

living planet symposium

BONN
23–27 May
2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



ACEO & The ESA's EO Science Strategy

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ACEO plays an important role in updating the ESA's EO Science Strategy by:

- Chairing science panels
- Reviewing panel inputs and recommendations
- Guiding and supporting update of challenges and EO science strategy

These are based on:

- The scientific feedback and comments received from the external scientific and user communities, and
- The recommendations made through the EO Science Strategy Foundation Studies

What is the ESA's EO Science Strategy?



- The ESA's EO Science Strategy is ESA's science vision, presenting cross-cutting priorities and accompanying strategies that reflect the user communities shared values and are directly responsive to both scientific and societal challenges.
- It identifies the areas of science that ESA needs to be responsive to along the value chain from innovative missions through excellent science to societal benefits.
- It involves innovation, strong partnerships with other organisations, funding agencies and national programmes.
- These priorities and strategies are intended to focus attention on those areas where ESA's EO Programmes can have the greatest impact over the next five years.

Why the ESA's EO Science Strategy is so important?



- The future ESA's science Earth Explorer missions will be selected based on this new updated science strategy.
- The proposed missions should meet the key challenges and relevant criteria outlined in the science strategy.
- The strategy is important to guide future decisions in ESA's EO Programmes.

The achievements of the previous Science Strategies

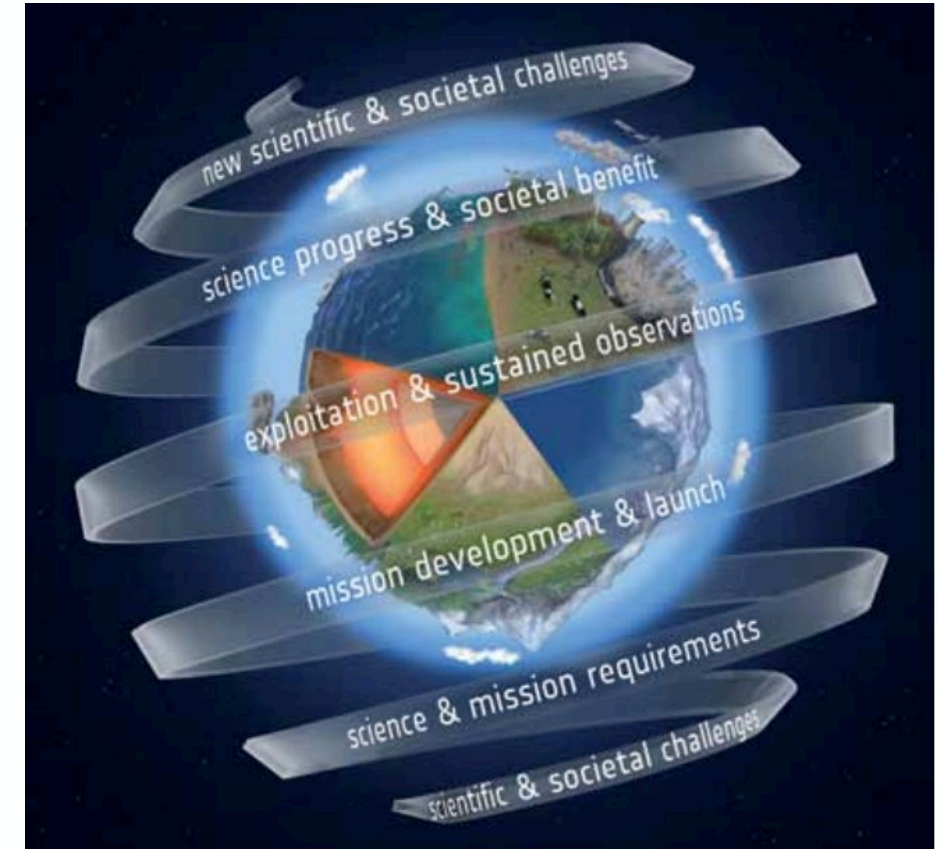
Based on the existing Science Strategies, we had a few **successful Earth Explorer** missions:

- **GOCE**: ESA's gravity mission, 2009 - 2013
- **SMOS**: ESA's water mission, 2009 - present
- **CryoSat**: ESA's ice mission, 2010 - present
- **Swarm**: ESA's magnetic field mission, 2013 – present
- **Aeolus**: ESA's wind mission, 2018 – present
- **EarthCARE**: ESA's cloud and aerosol mission, to be launched in 2023
- **Biomass**: ESA's forest mission, to be launched in 2023
- **FLEX**: ESA's photosynthesis mission, launch year TBC
- **FORUM**: ESA's planet's radiation budget mission, launch year TBC



The Previous ESA's Science Strategy 2015

- The previous ESA's Science Strategy* was developed in 2015 by ACEO (previously called Earth Science Advisory Committee (ESAC)).
- It includes contributions from a team of external scientific experts which were consulted by a wider scientific community during the preparation of the strategy, notably at ESA's Living Planet Symposium in Edinburgh, Scotland, in September 2013.
- The committee also took into account the recommendations made in the ESA Earth Observation Envelope Programme Science Review in May 2011.



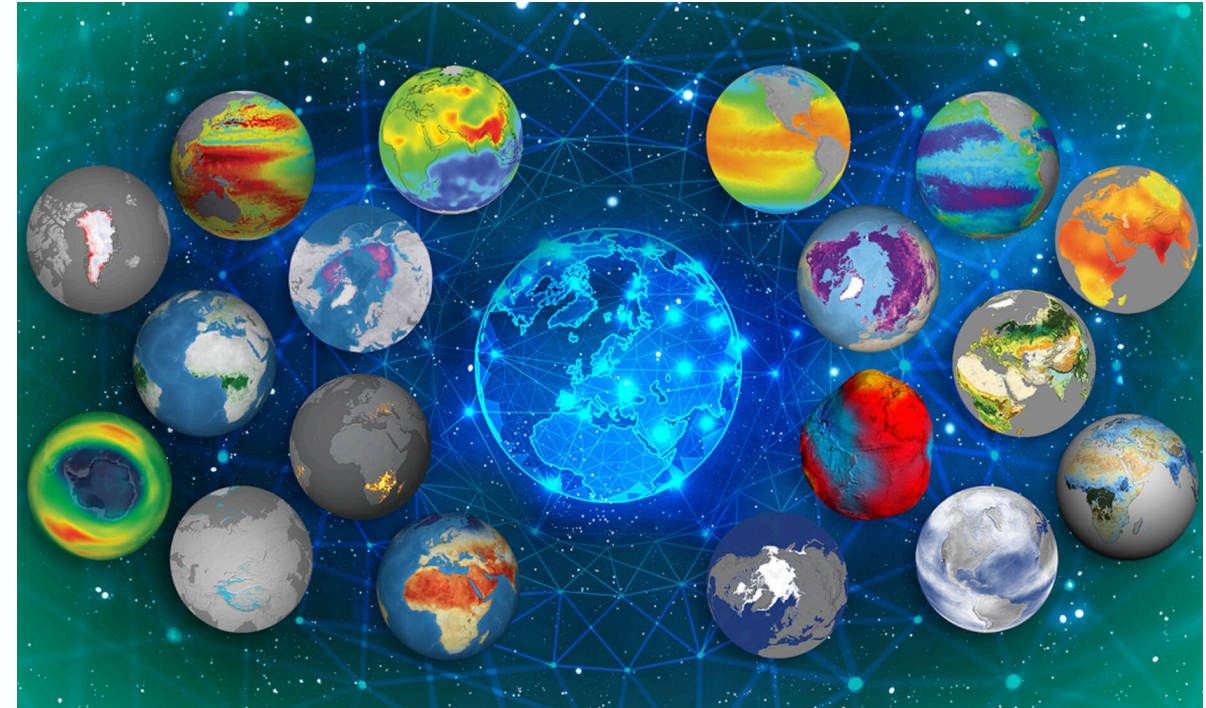
*ESA (2015) EO Science Strategy, Earth Observation Science Strategy for ESA - A New Era for Scientific Advances and Societal Benefits, ESA SP-1329 (1): [download here](#)

*ESA(2015) Scientific Readiness Levels (SRL) Handbook. Mission Science Division. EOP-SM/2776. issue 1. Revision 1. European Space Agency, Noordwijk, the Netherlands: [download here](#)

The achievements of the previous Science Strategy

These **successful Earth Explorer** missions:

- Not only have **led to the scientific excellence** that is critical to **addressing the challenges society faces** today and is expected to face in the decades to come;
- But also, they provide **sound scientific and technical heritage for developing operational missions** such as current suite of **Copernicus Sentinel** missions and the **future Copernicus Sentinel Expansion** missions.

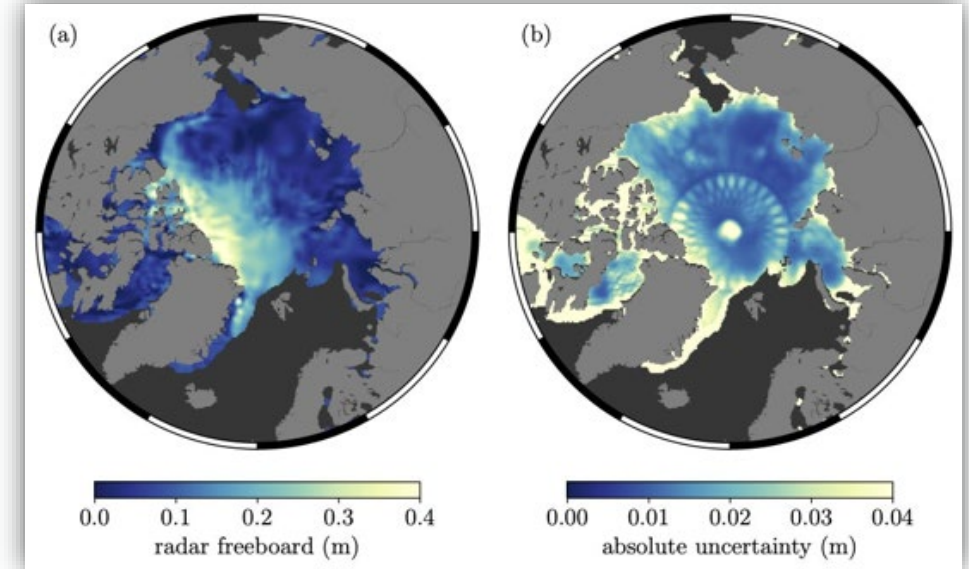


➤ CryoSat Achievements: Operational Forecasting

Advances in operational ice/ocean forecasting:

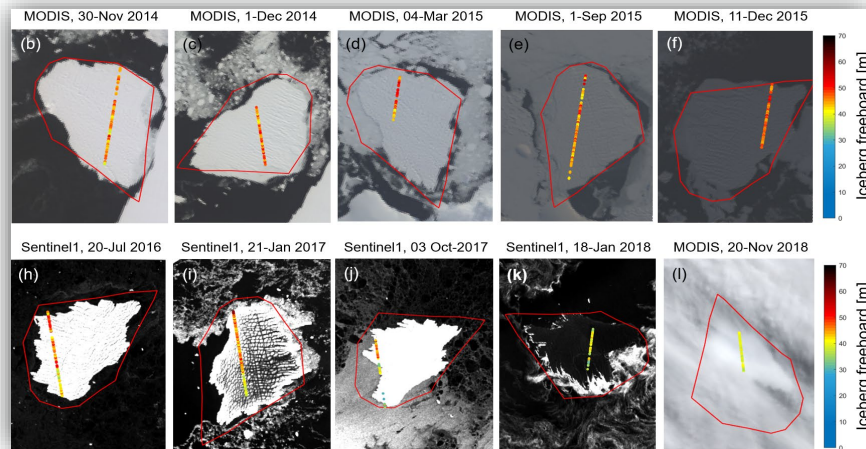
- Systematic CryoSat Near Real Time (NRT) products now used for assimilation, forecasting & operational services (e.g. NOAA/NCEP, Meteo France, ECMWF, CMEMS)
- Release of a new NRT Ocean Product (NOP) within 3 hours from sensing
- Systematic generation of 2-day, 14days, 28 day sea ice thickness maps
- CryoSat contribution to the IFREMER ALTIBERG iceberg database

Daily pan-Arctic freeboard combining CryoSat and Sentinel-3 data



(Gregory et al., 2021)

CryoSat-2 iceberg freeboard



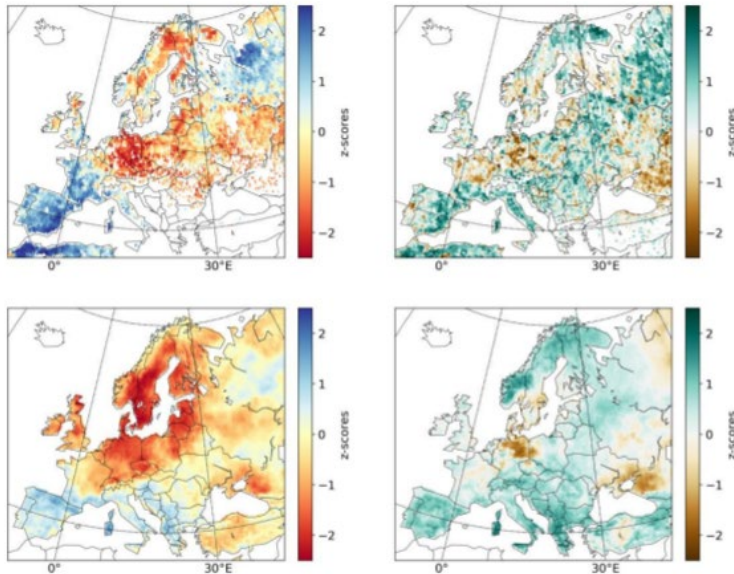
(Braakmann-Folgmann et al., 2021)

Key Achievements:

- Developing daily pan-Arctic sea ice freeboard and uncertainties maps by combining CryoSat and Sentinel 3 data
- Tracking changes in the freeboard, thickness, and volume of icebergs
- Progressive development of operational forecasting-based services

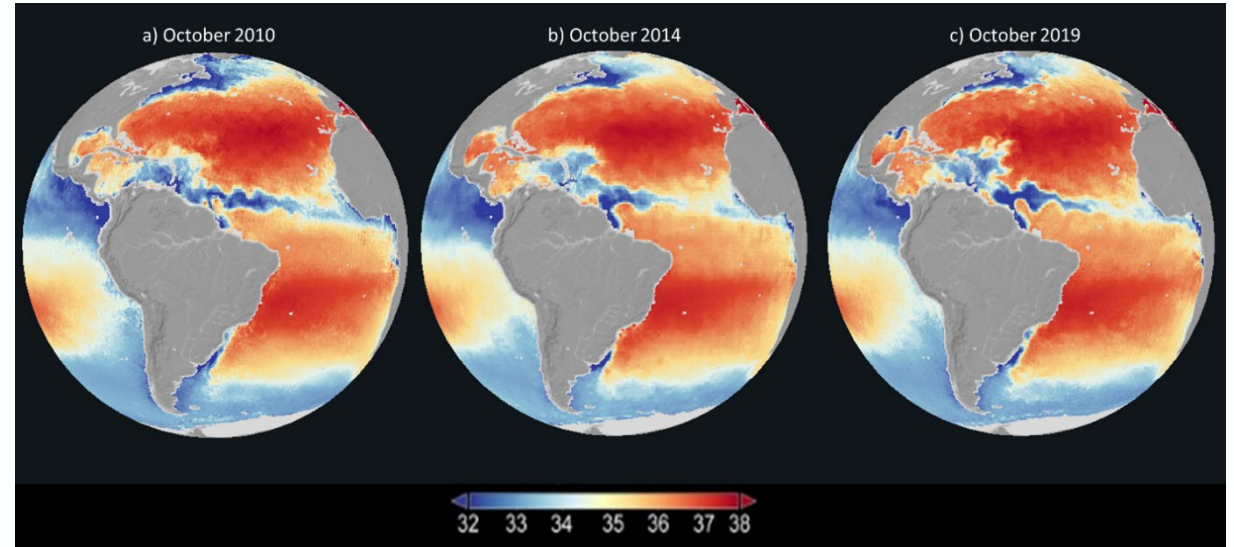
➤ Some SMOS Achievements

Spring and summer soil moisture (left) and above ground biomass (right) anomalies from SMOS observation (above) and modelled (bottom)



Bastos et al., 2020

Satellite-based sea surface salinity Essential Climate Variable (ECV)



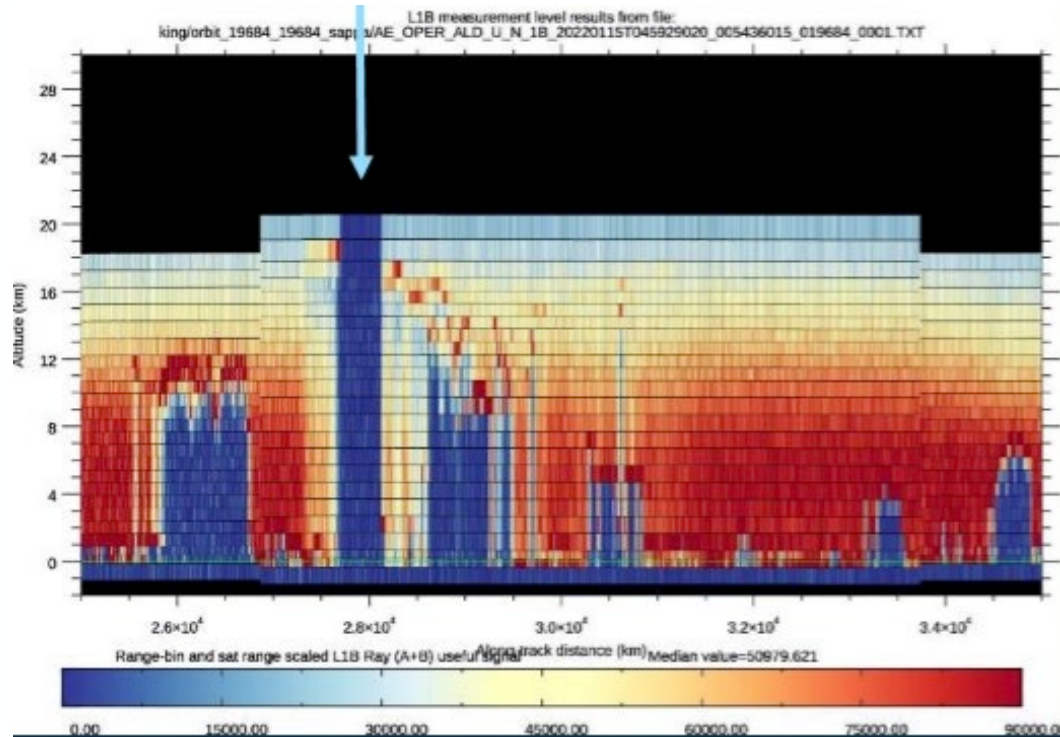
Boutin et al., 2021

- SMOS soil moisture data used to understand impact of droughts on ecosystems productivity
- Longevity in SMOS, Aquarius and SMAP missions has enabled > 10-year long Climate Data Record (CDR) of high quality Sea Surface Salinity (SSS) and associated uncertainties

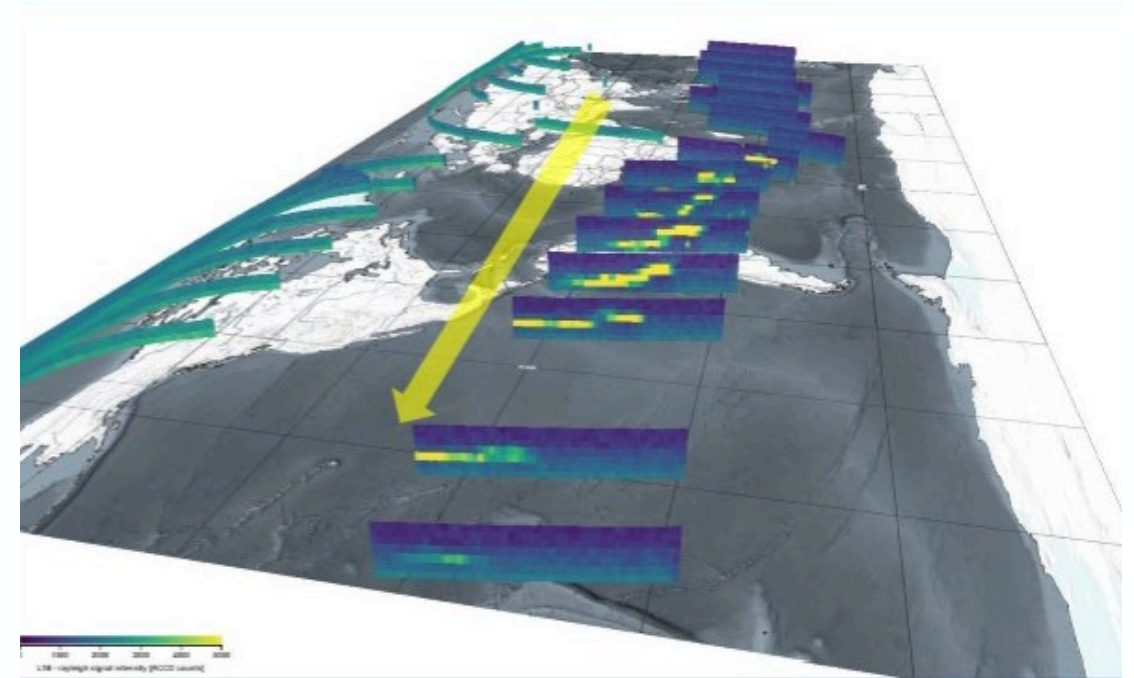
➤ Some Aeolus Achievements

Tonga volcano eruption (main explosion on 15 January 2022 at 4:45 UTC)

Aeolus shows the Tonga eruption to rise above 20.5 km, since the lidar signal is totally attenuated (dark blue) below the top range-bin



Aeolus data from 27 Jan. (18 UTC) to 28 Jan. (06 UTC) with the eruption plume having circumnavigated the globe (shown by the L2B Mie winds and L1B signal strength)



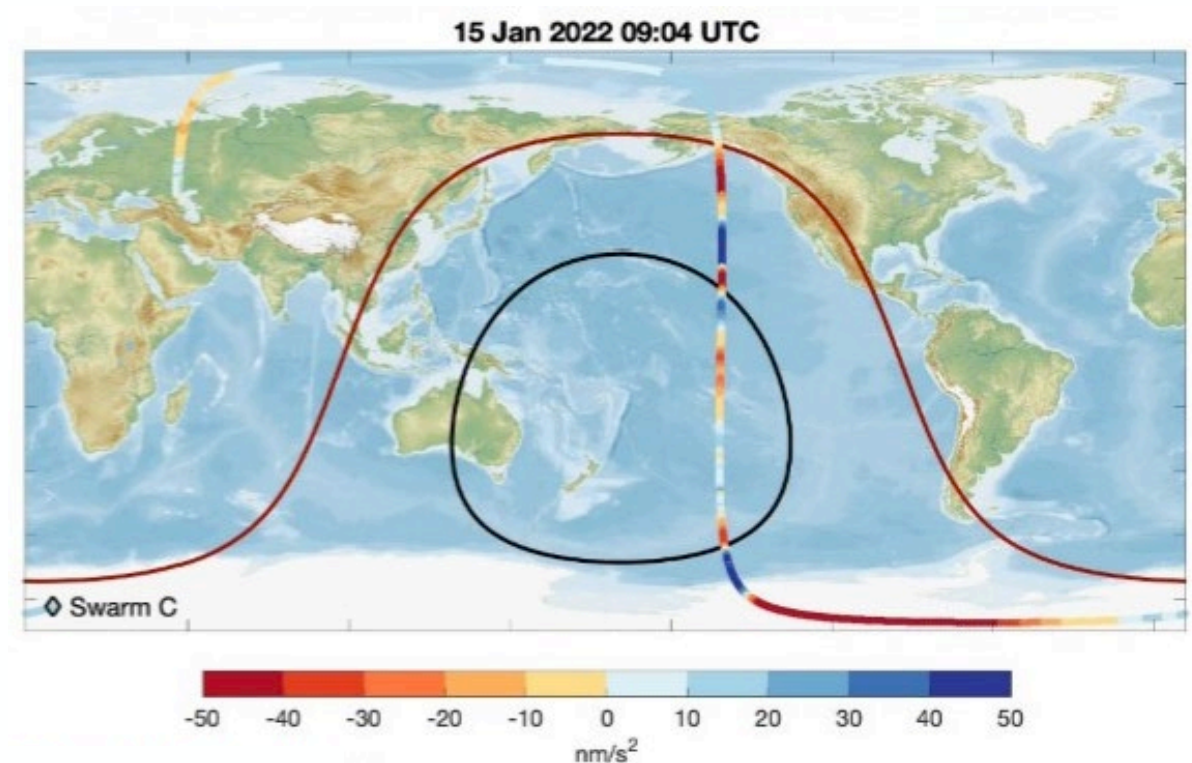
Courtesy Michael Rennie (ECMWF)

➤ Some SWARM Achievements

Swarm-Charlie Accelerometer (ACC) shows indications of perturbations from the Tonga volcano eruption

The image shows:

- **Black line** = eruption shockwave travelling at ground (330 m/s)
- **Red line** = shockwave travelling at Swarm-C altitude (time from ground to Swarm-C altitude: 18 min, then travel speed of 630 m/s)
- **Colours** = variations in the along-track acceleration of Swarm-C (i.e. high-pass filtered)



[Courtesy of TU-Delft as member of Swarm DISC consortium]

The next steps

ACEO need to receive **feedback and recommendations** through

- The EO Science Strategy Foundation Studies;
- The wider scientific and user communities; and
- LPS consultation.

Your views and feedback on scientific challenges, thematic priorities and cornerstones, will be a source of ideas for ACEO to fuel an innovative EO Science Strategy in support of ESA's future EO Programmes.

Thanks for your attention!

Any questions?