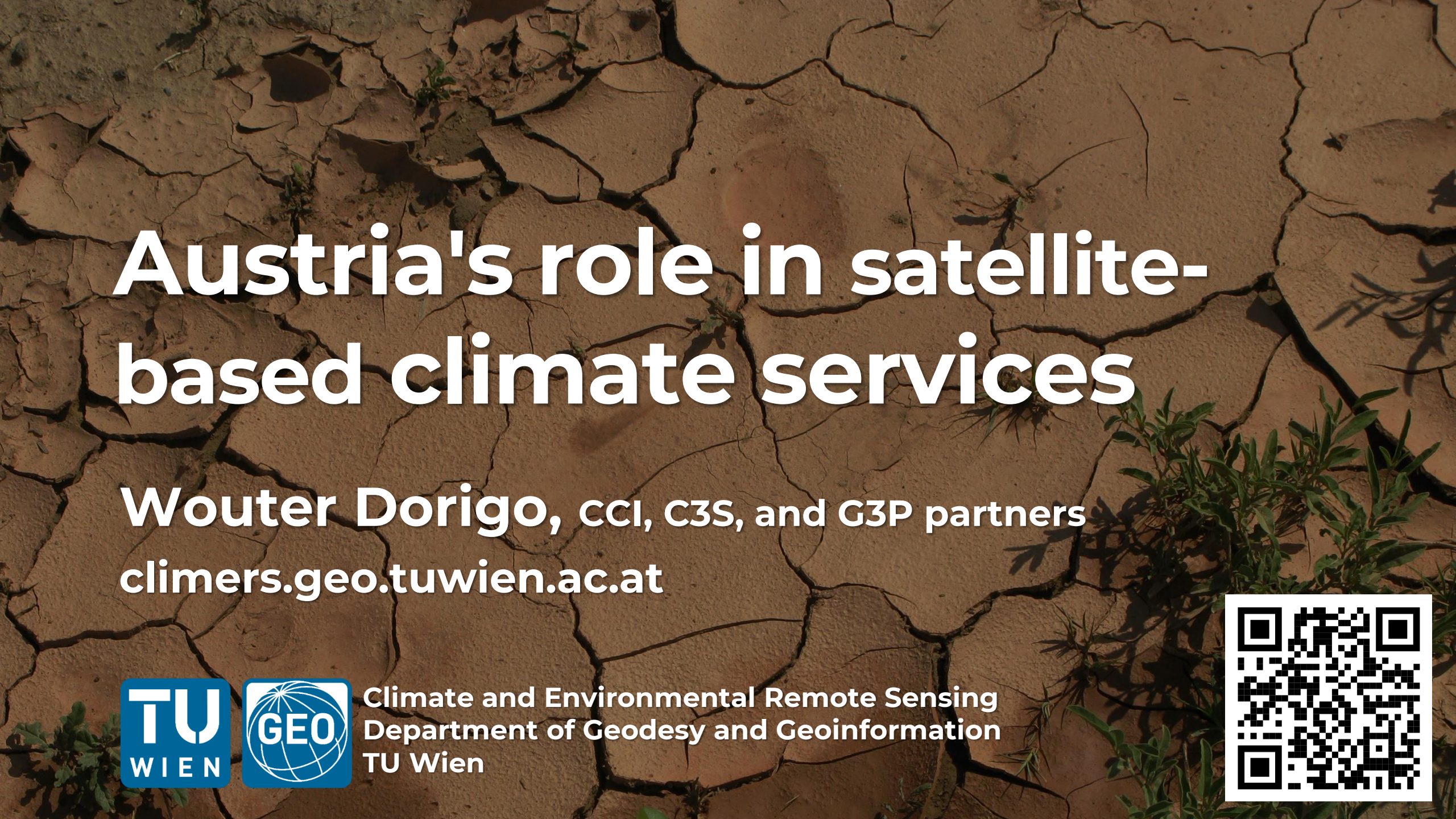


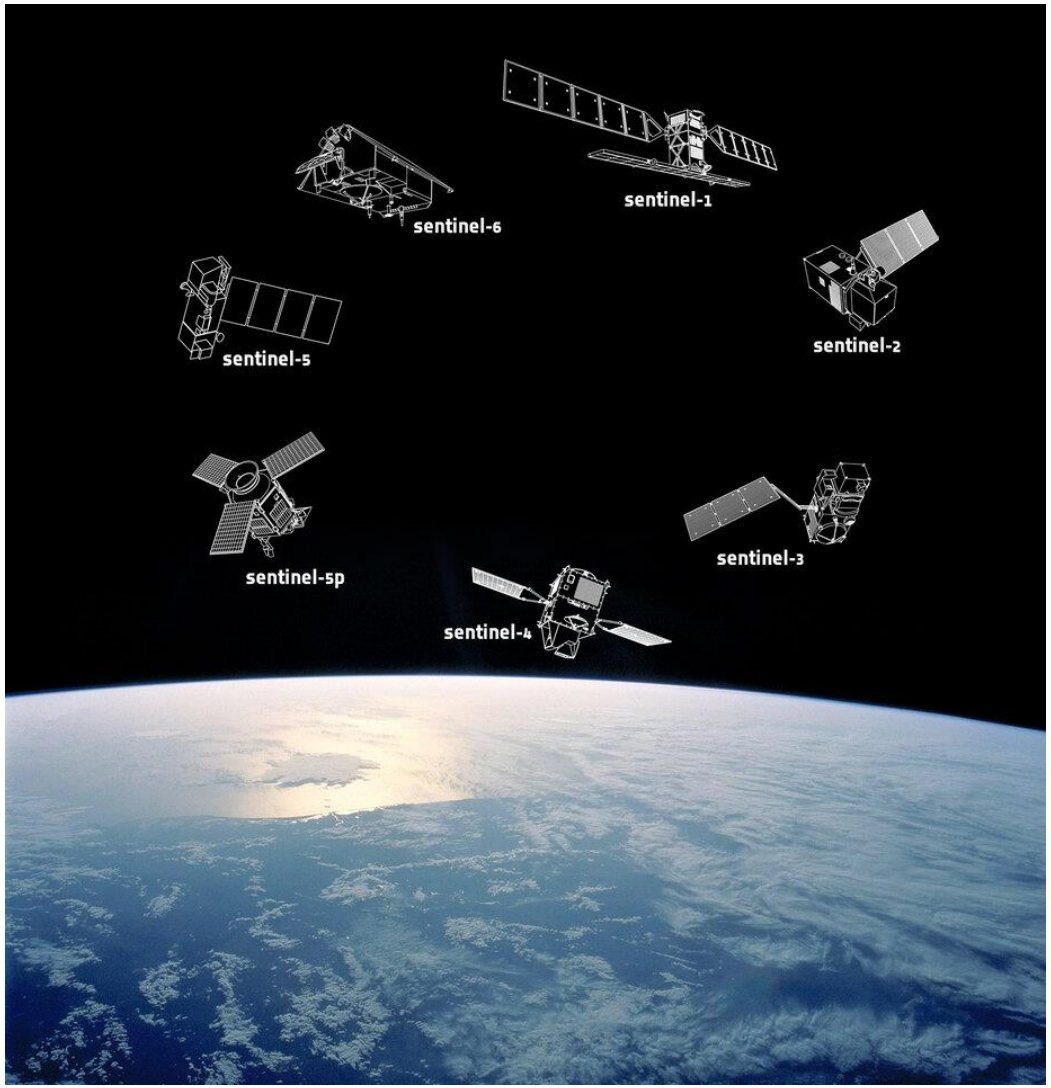
Austria's role in satellite-based climate services

Wouter Dorigo, CCI, C3S, and G3P partners

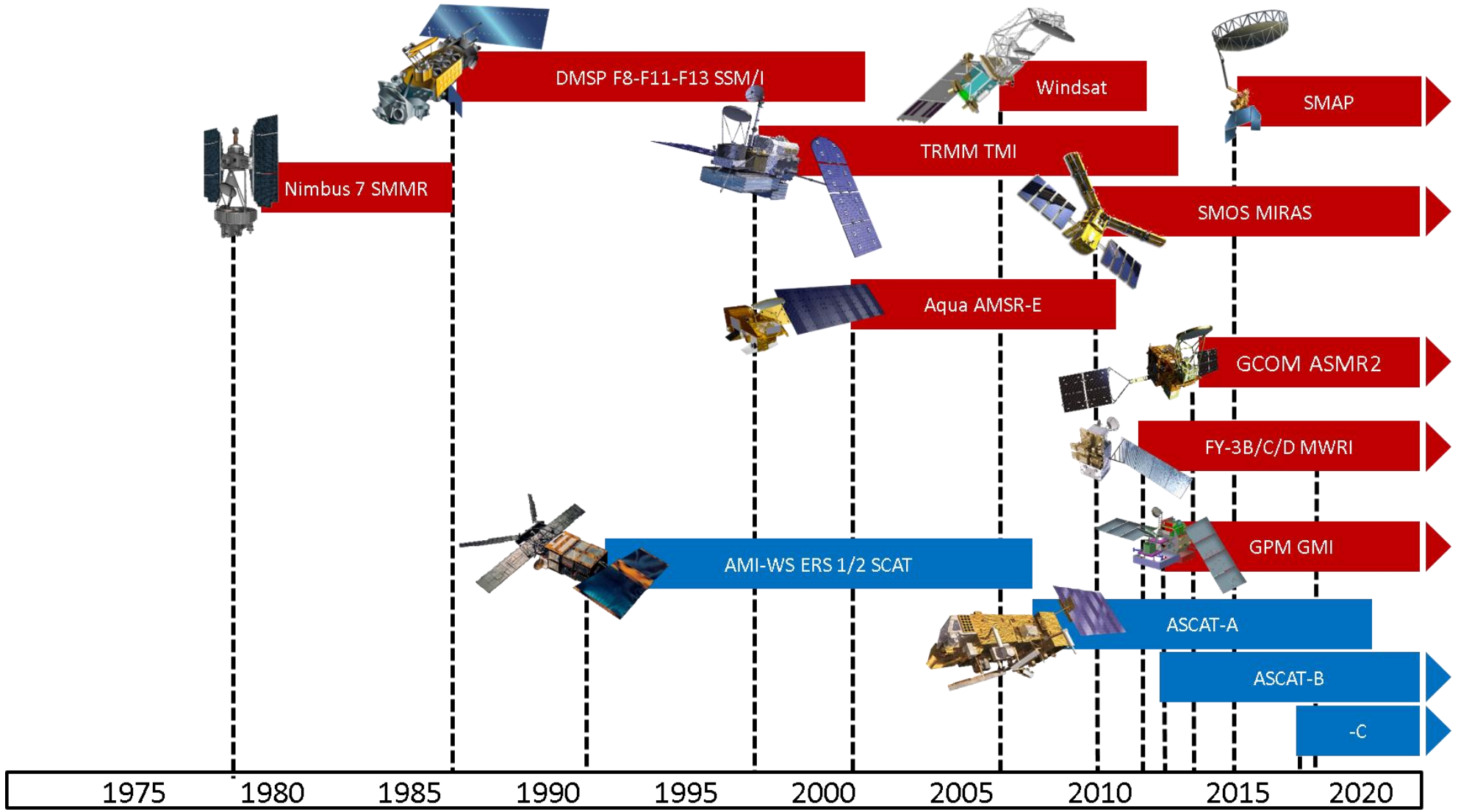
climers.geo.tuwien.ac.at

Climate and Environmental Remote Sensing
Department of Geodesy and Geoinformation
TU Wien

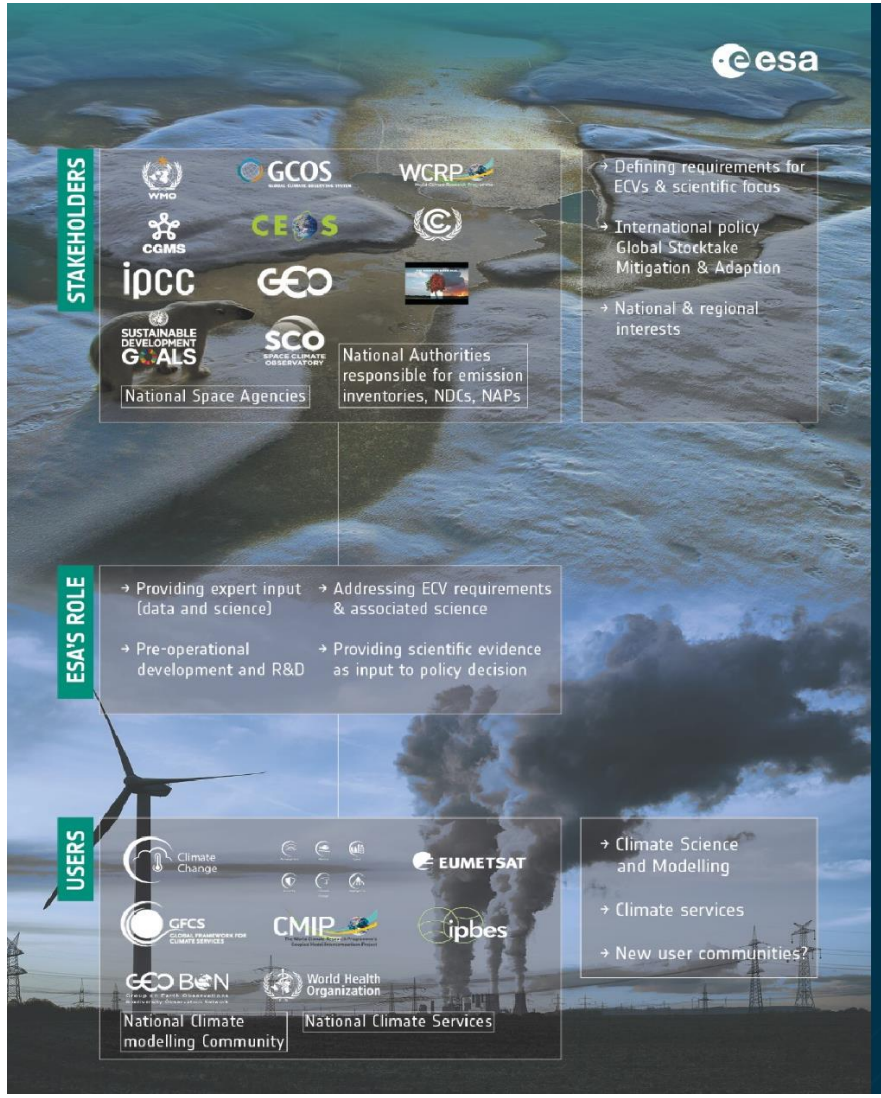
Copernicus services



What is a climate service?



International policies as a driver



esa

The international climate network

Main drivers

- UNFCCC Paris Agreement/ IPCC
- 2030 Agenda for Sustainable Development
- Sendai Framework for Disaster Risk Reduction 2015–2030

- Green Deal
- UN conventions for biodiversity and ecosystems

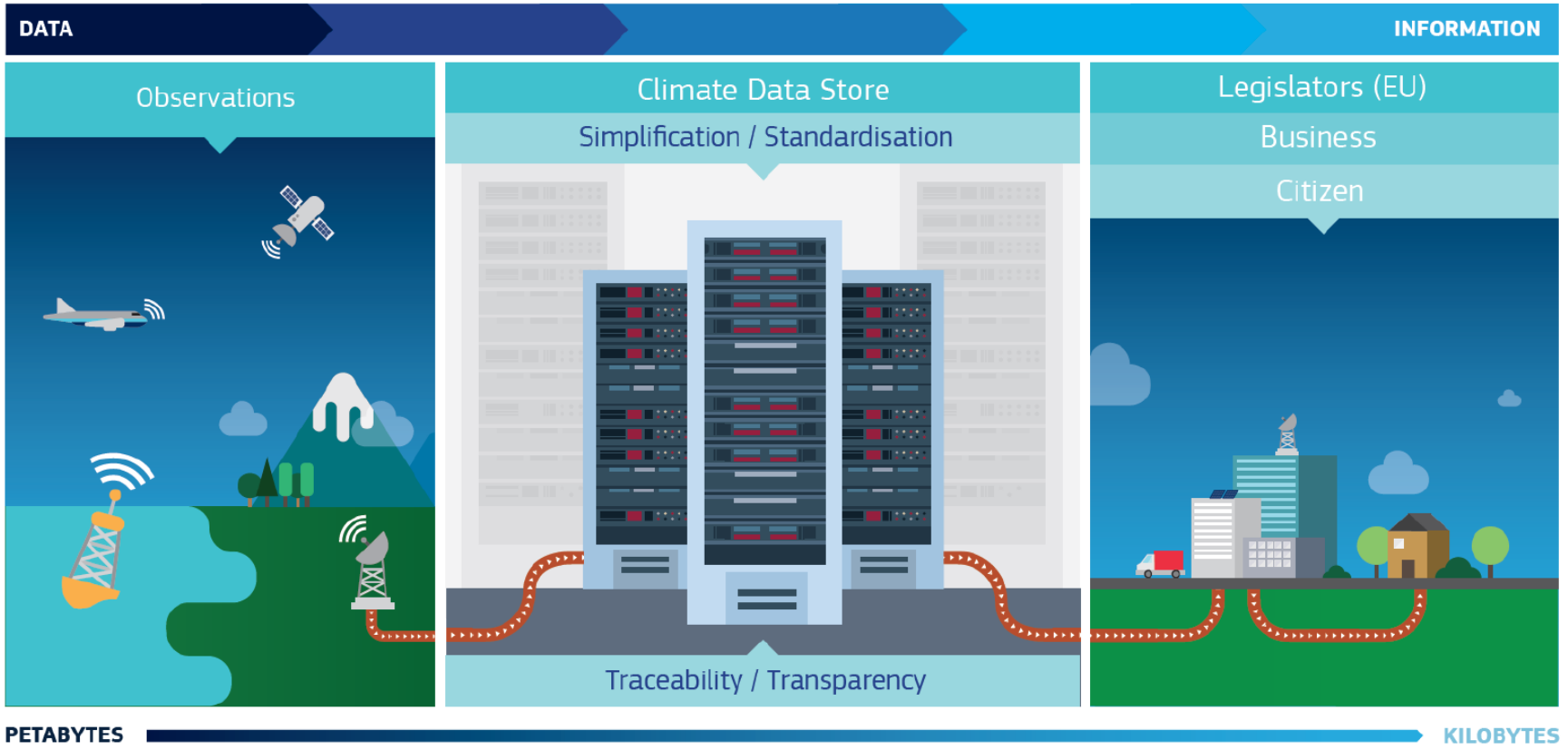
31

C3S - Copernicus Climate Change Service

Goal: Reliable Access to high-quality Climate Data through the **Climate Data Store**

What is on the CDS?

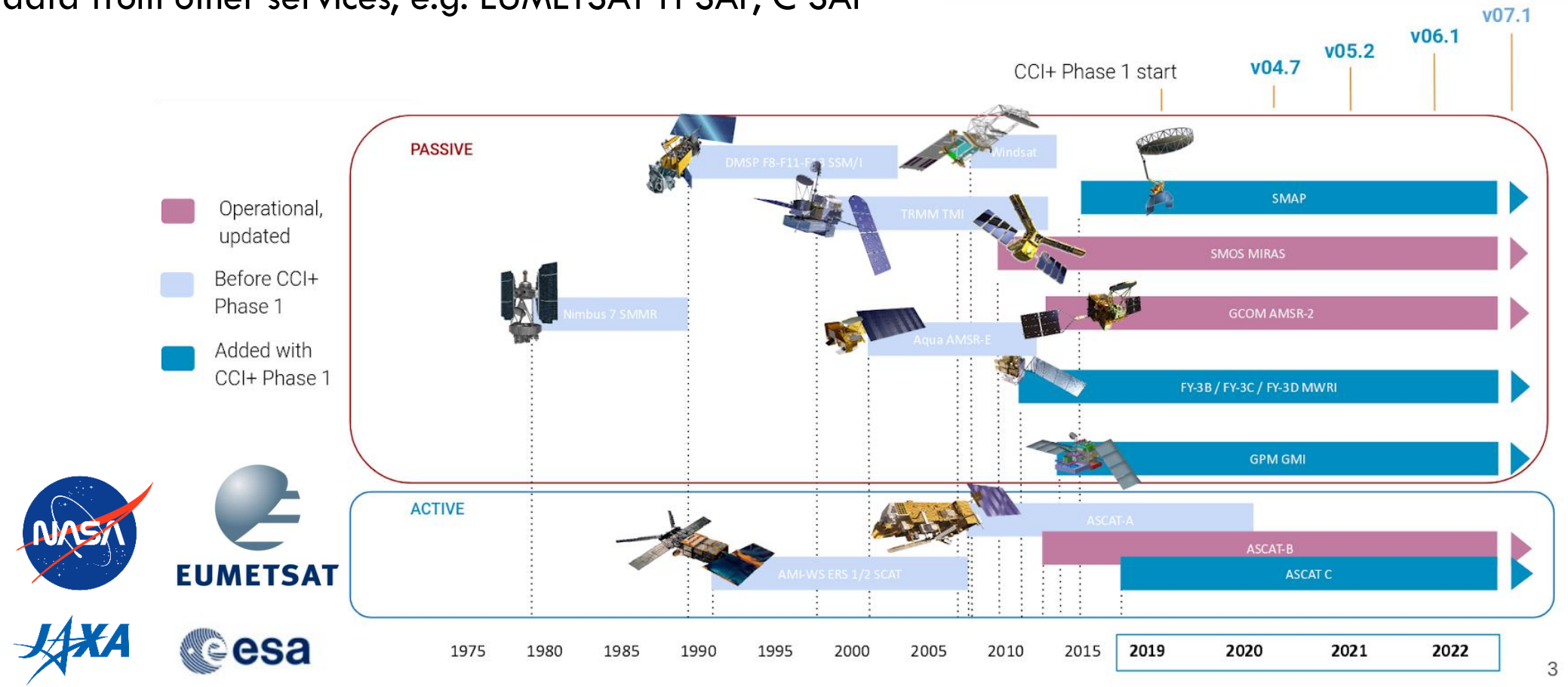
- Global Reanalysis (ERA5 and ERA5 Land)
- Satellite Observations (GCOS ECVs)
- Surface Observations
- Forecast data
- Climate projections



ESA CCI at the core of C3S

ESA Climate Change Initiative provides R&D

Also uses data from other services, e.g. EUMETSAT H SAF, C SAF



The implementation: current status

WMO defined **54** Essential Climate Variables
36 benefit from space observations
21 generated by ESA Climate Change Initiative

climate change initiative

Oceanic | sea level budget closure cci | Terrestrial | reccap-2 cci | Atmospheric

climate.esa.int

ESA's Climate Change Initiative

AUSTRIAN CONTRIBUTION

Involved in

- biomass cci
- glaciers cci
- antarctic ice sheet cci
- greenland ice sheet cci
- high resolution land cover cci
- permafrost cci

Prime for

- snow cci
- soil moisture cci

6 Institutions

- Enveo
- TU Wien
- EODC
- Geoville
- IIASA
- b.geos

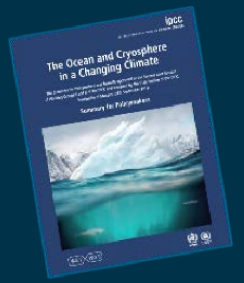
8 ECV projects (from a total of 23 CCI ECV)

4 ECVs transferred to Climate Change Service climate.copernicus.eu

4 new ECV projects (of 9 new CCI projects)

356 peer-reviewed papers (CCI total 1,600)

ipcc



9 authors of CCIs with Austrian involvement contributed to AR5 WGI statements on: glaciers and ice sheets

23 citations in Special Report Oceans & Cryosphere related to CCIs with Austrian involvement (total CCI citations 47)

C3S Land Hydrology and Cryosphere ECVs

Led by:

The **LHC service** provides **11 products** over the **four ECV** thematic areas

Soil Moisture

TU WIEN DEPARTMENT OF GEODESY AND GEOINFORMATION

VanderSat

planet.

Science Lead: TU Wien
Wouter Dorigo

Service Manager: EODC
Christoph Reimer

Glaciers

University of Zurich[UZH]

Science Lead: Uni Zurich
Michael Zemp

Service Manager: Uni Zurich
Frank Paul

Lakes

University of Reading

CLS COLLECTE LOCALISATION SATELLITES

Science Lead: Uni Reading
Christopher Merchant

Service Manager: Uni Reading
Laura Carrea

Ice Sheets and Ice Shelves

UNIVERSITY OF LEEDS

DTU Space National Space Institute

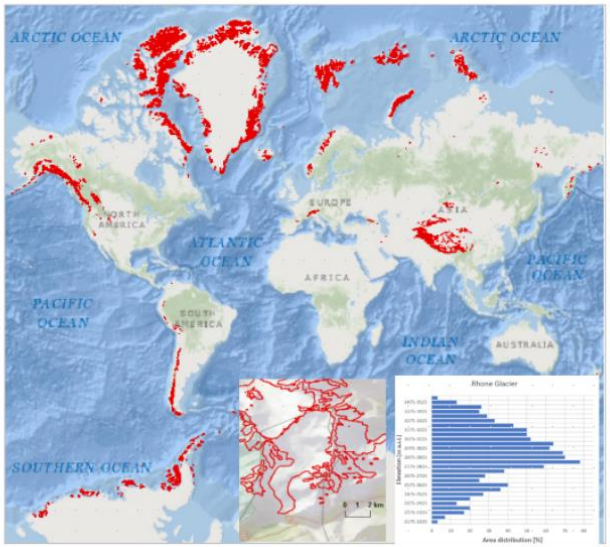
Science Lead: Uni Leeds
Andrew Shepherd

Service Manager: UCL
Lin Gilbert

C3S Glaciers

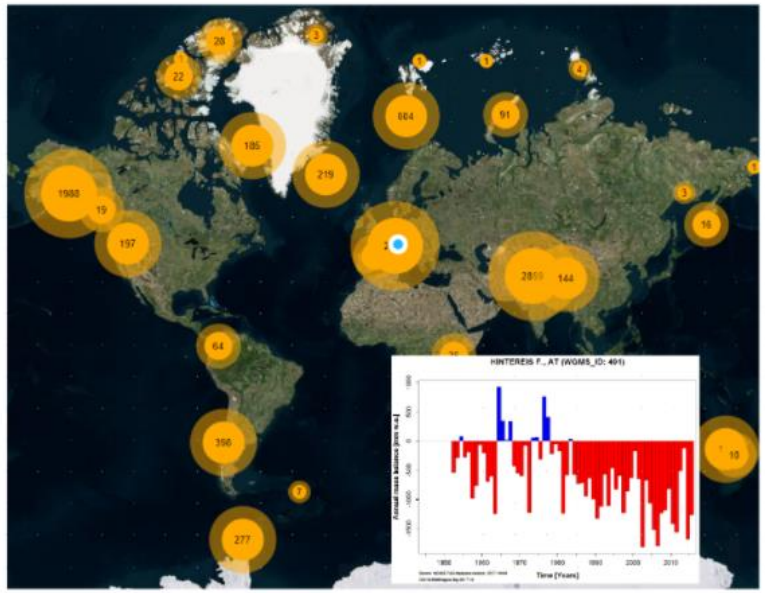
Glacier Area CDR/ICDR - globally complete glacier outlines, > 30 years monitoring
Elevation Change CDR /ICDR – CDR from 1900 to present, ICDR focus on 2000-15
Mass Change CDR Annual update brokered from World Glacier Monitoring Service FoG database

Glacier Distribution

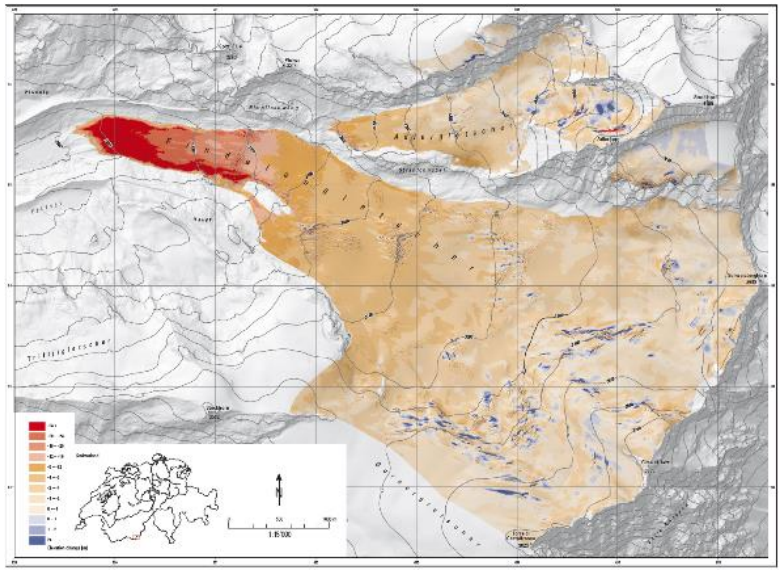


Worldwide distribution of glacier outlines associated with individual glacier parameter including hypsometry. The inset figures show a close up of the outlines of the Rhone glacier in Switzerland and the corresponding hypsometry.

Glacier Elevation



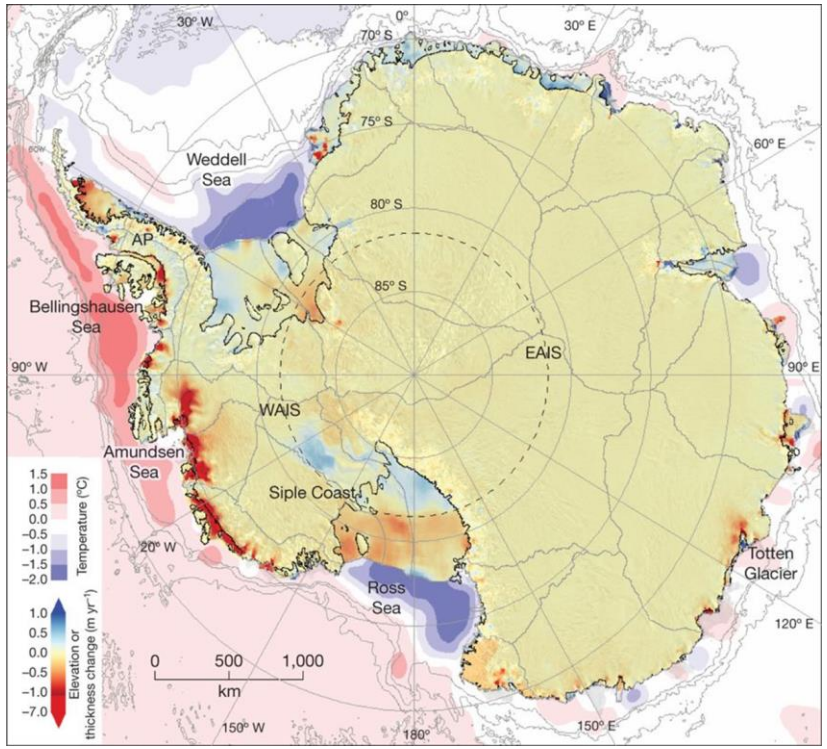
Worldwide distribution of glaciological series. The blue dot refers to the location of the Hintereis Ferner glacier in Austria. Its glaciological serie is shown in the graph.



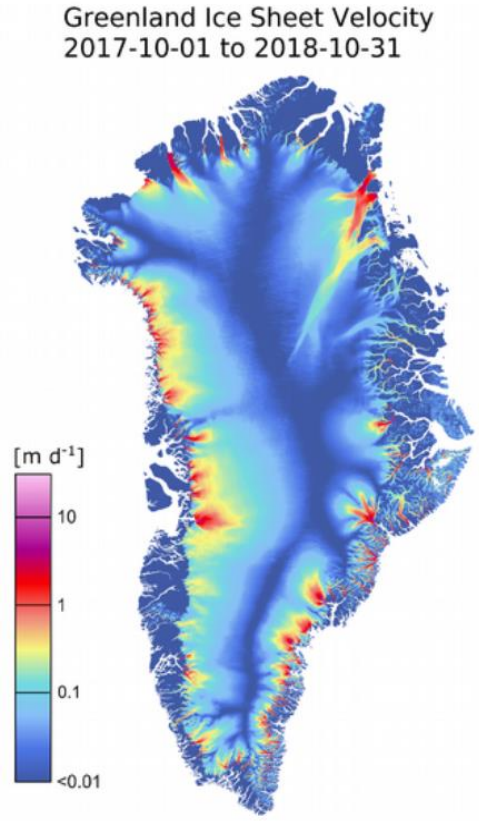
Findel Glacier, Zermatt (CH): Elevation Change 2005 to 2010: -3.2m, Joerg et al. (2012), in WGMS (2012)

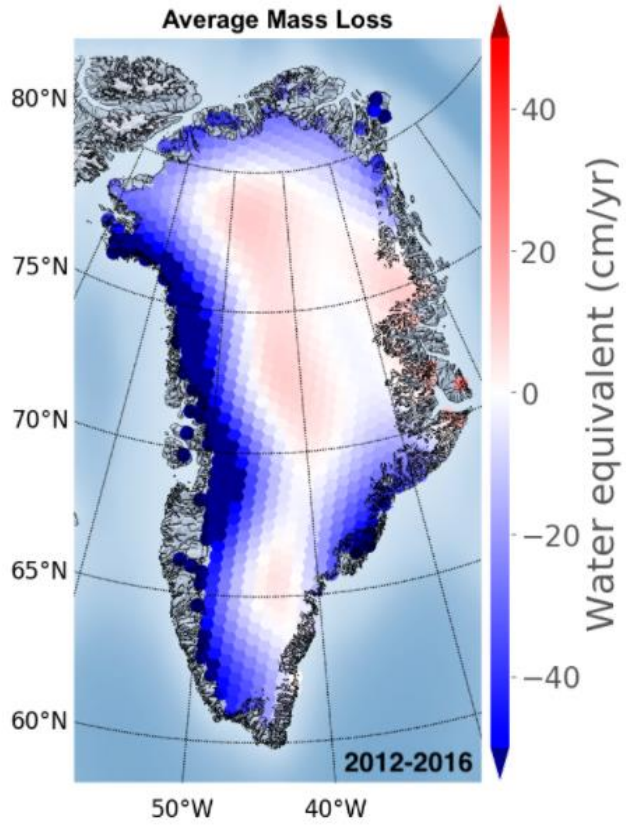
C3S Ice Sheets and Ice Shelves

Surface Elevation Change (CDR/ ICDR), Antarctic and Greenland from 1992, Monthly Updates
Ice Velocity (CDR/ ICDR), high resolution coverage, from 2014 for Greenland Ice Sheet
Gravimetric Mass Balance (CDR), Antarctic and Greenland from 2002 to 2017, Monthly basin values



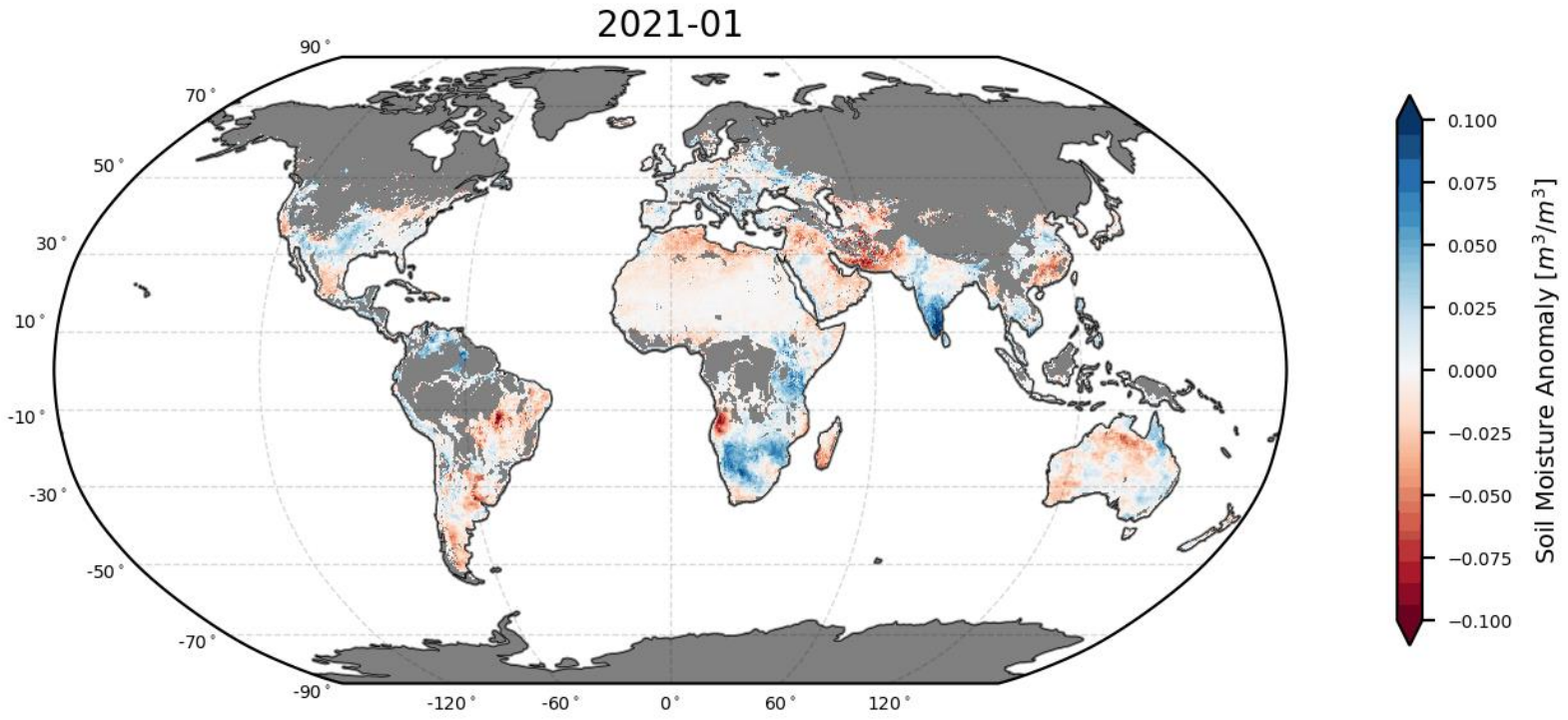
Surface Elevation Change: Shepherd et al., 2018





C3S Surface Soil Moisture

PASSIVE: Radiometer-based surface soil moisture (CDR/ ICDR)
ACTIVE: Scatterometer-based surface soil moisture (CDR/ ICDR)
COMBINED: Radiometer and Scatterometer-based product (CDR/ ICDR)



Product family	Satellite observations
Spatial coverage	Global
Temporal coverage	1978 – NRT
Spatial resolution	0.25° x 0.25°
Temporal resolution	Daily, 10-daily, monthly
Data format	Gridded
File format	netCDF
Update frequency	12 months (CDR) / 10 days (ICDR)
CDS online access	https://cds.climate.copernicus.eu/portfolio/dataset/satellite-soil-moisture
License	License-to-use-Copernicus-products

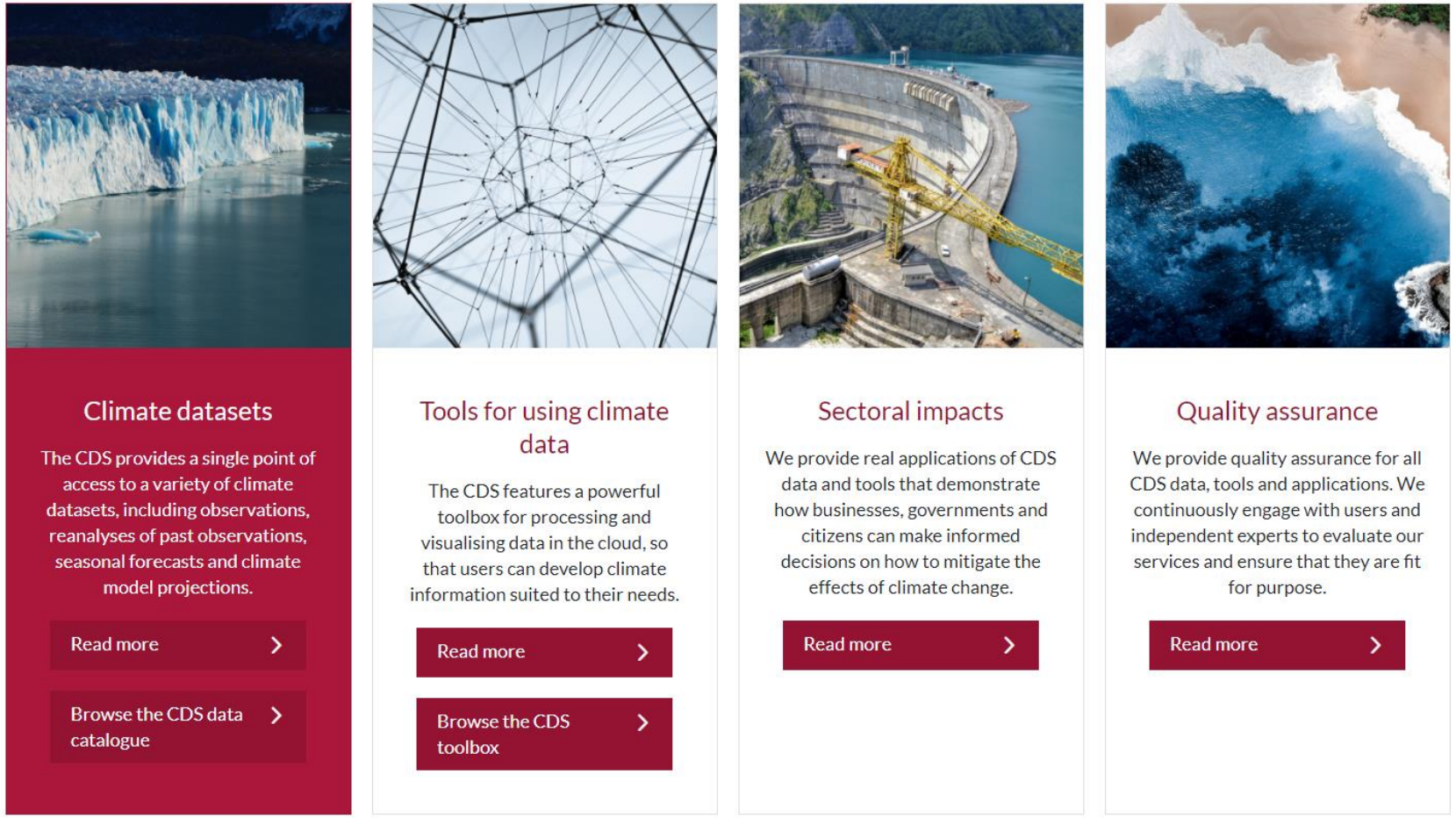
Climate service is more than just satellites

Not just making information available

- Also – quality assessment – **Quality Control**

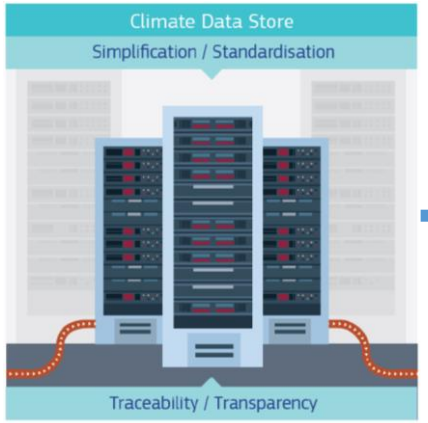
Information from the CDS is:

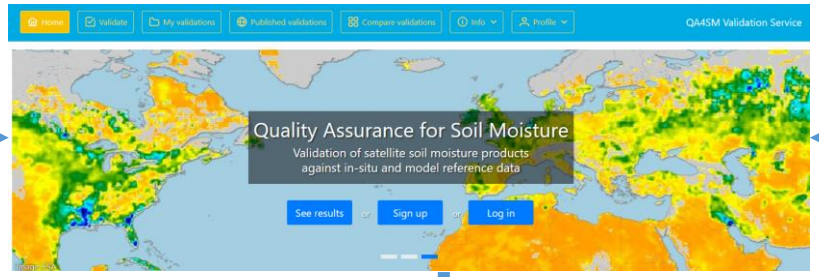
- Used as a **Monitoring tool** – Monthly Bulletins (ESoTC), **Climate Indicators**
- Used for **Seasonal predictions** – to manage climate risks



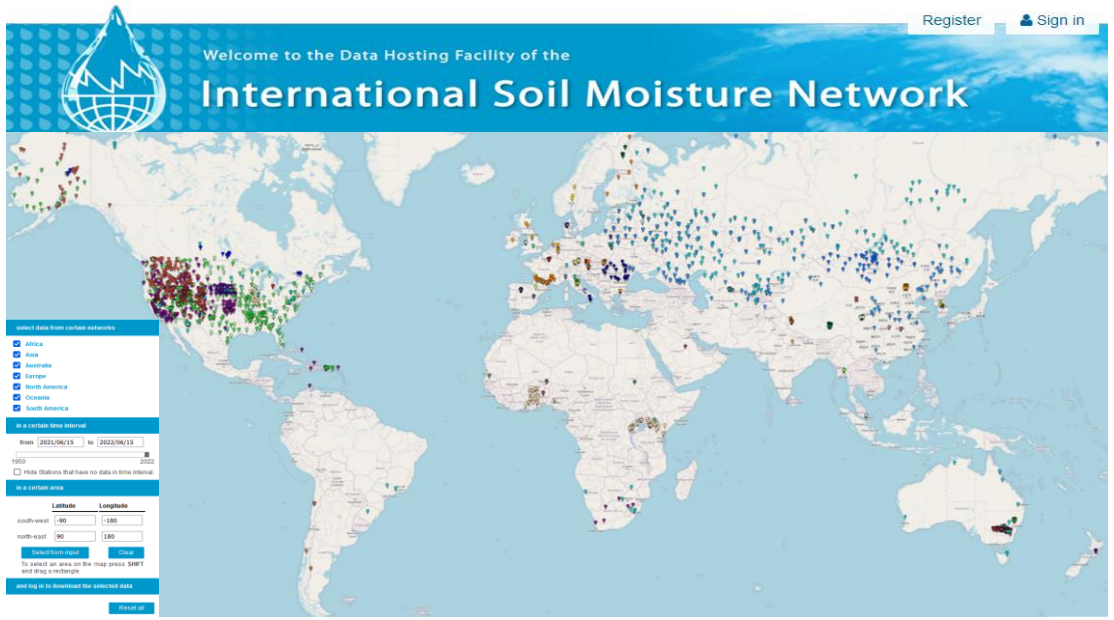
https://climate.copernicus.eu/what-we-do/

Quality assurance and assessment

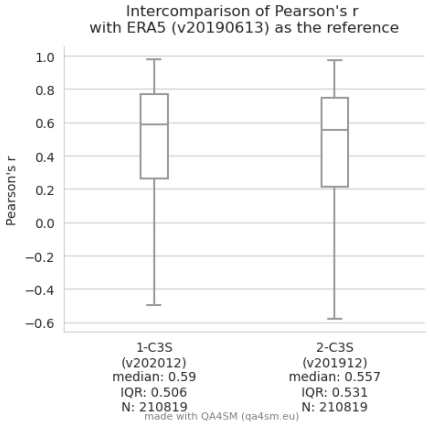


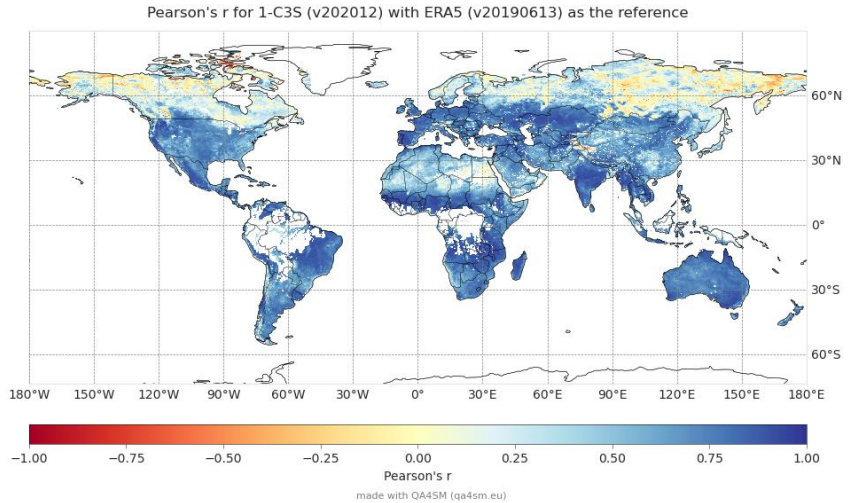


qa4sm.eu



ismn.earth

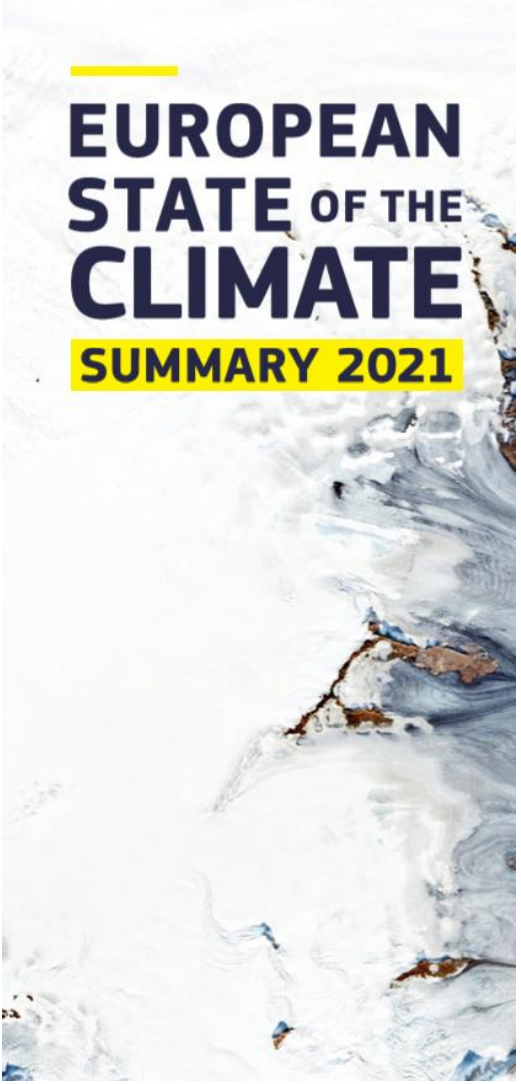


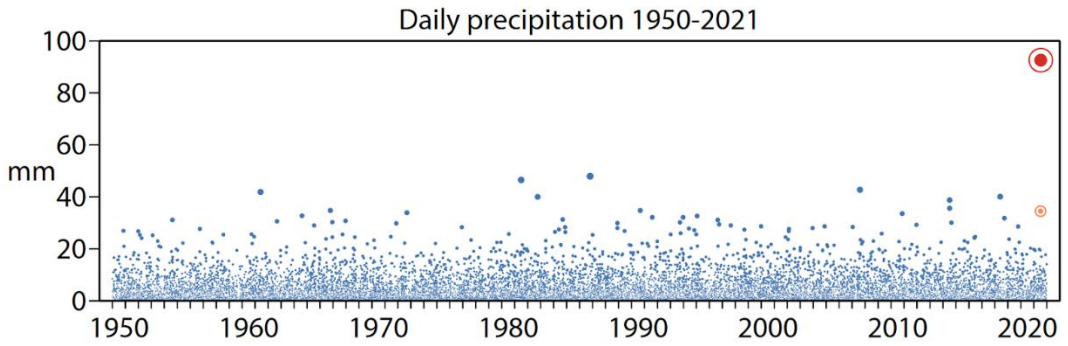


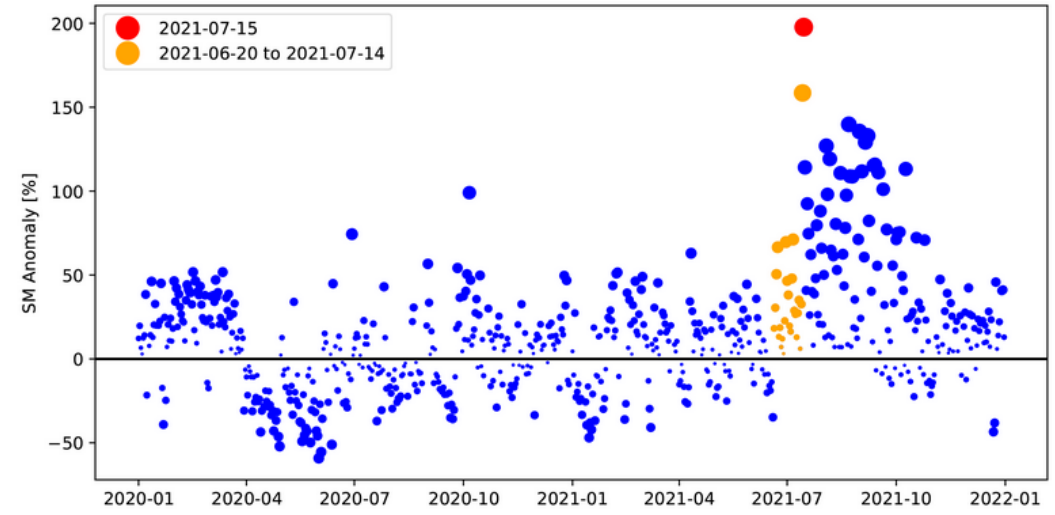
bfg Bundesanstalt für Gewässerkunde

ICWRGC International Centre for Water Resources and Global Change

Climate indicators – European floods 2021







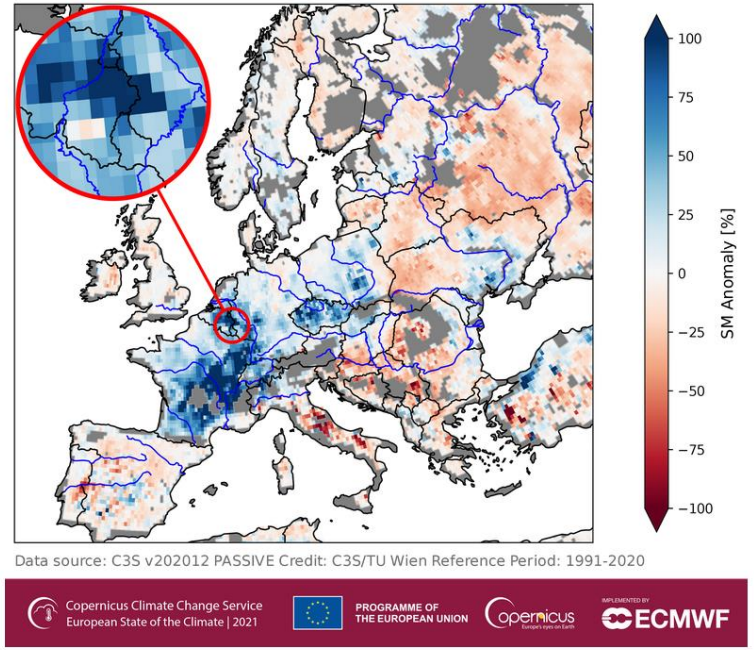
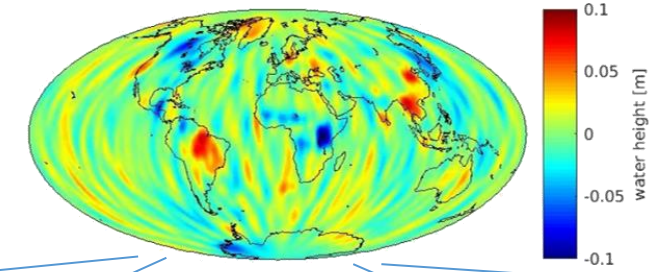


Figure S2. Soil moisture anomaly (%) for 13–16 July 2021 relative to the average for the same days in the 1991–2020 reference period. Note that areas with dense vegetation and/or high topographic complexity are masked out (in grey) as satellite soil moisture retrieval is not reliable in these regions. Data source: C3S v202012 PASSIVE. Credit: C3S/TU Wien.

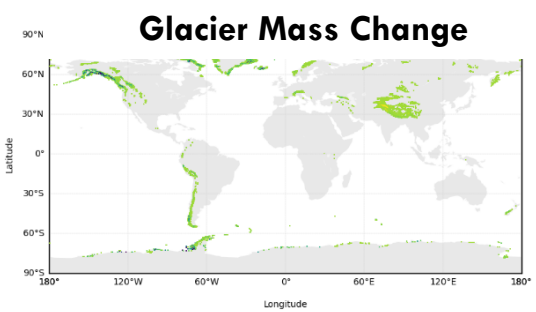
Beyond soil moisture

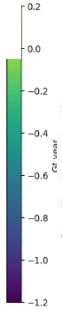
Global **G**ravity-based
Groundwater **P**roduct

Terrestrial Water Storage

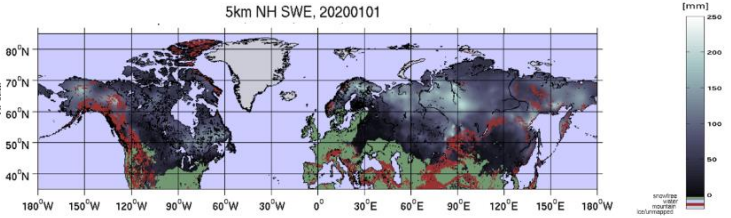


Glacier Mass Change

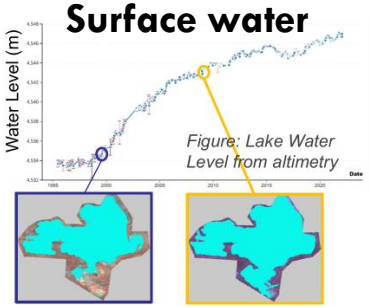




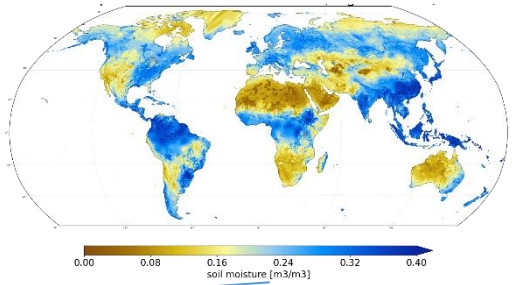
Snow variations



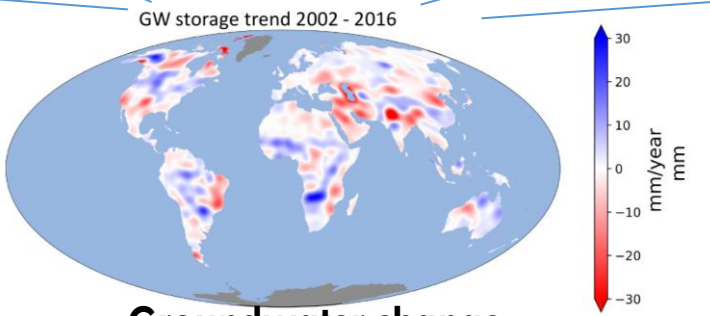
Surface water



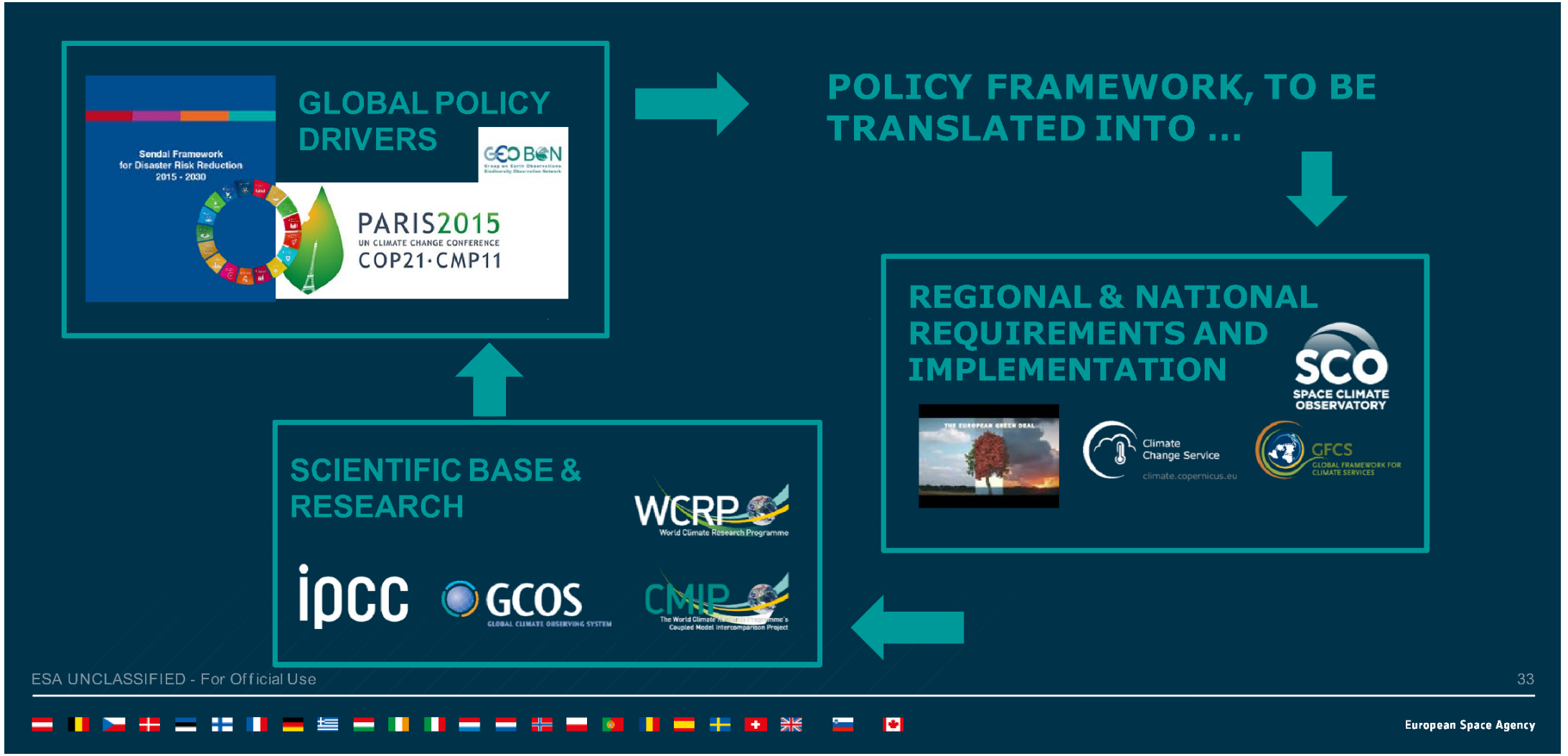
Root zone soil moisture



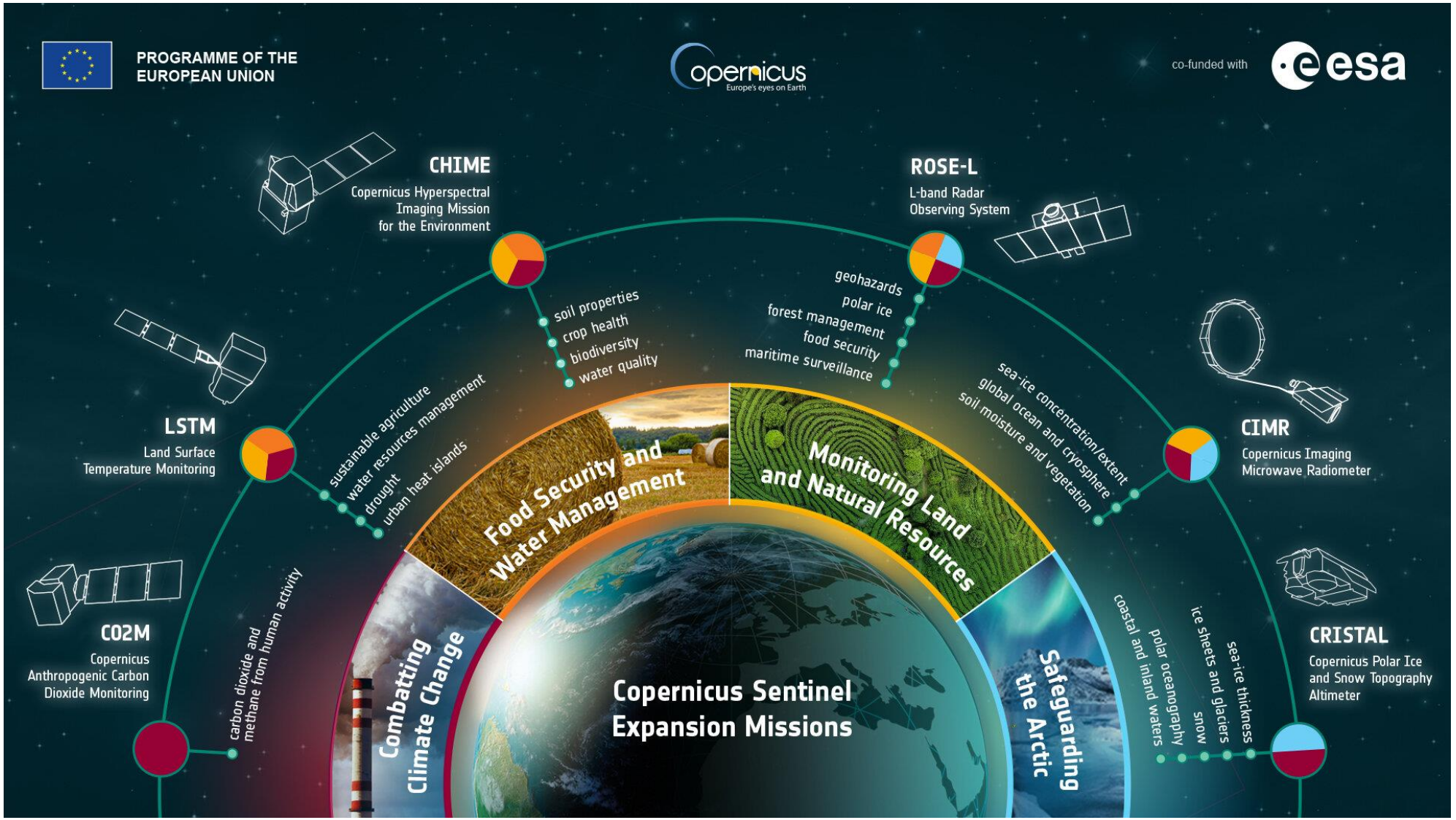
Groundwater change



What is next?


GLOBAL POLICY DRIVERS
Sendai Framework for Disaster Risk Reduction 2015 - 2030
GEO BON
PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11
POLICY FRAMEWORK, TO BE TRANSLATED INTO ...
REGIONAL & NATIONAL REQUIREMENTS AND IMPLEMENTATION
SCO
SPACE CLIMATE OBSERVATORY
THE EUROPEAN GREEN DEAL
Climate Change Service
climate.copernicus.eu
GFCS
GLOBAL FRAMEWORK FOR CLIMATE SERVICES
SCIENTIFIC BASE & RESEARCH
WCRP
World Climate Research Programme
ipcc
GCOS
GLOBAL CLIMATE OBSERVING SYSTEM
CMIP
Coupled Model Intercomparison Project
ESA UNCLASSIFIED - For Official Use
33
European Space Agency

Future missions of importance



Mass change And Geosciences International Constellation (MAGIC)

To conclude

Austria has been very successful in European satellite-based climate programs

- ESA CCI, C3S, EUMETSAT H SAF, ….
- These programs have had large impact and visibility

Large potential within Austria to participate in new Essential Climate Variables

- Groundwater
- Irrigation
- Evapotranspiration
- Vegetation Water Content

Climate services need long-term observations …

… and commitment!

climers.geo.tuwien.ac.at