International Efforts to generate a homogeneous GEO-Ring data record of spectral radiances

joint EUMETSAT & NOAA project,
in collaboration with JMA, IMD

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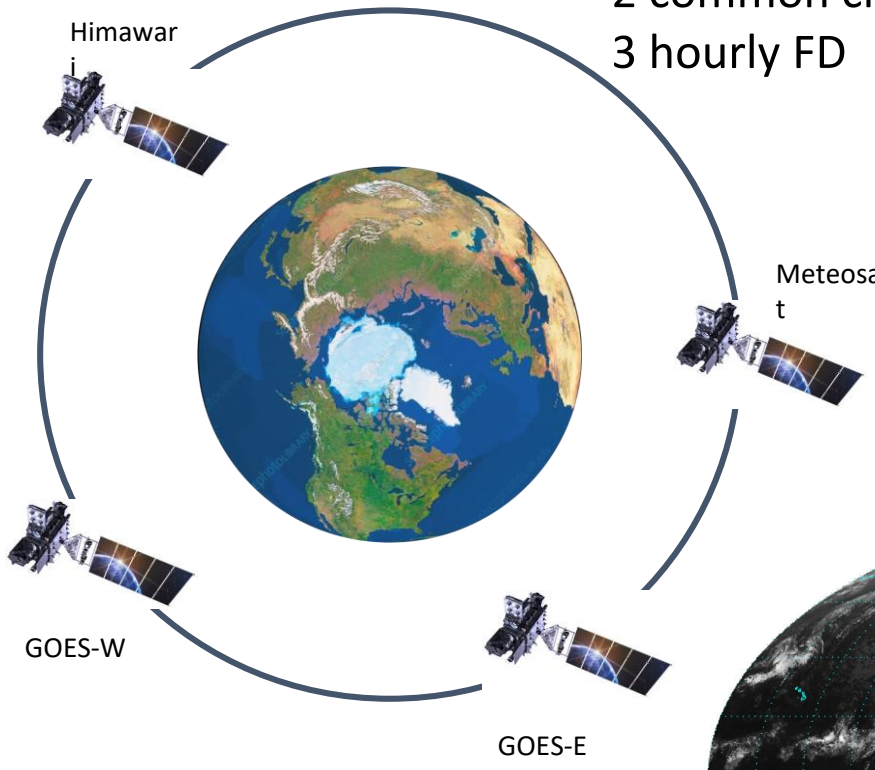
Next-Generation International Cloud Climatology Project ISCCP-NG

Heidinger et al. BAMS 2025 *(in revision)*
GEO-Ring and ISCCP-NG Workshop*, Feb 2024 at EUMETSAT*
presentation by Jörg Schulz *at Workshop on Global Precipitation Monitoring, May 2025*

GEO-RING / ISCCP-NG Introduction

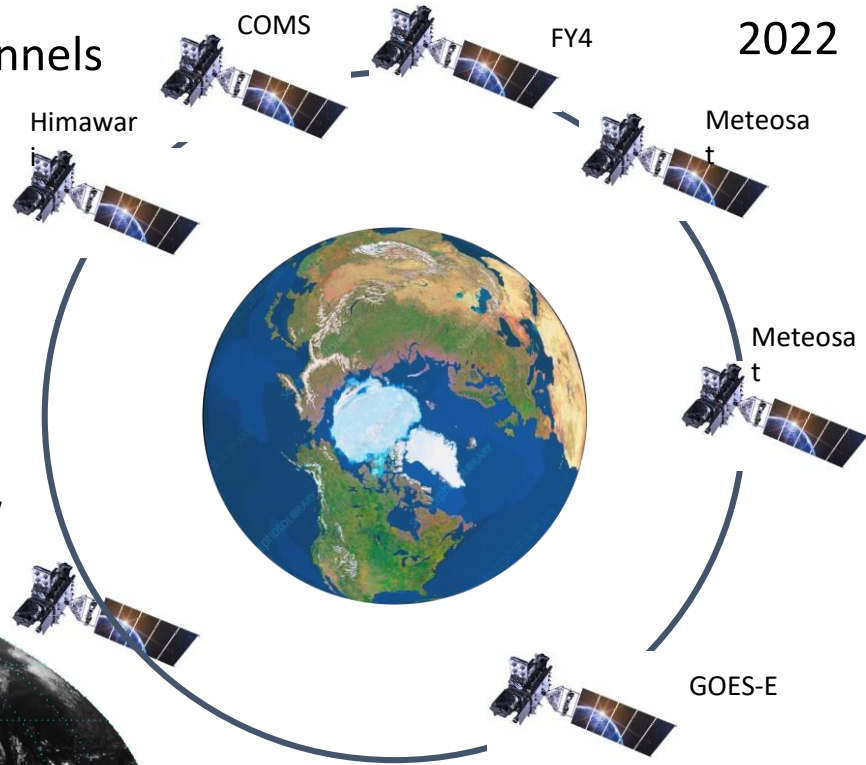
1983

2 common channels
3 hourly FD

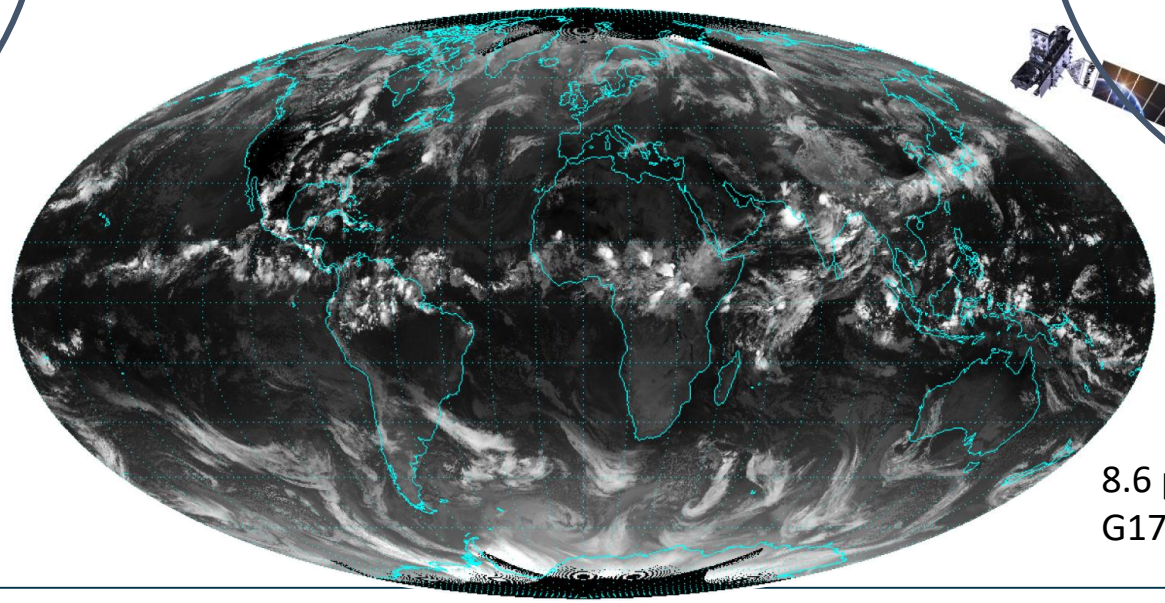


12 common channels
10 minute FD

2022



GEO-RING Projects merge the separate data from each GEO imager into a single global data



8.6 µm image from G17,G16,MET11,MET8,HIM8

weather and climate know no borders. GEO-RINGS allow for global high temporal process studies.

A GEO-Ring of spectral radiances: toward a Next Generation of the International Satellite Cloud Climatology Project (ISCCP-NG)

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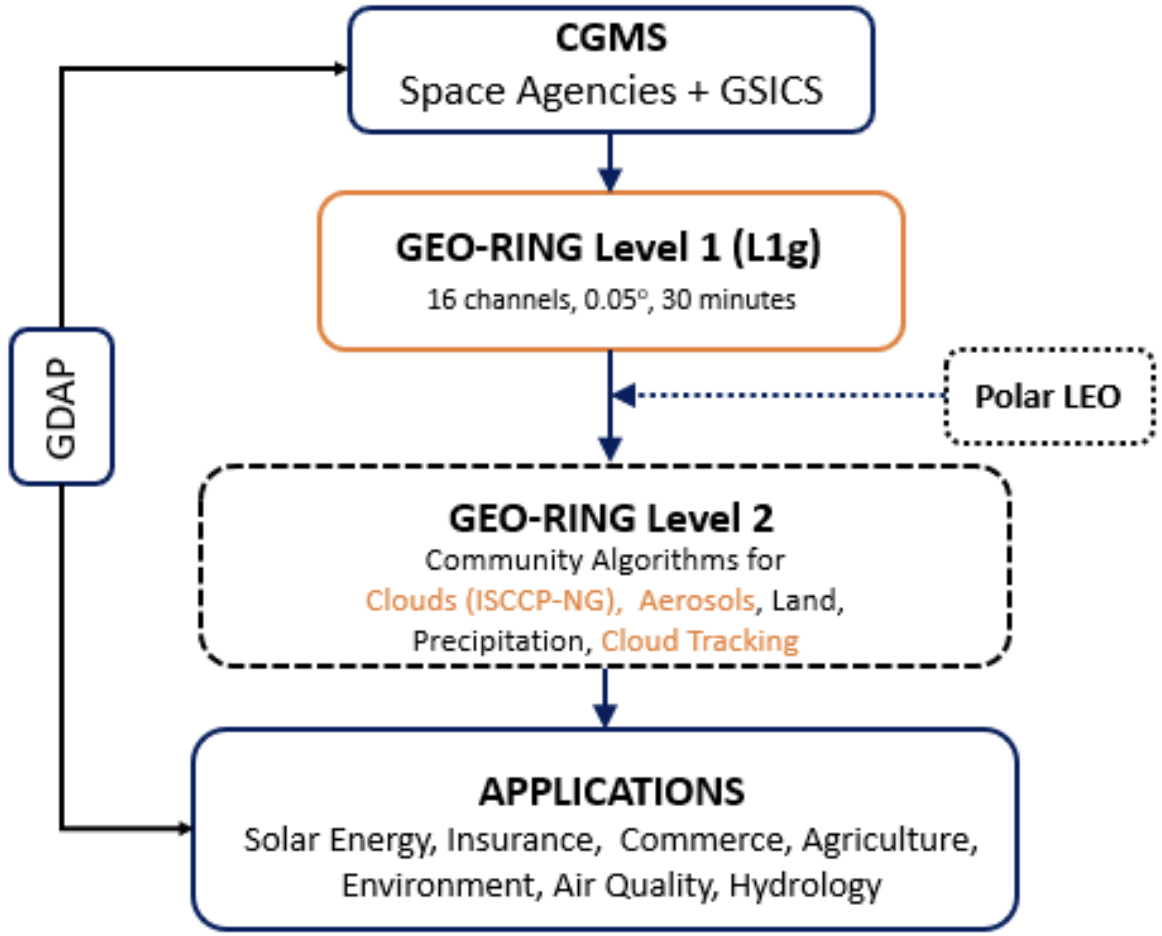
BAMS, in revision



Advanced multi-spectral imagers

since 2018: at least **10 common channels,** 0.47, 0.64, 0.86, 1.6, 3.9, 6.2, 7.3, 8.5, 11, 12 μm

with **better spatial (2km) & temporal (10 minutes) resolution**

Joint EUMETSAT-NOAA Fundamental Climate Data Record (FCDR)

for retrieval of **clouds, aerosols, precipitation, fluxes, T_{surf}, MCS tracking, etc**

ISCCP (1984-2017) **:**

based on 1 IR & 1 VIS (daytime only) window channel

Cloud Retrievals

from CM SAF (EUMETSAT) & PATMOSx (NOAA)

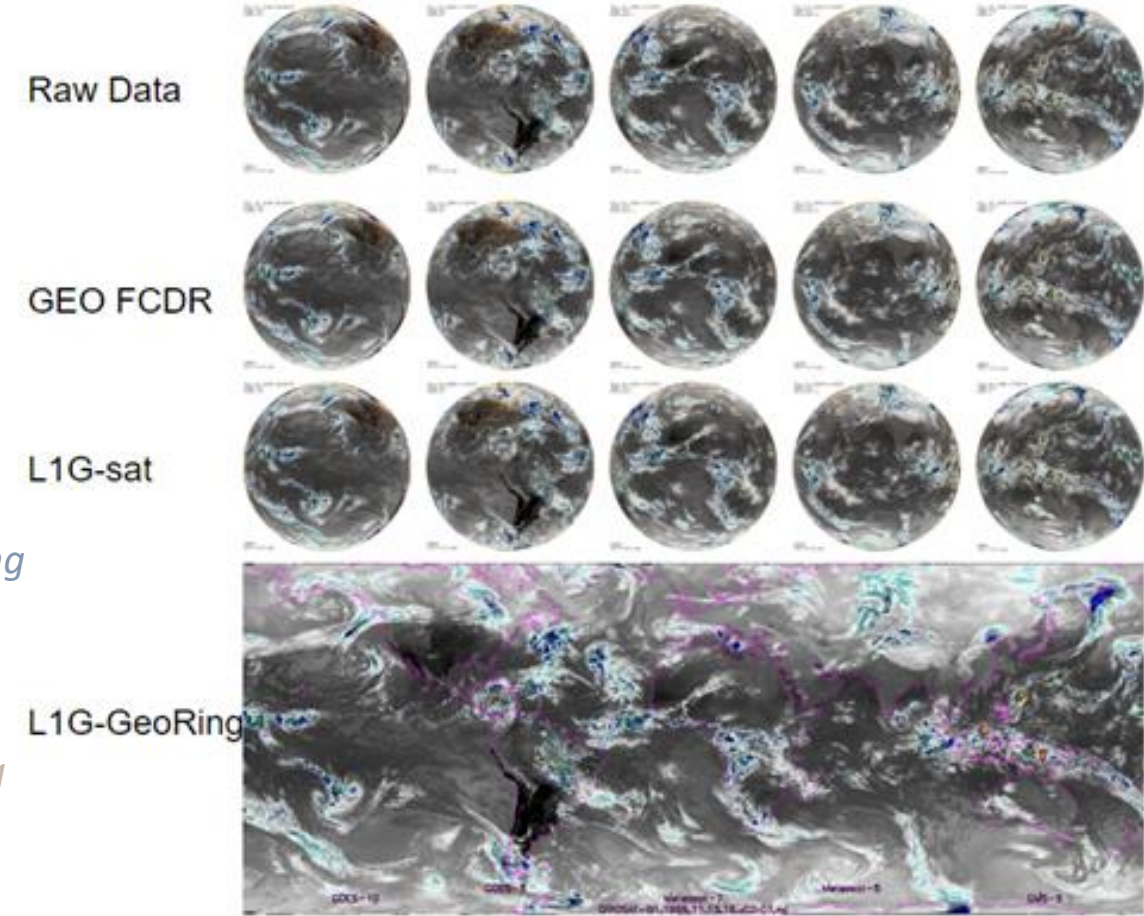
based on inter-calibrated & combined L1 data (L1G)

at present reduced to sampling 0.05° & 30 min:

data sample & source codes available at http://*cimss.ssec.wisc.edu/isccp-ng*

2 International workshops** (on invitation only) **organized at

EUMETSAT: Nov 2019 & Feb 2024 *http://cimss.ssec.wisc.edu/isccp-ng*



Recalibration & Correction of Data - Data Status

J. Schulz, EUMETSAT

LW calibration applied to all instruments (using IASI, AIRS & recalibrated HIRS as reference, spectrally adjusted)
-> anchoring all maesurements to state-of-the-art hyperspectral instrument radiometric quality

VIS calibration still under development (8 methods being assessed)
EUMETSAT developed improved calibration of SEVIRI using Pseudo Invariant Calibration Sites

Angular correction: use IASI/SEVIRI collocations of near-nadir measurements

Current plan based on GEO-Ring workshop is to provide corrections as ancillary data to be applied by users

GEO-Ring project made good progress:
test data set covering 2019-2024 expected to come out in 2025, full product planned for late 2027

EUMETSAT took commitment to extend GEO-Ring radiances to global with polar orbiter data
(AVHRR, MODIS, SLSTR, etc.)

As part of a general EUMETSAT AI/ML activity on feature identification:

- will generate a Deep Convective System (DCS) Tracking Database based on TOOCAN for GEO-Ring (readiness ~2028)
- may include other trackers as well
- could be complemented with collocated precipitation data for systems-based statistics

Evolution of scientific goals for clouds

- **Global cloud climatology for climate evaluation:** 5° & 5 yrs, maps of monthly averages
  total & cloud type amount, height
- **Cloud radiative effects on fluxes at TOA & surface:** 2.5°, 10 yrs, 3 hrly
  + cloud radiative properties, atmosph. T & composition, Tsurf, albedo, snow/ice
- **Role of clouds in global energy & water cycles** (radiation – precipitation): 1°, >10 yrs, 3 hrly
  + cloud water path, phase, particle sizes, coincident precipitation & surface turbulent fluxes
- **Dynamics of cloud feedbacks** (atmospheric diabatic heating in synoptic weather evts; Lagrangian):
  0.1°, >10 yrs, < 1hrly; *+ vertical structure of clouds & precipitation, atmospheric motions*
- **Cloud processes:** 3-5 km, >10 yrs, 15-30 min
  + time-resolved aerosols & improved surf properties

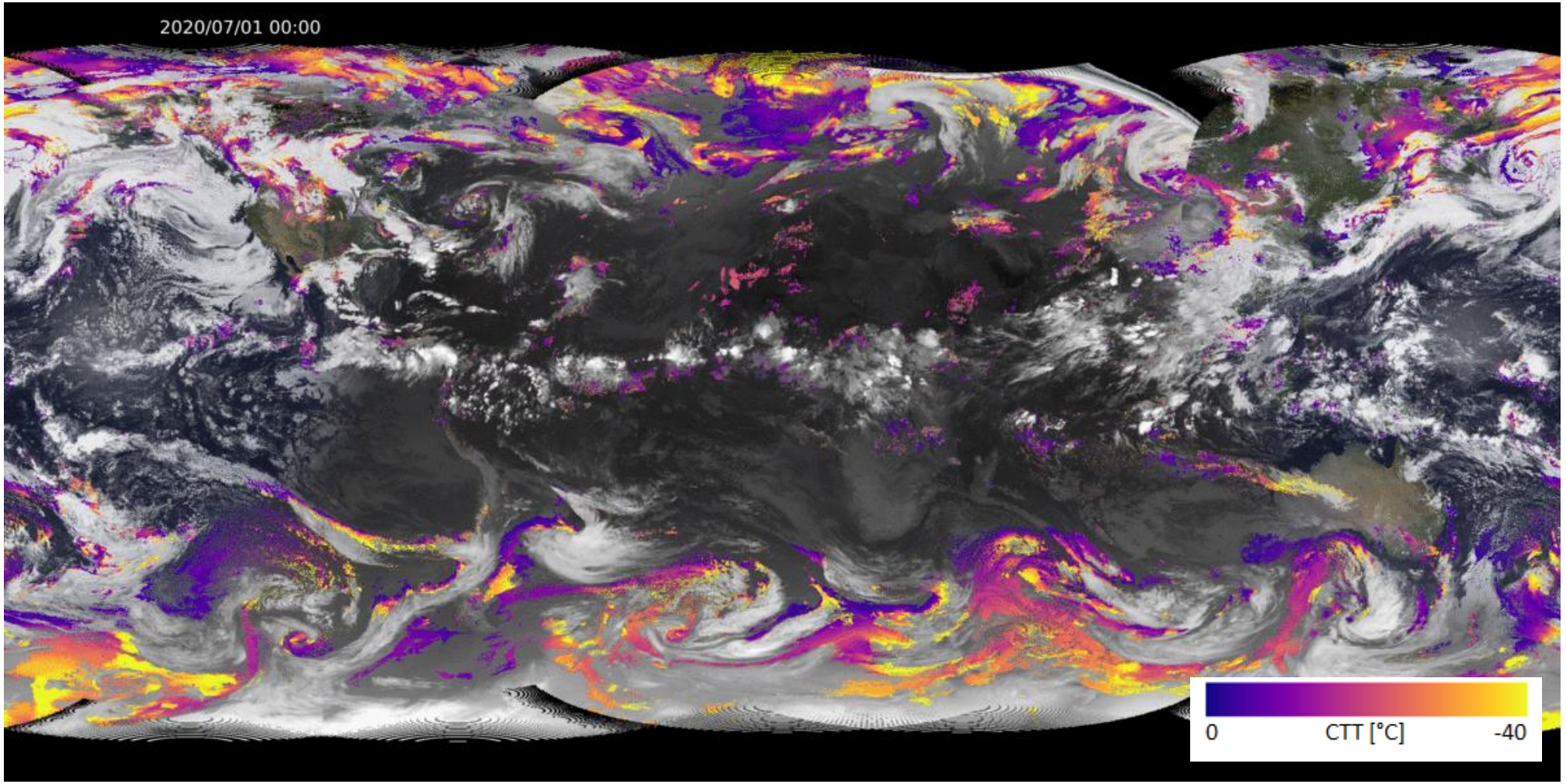
Improvements expected by **ISCCP-NG**

10 channels, 2km, 10 minutes

History of ISCCP, WCRP report 6/2022

First scientific application based on CM SAF ISCCP-NG prototype cloud products

Analysis of super-cooled liquid clouds from the current ISCCP-NG



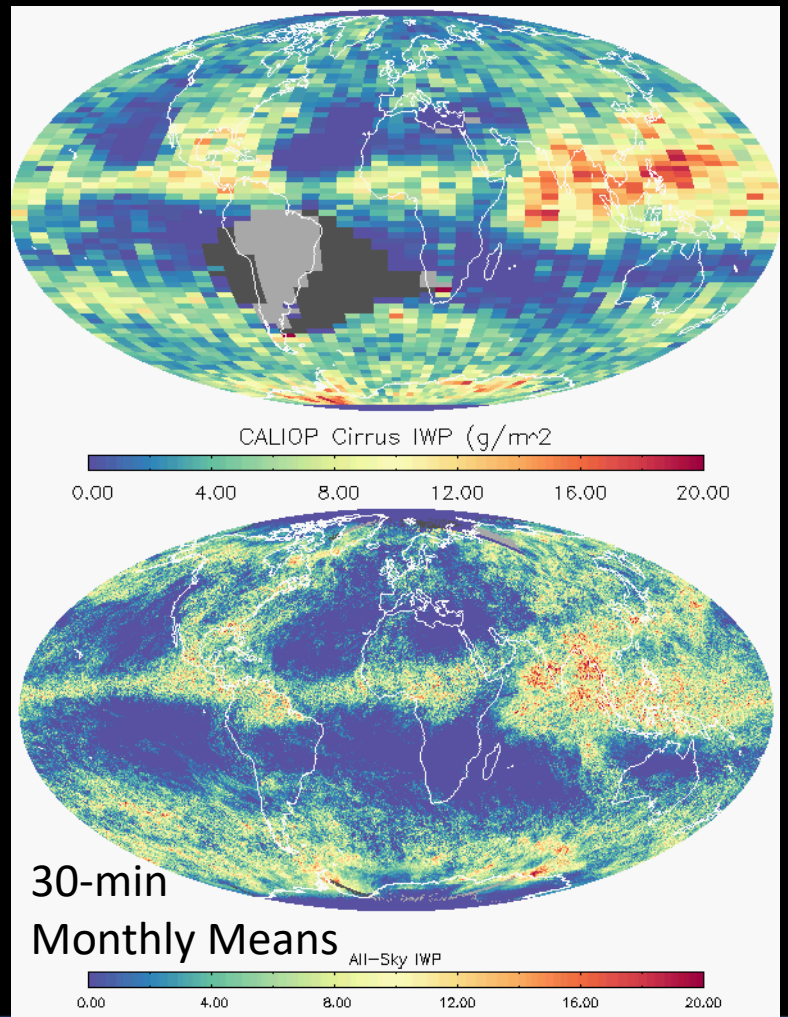
Shown is the CTT of super-cooled liquid cloud pixels

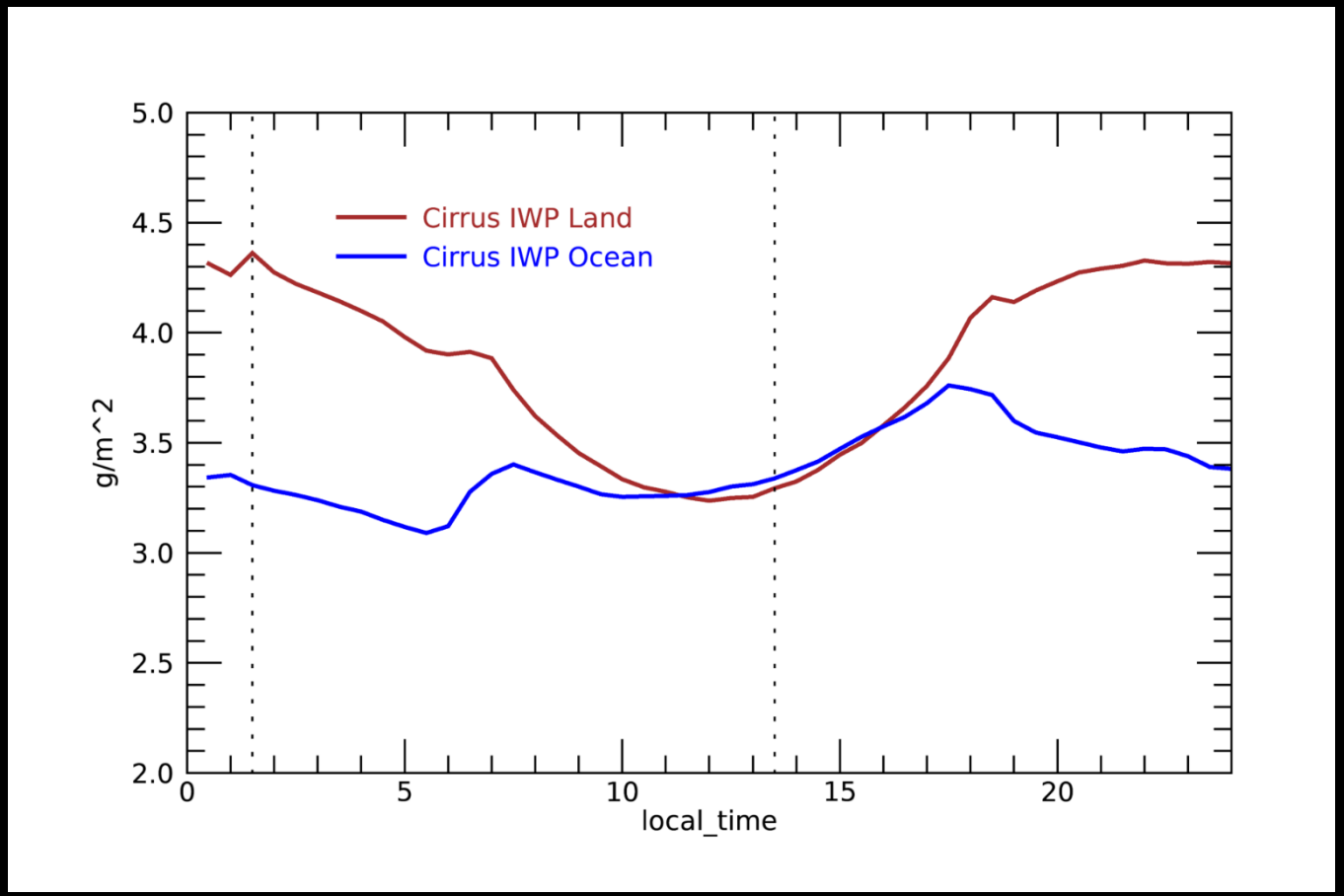
ISCCP-NG L2 Application: Cirrus Ice Water Path

- With the multiple IR Channels, ISCCP-NG will be a powerful platform to observe cirrus evolution throughout the day. Polar orbiters only observe twice per day (dotted lines) and do capture diurnal structure.

- In terms of mean for July 2021, ISCCP-NG IWP is 4.5 gm^2 and CALIOP is 5.2 g/m2. ISCCP-NG is 15% less than CALIOP. Cirrus IWP is defined as the IWP for cirrus clouds with optical depths < 3.0

monthly means agree to with 15%





Status of ISCCP-NG

ISCCP-NG *(more spectral channels **(Ci identification)**& better time resolution **(process studies**)* should allow to advance our knowledge on role of clouds in the energy & water cycles & on cloud processes

inter-calibrated & combined L1G data : 2019-2024 to be distributed by end of 2025

free of charge, via EUMETSAT Data Store

Development of improved retrieval algorithms & their assessment :

- so far 2 retrievals (EUMETSAT & NOAA) run on 1 year with strengths & weaknesses
- other retrievals welcome & can be compared within the framework of the ICWG GEO-Ring Cloud Product Intercomparison Group, led by *Jan Fokke Meirink* (KNMI) *meirink@knmi.nl*

  created during 3rd International Cloud Working Group Workshop, Feb 2024, in order to assess L2 cloud products
- 2 virtual meetings held (last in Sep 2024):

1) Intercomparison of 1 'golden day' (1 Oct 2021) analysis by June 2025
2) Study longer time period once EarthCARE available (1 month)
   needs funding