

GEO-Ring - Reprocessing of data for climate monitoring

Presented to CGMS-52 Plenary session, EUMETSAT WP-01p

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Executive summary of the WP

CGMS agencies EUMETSAT and NOAA started a bilateral activity to reconstruct radiance measurements into a Fundamental Climate Data Record (FCDR) from all historical measurements from imagers in geostationary orbit that form the Geostationary Ring or short GEO-Ring. The activity was supported by data and knowledge about them provided by JMA and more recently by IMD providing additional measurements over the Indian subcontinent and ocean in the 1990s.

The envisioned resulting climatology will come with 30-minute temporal and approximately 0.05° spatial sampling. It would start with data in the mid-1970s and extend to today's much more advanced measurements spanning 50 years' worth of data. The FCDR enables the creation of a large amount of quasi-global atmospheric, oceanic and terrestrial geophysical climate data records and has also good potential of being used in NWP model-based reanalyses.

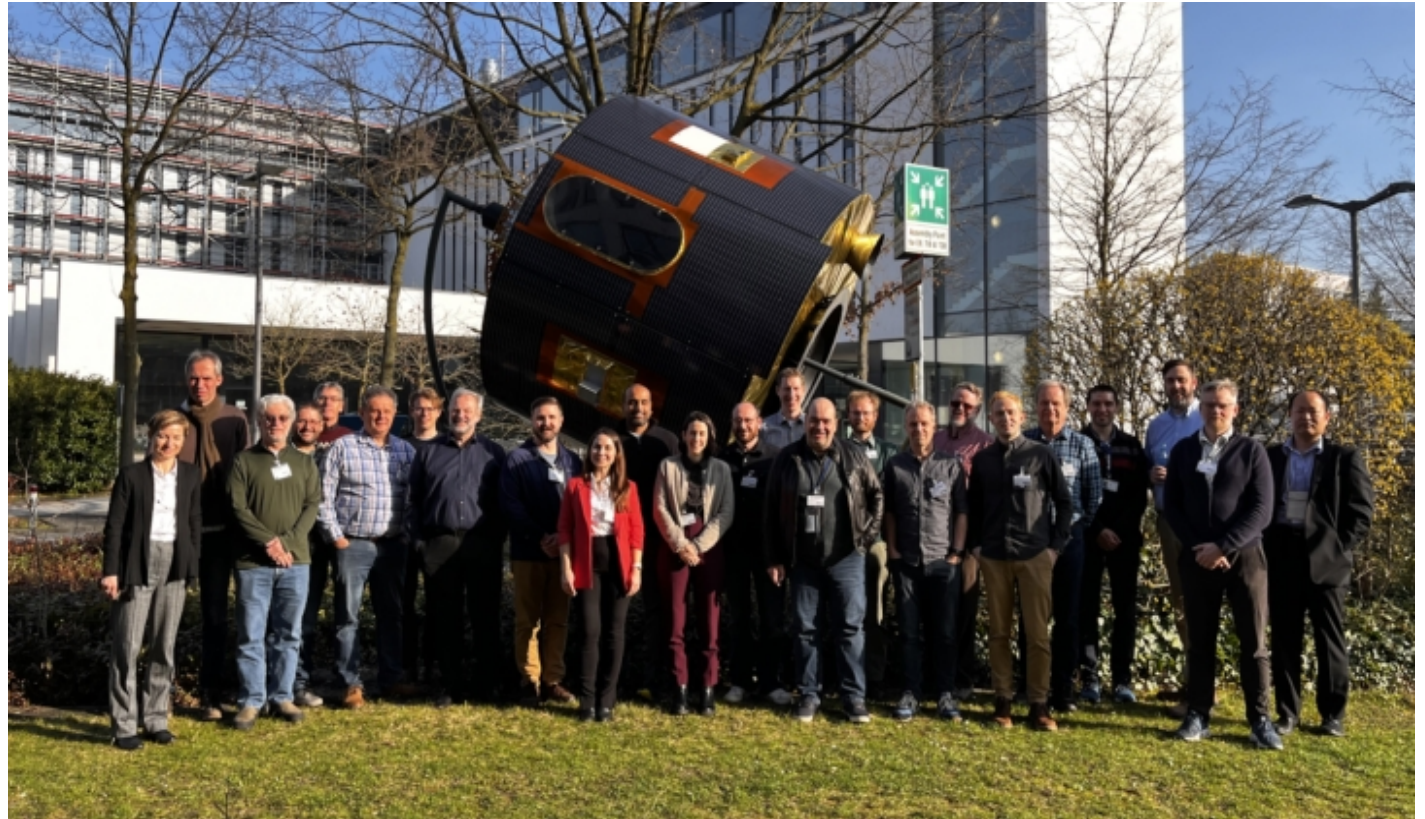
The presentation highlights the steps that need to be undertaken to generate the FCDR (data rescue, quality control, sensor recalibration and cross-calibration, production, and validation). In addition, it presents a new way of co-developing and distributing the data record using cloud environments. This new way requires a detailed consideration of applicable data policies of participating agencies to make this most beneficial for the users.

CGMS agencies are invited to contribute to this activity and to its possible extensions such as addition of imager data from polar orbiting satellites and atmospheric sounding instruments in the future.



GEO-Ring/ISCCP-NG Workshop

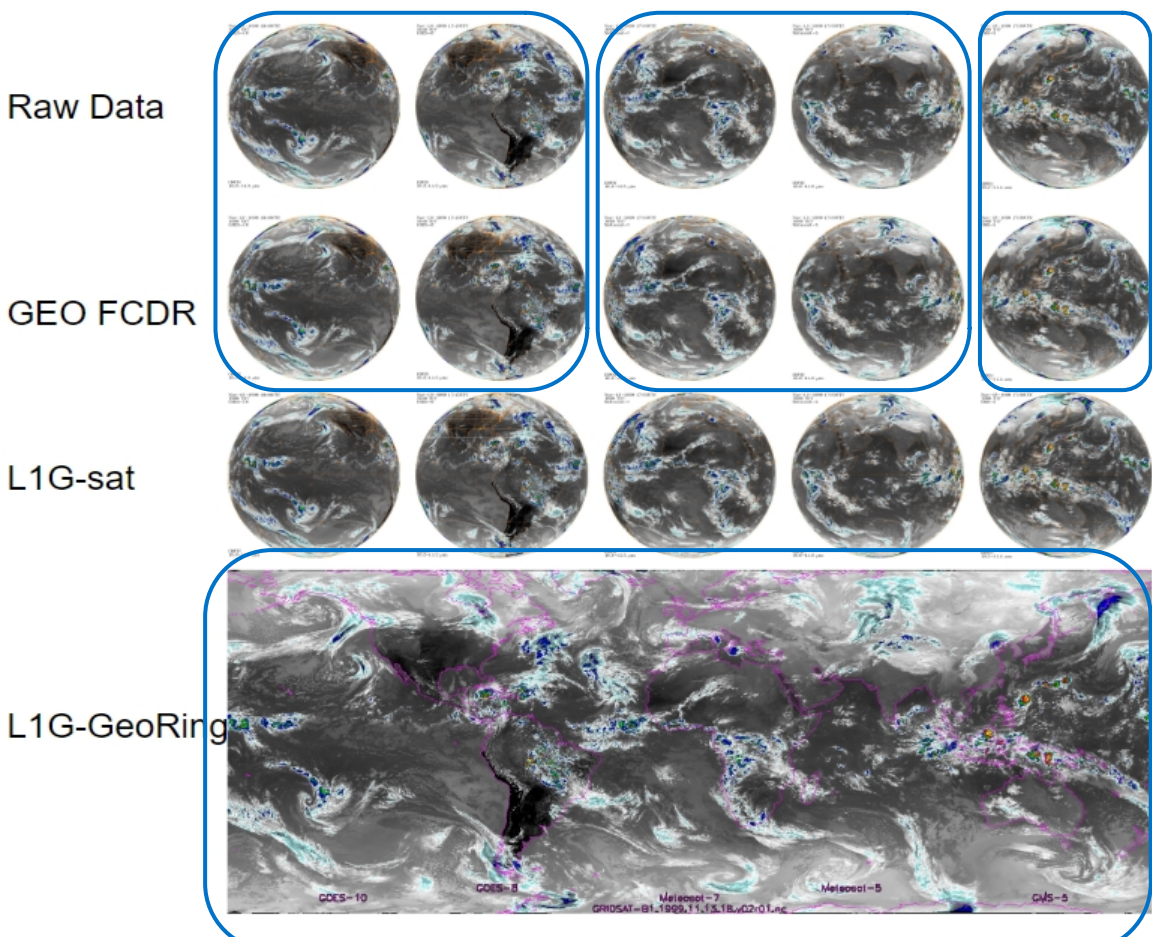
- Hosted by EUMETSAT on 02/29&03/01
- Followed from the 1st ISCCP-NG Workshop in 2019
- 35 people attended in-person or on-line
- Workshop had two Goals:
 - Show progress of developing the GEO FCDRs and ISCCP-NG
 - listen to various applications about their needs and uses for GEO-RING data



Summary Report and Presentations Available here
<http://cimss.ssec.wisc.edu/isccp-ng>

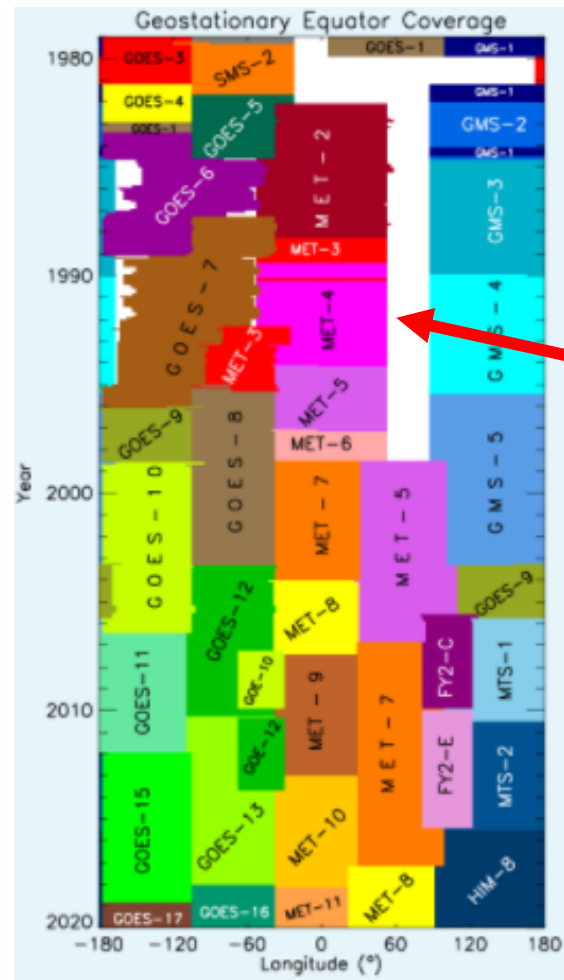


EUMETSAT-NOAA GEO-Ring project with contributions from JMA and IMD



Federated production by agency

Produced in the cloud

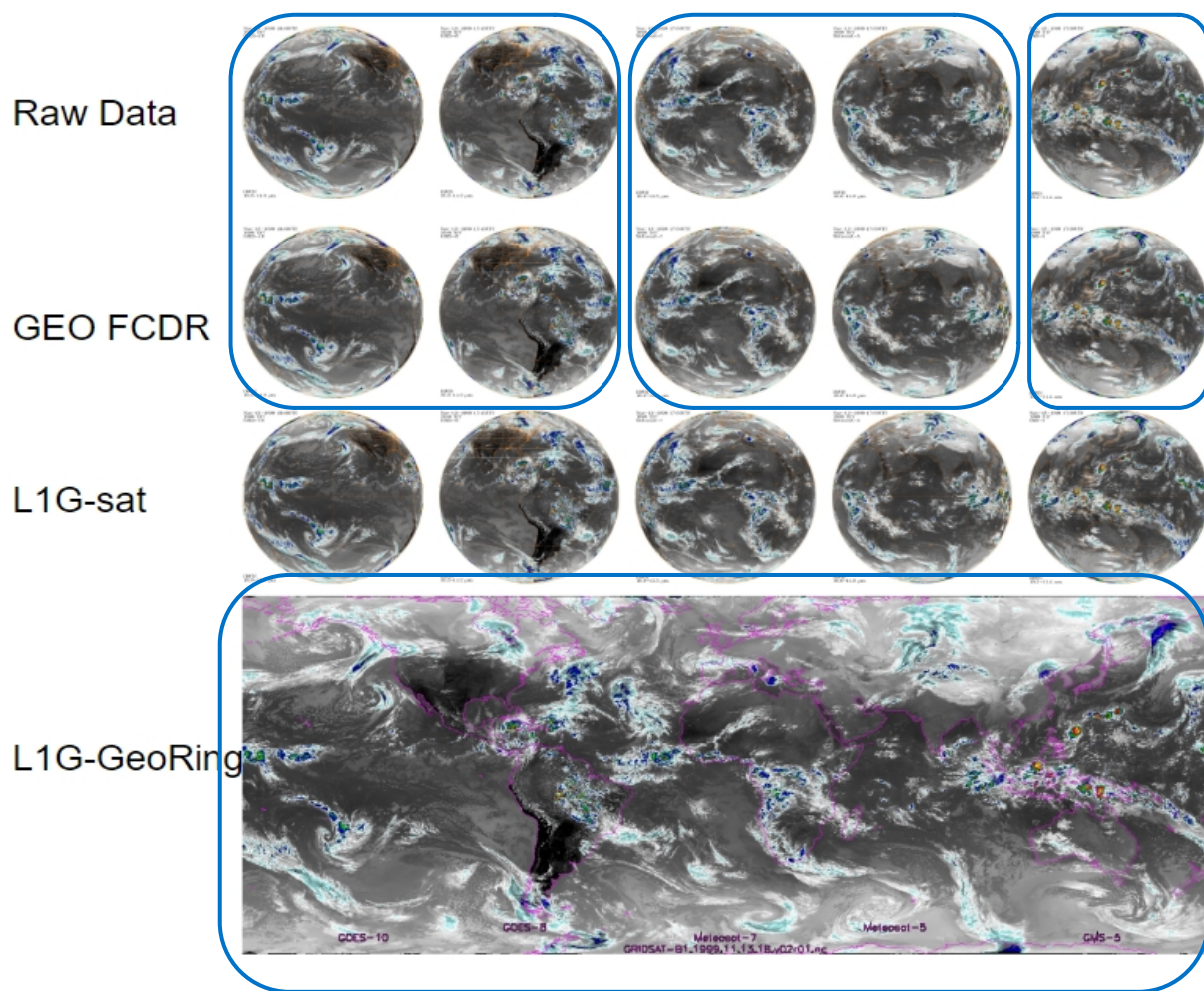


- GEO-Ring radiance data 1974-today and beyond
- Includes rescued data from SMS-1/2, GOES 1-7 and **~10 years INSAT data**
- Nominal resolution is 30 min, 0.05° and all spectral channels
- Project runs 2023-2027 and aims at best and longest radiance climatology ever
- First data 2025/2026

Coordination Group for Meteorological Satellites



From Single Satellite Raw Data to Global Product



Federated production by agency

Produced in the cloud

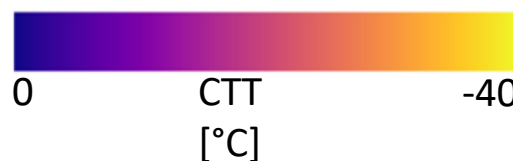
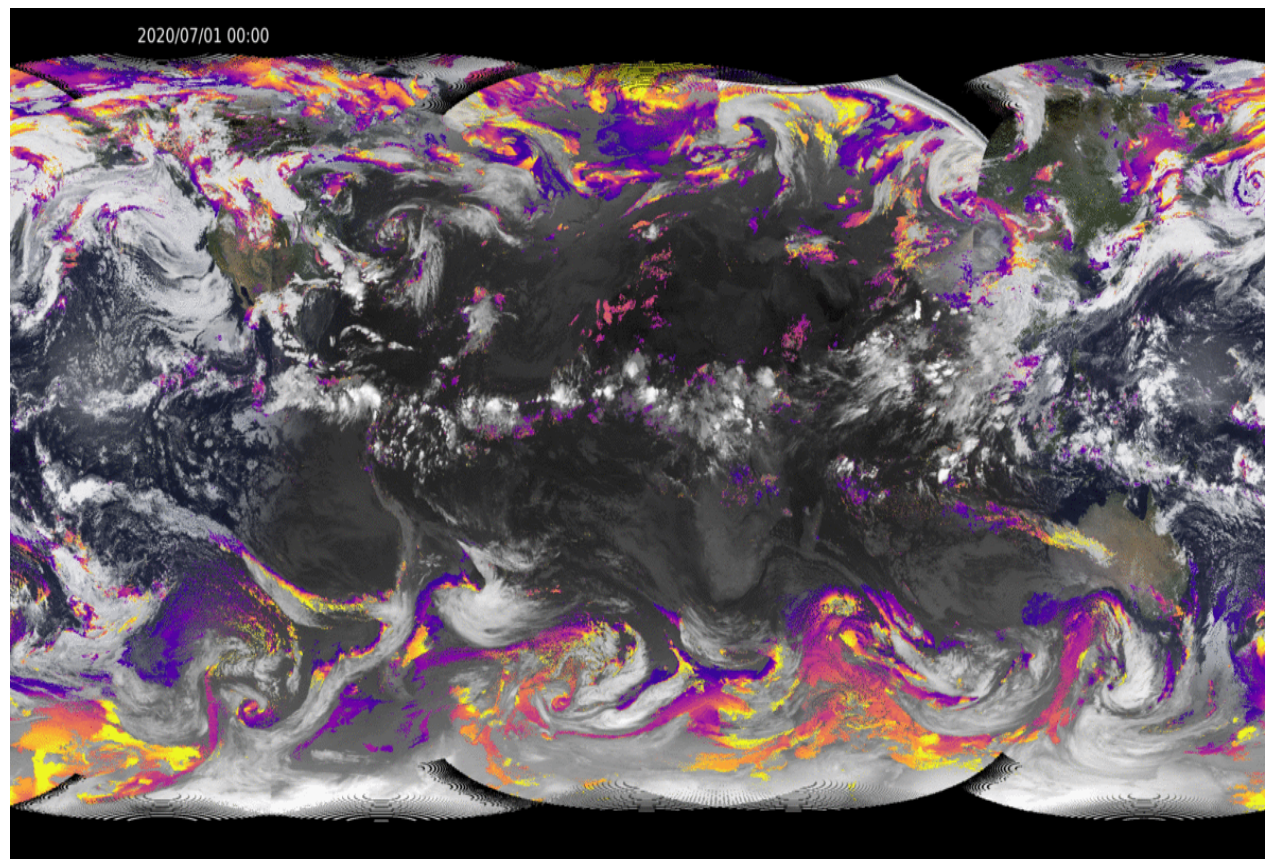
- Raw data: rescue activities, radiometric anomaly detection, navigation
- GEO FCDR: channel re-calibration, uncertainty characterisation, cross-calibration (rather easy for IR but complex for VIS), spectral band adjustment, validation
- L1G-sat: mapping on standard grid with fixed temporal sampling
- L1G-GeoRing: combination of L1G-sat into quasi-global product to be initially distributed by EUMETSAT, NOAA and maybe JMA with additional access for users within cloud compute systems if feasible



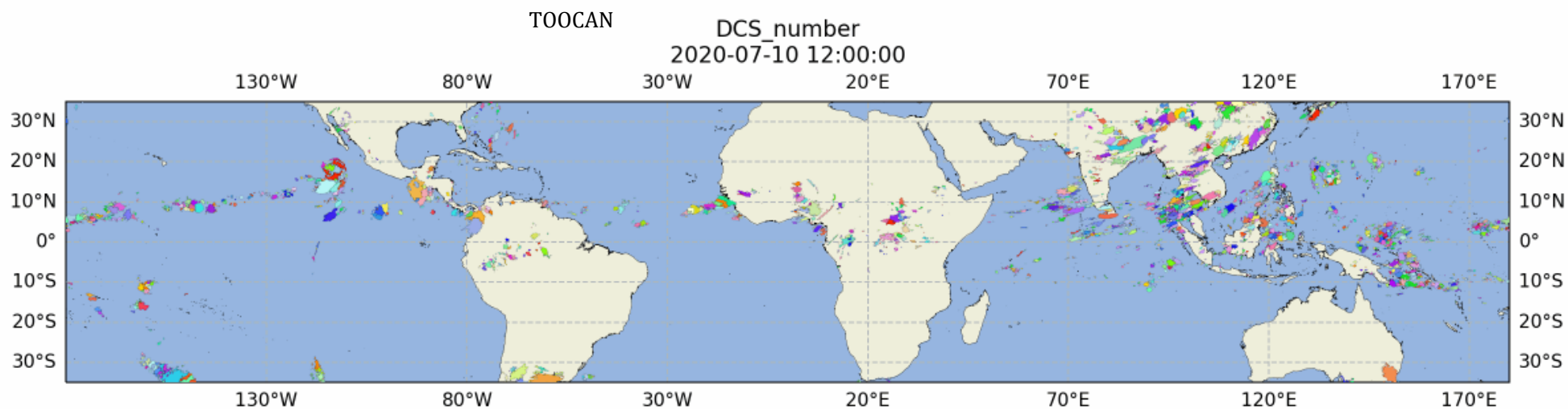
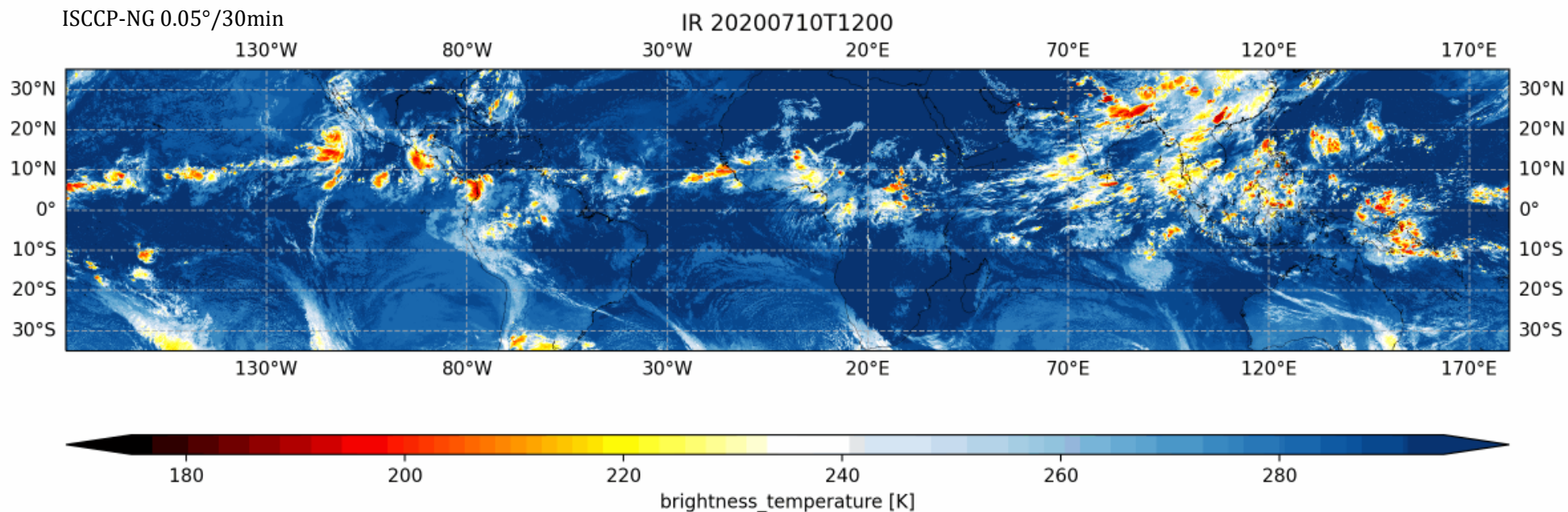
GEO-Ring Application: ISCCP-NG

- ISCCP-NG uses the current GEO-Ring (SEVIRI, AHI, ABI, AMI)
- ISCCP-NG L1g is a prototype method to combine all sats into a seamless GEO-Ring. Code being developed by NESDIS (CIMSS), EUMETSAT and KMA. All are welcome
- Goal is to support cloud, aerosol, surface temperatures, AMVs, precipitation and other applications
- Nominal resolution is 30 min, 0.05° and all channels
- NOAA/NESDIS and EUMETSAT/CM-SAF have demonstrated use of ISCCP-NG L1g for cloud applications
- Prototypes for 2021 and 2023 available from UW/CIMSS

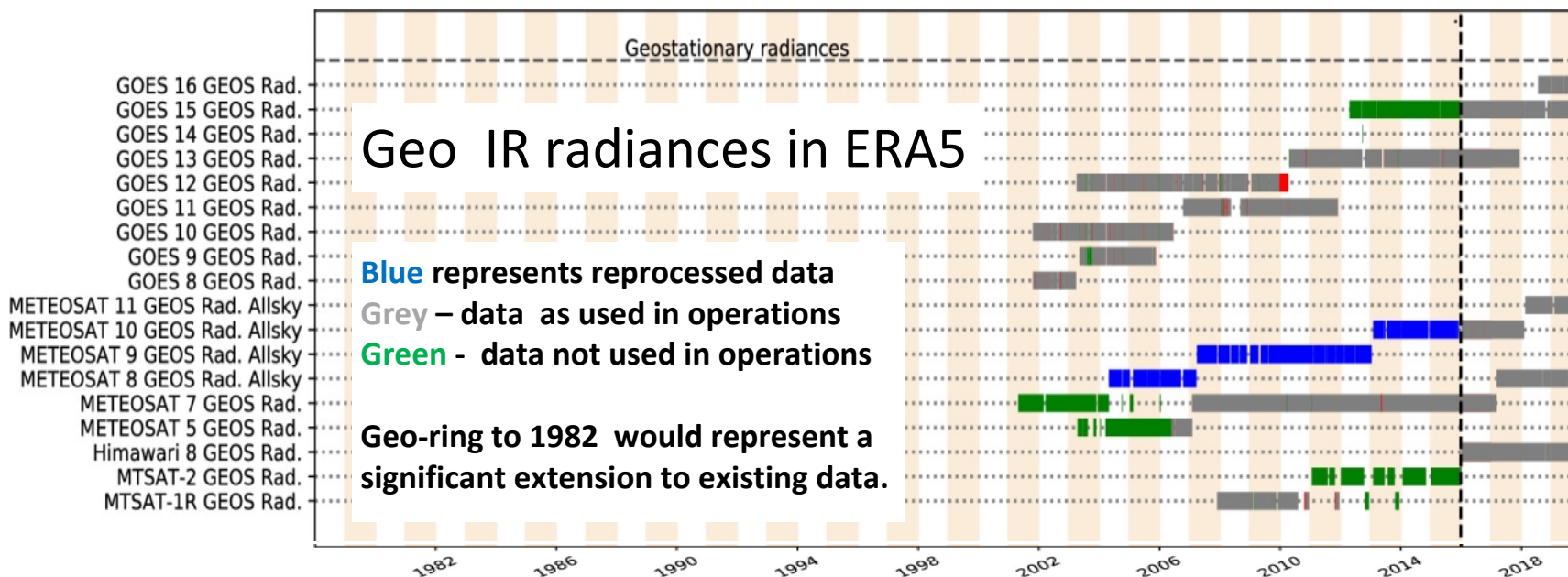
ISCCP-NG supercooled cloud detection (Martin Stengel, DWD)



GEO-Ring Application: Deep Convective Strom tracking



GEO-Ring Application: Global Reanalysis@ECMWF



- Assimilation of GEO radiances in ERA likely evolves in next 2-7 years:
 - assimilation of cloud affected IR (&Vis ?)
 - value of window channel will increase in coupled DA developments, e.g., surface emission for better vertical localisation and accuracy of humidity information, coupled SST analysis and later for coupled LST analysis
 - IR window is only source for diurnal cycle of skin temperature in 4D-Var

- Only WV channel data is assimilated, IR window used for quality control regarding cloud contamination
- AMVs are used back to 1982, with more reprocessed data
- Current relative FSOI is maximum 1% for radiance and 2% for AMV
- Harmonisation of radiance may have little impact as bias correction is small and works well

Bill Bell and Samuel Queseda Ruiz, ECMWF

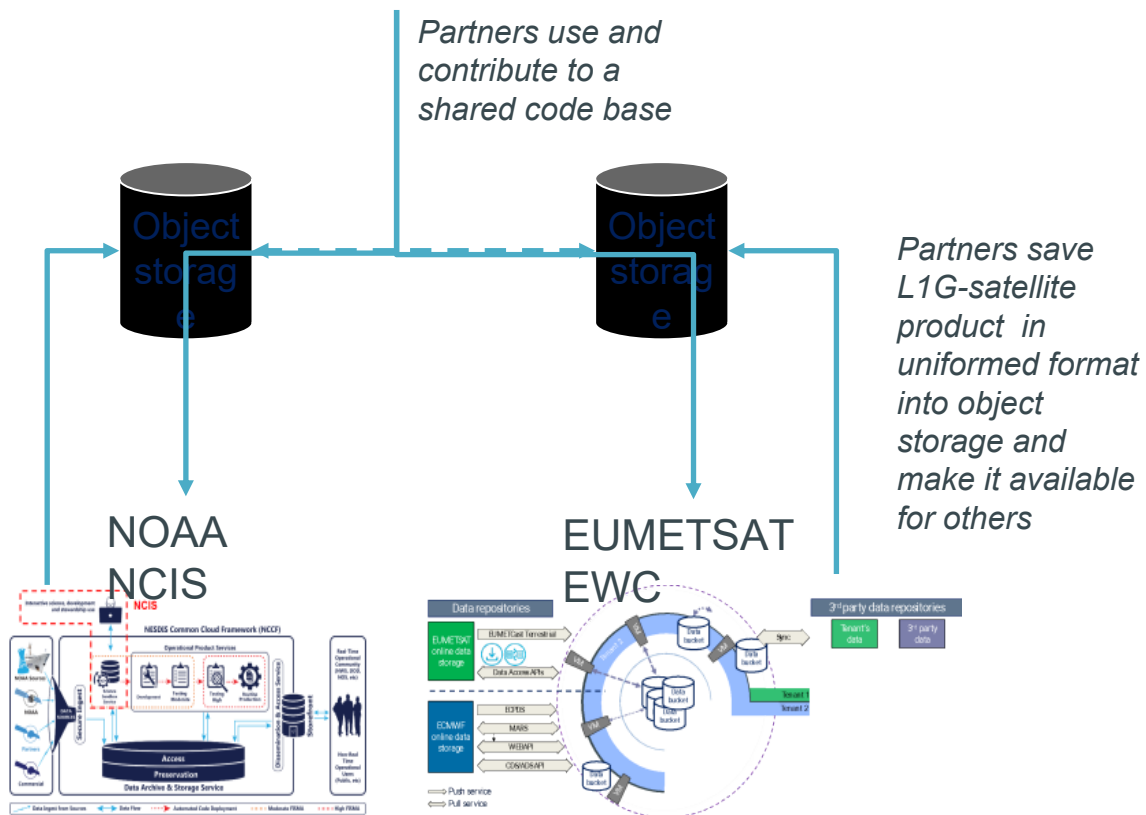


Usage of GEO-Ring Cloud Infrastructure

EUMETSAT code repository



Partners use and contribute to a shared code base



- NOAA and EUMETSAT will use their cloud infrastructure services, the NESDIS Common Cloud Framework (NCCF) and the EUMETSAT&ECMWF European Weather Cloud to co-develop and distribute the GEO-Ring data record
- This poses a couple of issues to solve:
 - It's better to get processing close to the data, but replicating L1G GEO-Ring production requires at least syncing of latest data to all processing environments
 - Copying large amounts of raw data takes time and cost money but reduces the likelihood of data loss
 - Containerization should help interoperability but in practice lots of testing is required
- Data policies for the usage of raw data and dissemination of products from GEO FCDR level need careful consideration.

A practical and agile approach is needed!



Key issues of relevance to CGMS:

Data Policy Awareness

- Data processing and distribution via cloud systems is a relatively new way of addressing data production together.
- We need to be aware about the data policy for L1 data and rights required for redistributing L1 data of another agency
- May need to consider harmonization of data policies for the specific GEO-FCDR, L1g-sat, and L1G-GeoRing data looking at different user groups, e.g., public sector services, research, and commercial users

To be considered by CGMS:

Coordination of GEO-Ring work

- EUMETSAT/NESDIS have partnered together in a Bilateral Activity
- JMA has contributed data to both the GEO-Ring FCDR and ISCCP-NG
- IMD has started to contribute data to the GEO-Ring FCDR
- KMA and CMA have expressed interest in GEO-Ring/ISCCP-NG L1g activities
- PoC: Jörg Schulz, EUMETSAT and Andrew Heidinger, NOAA

Potential Extension of GEO-Ring activities

- GEO-Ring imaging data records could be produced at low latency (~5 days) if initial project on past data is successful
- GEO-Ring imaging data records could be enhanced with imager data from polar orbit to become truly global
- GEO-Ring data sets can be envisaged also for atmospheric sounding instrument data