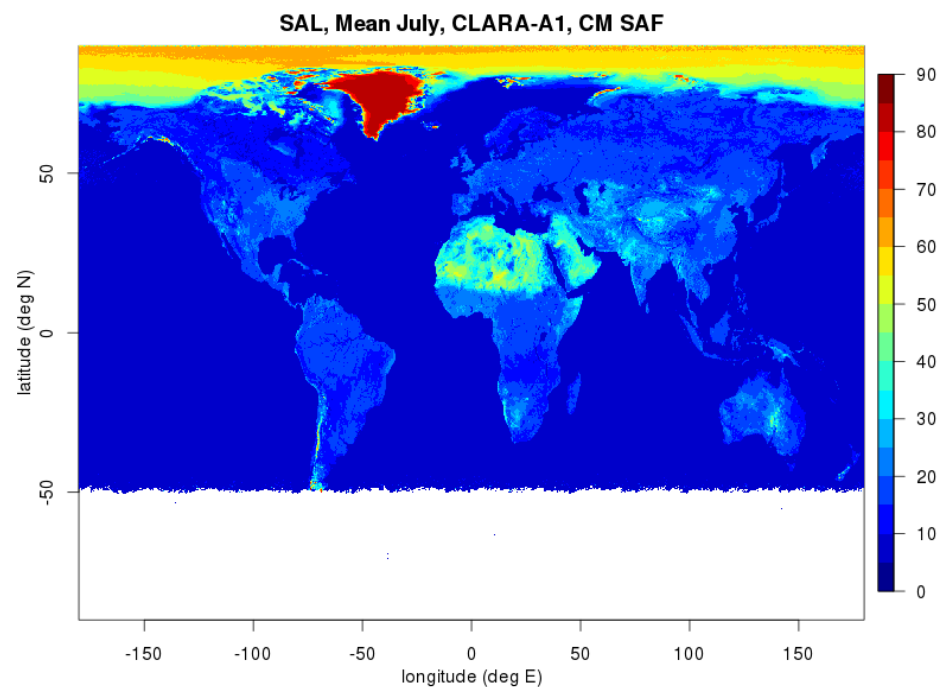
→ Spatial:  $0.25^\circ \times 0.25^\circ$

→ Temporal: pentad, monthly means

#### → Coverage

→ Spatial: global, polar projections

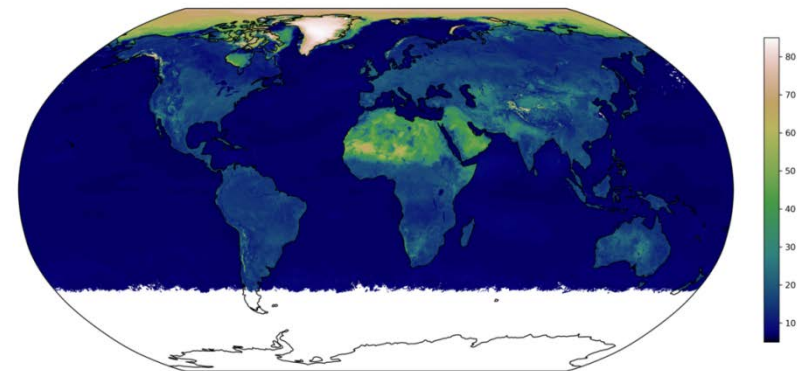
→ Temporal: 1982 to 2015  
(soon to 2018)





## Upcoming CLARA-A3 Surface Albedo Data record

- Full reprocessing, data available in Fall 2021
- Covering 1979 to 2019 / 2020
- Surface albedo (SAL), white-sky albedo (WAL), blue-sky albedo (BAL)
- Improved cloud detection
- Improved radiometric accuracy due to improved AVHRR FCDR calibration
- Better atmospheric correction by ozone data
- Gap filling of cloudy pentads using microwave data



## CLARA-A2 SAL, Discussion Items

- Are you happy with the temporal / spatial resolution?
  - Any other parameters to complement the surface albedo, e.g., fPAR, NDVI....
- *Any more comments??*

## OK, so lets start with the Product-specific discussions

- Top-of-the-atmosphere Radiation (Nicolas)
- Surface Radiation (Uwe, Jörg)
- SUMET (Anke)
- Surface Albedo (Terhikki, Aku)

## Key Questions

- Which CM SAF data and services do you use for your application?
- What do you like/dislike about the current CM SAF data and services?
- Which data or services are missing for your application?
- How can CM SAF improve the service for your application (technically and scientifically)?