

# New developments from atmospheric observations panel for climate

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# AOPC relevant priorities from recent IP

- **Prior talk by Han Dolman has given high level outline of the IP**
- **In this talk aim to give a flavour of those actions in which AOPC is involved of relevance to satellite community that have highest priority**
- **Deliberately selective**
- **Before that ...**

# Open call for new panel members

- <https://gcos.wmo.int/en/news/open-call-experts-aopc-and-oopc-panel>
- Closes 15<sup>th</sup> November
- Particularly looking for experts in:
  - Reanalyses
  - Atmospheric composition
- Geographical and gender balance of panel

# Upcoming critical gap - stratospheric water vapour (A2)

- Limb sounding missions at risk
- Small changes in WV abundance in the UTLs produce large, direct changes in outgoing longwave radiation, strongly influencing climate (e.g. Solomon et al., 2010)
- Chemical impacts on SO<sub>2</sub>, aerosols, ozone and other stratospheric constituents
  - Indirect, potentially competing effects of increased UTS WV on Earth's radiation budget may have a significant impact on global surface temperatures

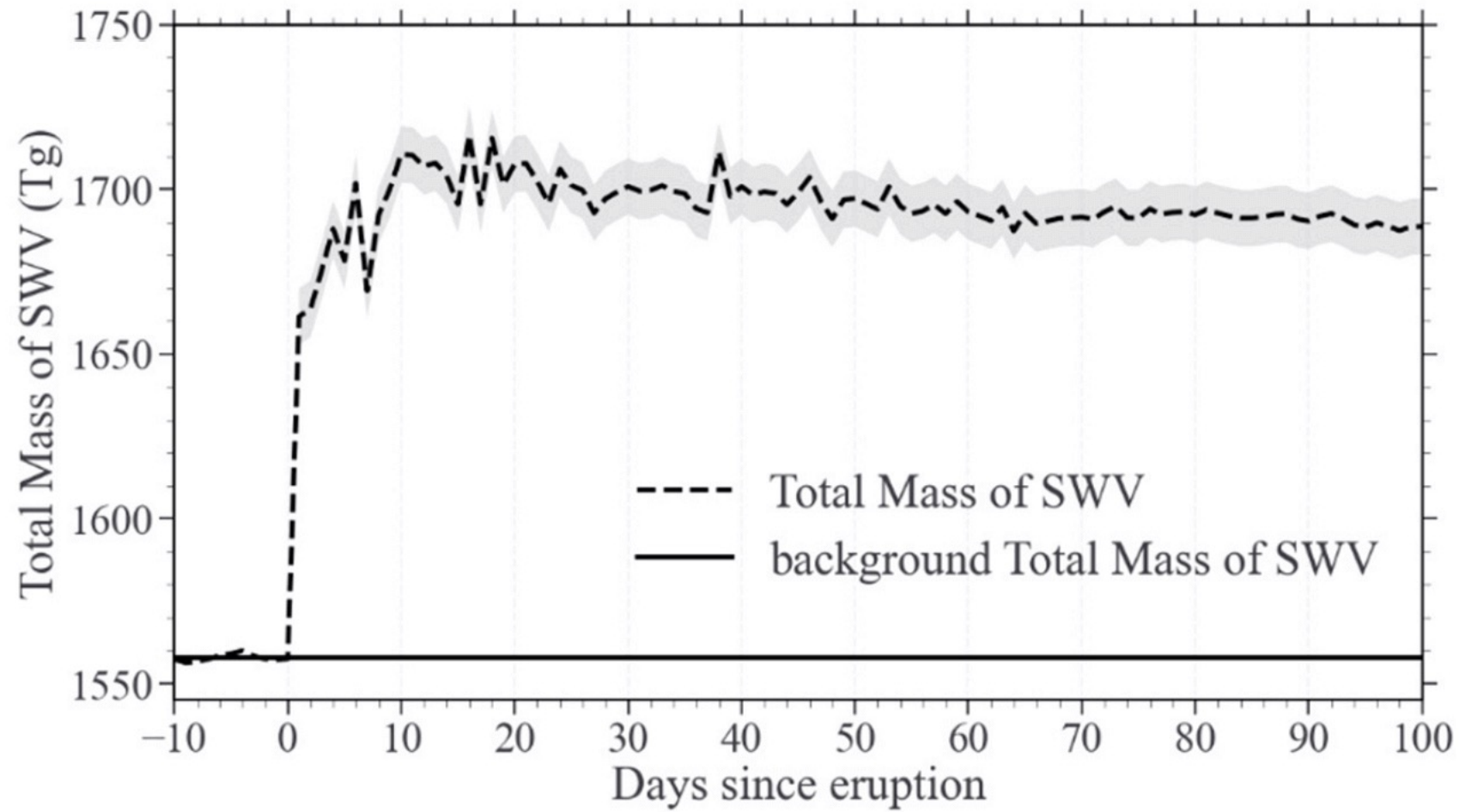
- Aura Microwave Limb Sounder (MLS) currently provides >95% of UTS water vapor measurements around the world
  - ~3500 MLS profiles day<sup>-1</sup> from 82°N to 82°S compared to ~30 profiles day<sup>-1</sup> from each of the three other satellite-based UTS WV instruments that currently exist
  - The multi-year measurement “gap” created by ceasing MLS measurements before the next limb sounder for UTS water vapor measurements (Altius) is deployed (anticipated in 2025) will be detrimental to upper atmospheric science
  - The ability to perform essential “bias adjustments” between UTS WV measurements by MLS and its successor is lost if there is no temporal overlap

# Simultaneous challenges with in-situ

- Frostpoint hygrometers are the only in-situ balloon borne instrumentation
- Use R23 – a powerful very long-lived GHG banned under Kigali amendment
- Efforts are underway to resolve but several sites are now needing to discontinue operation.

# But scientific imperative!

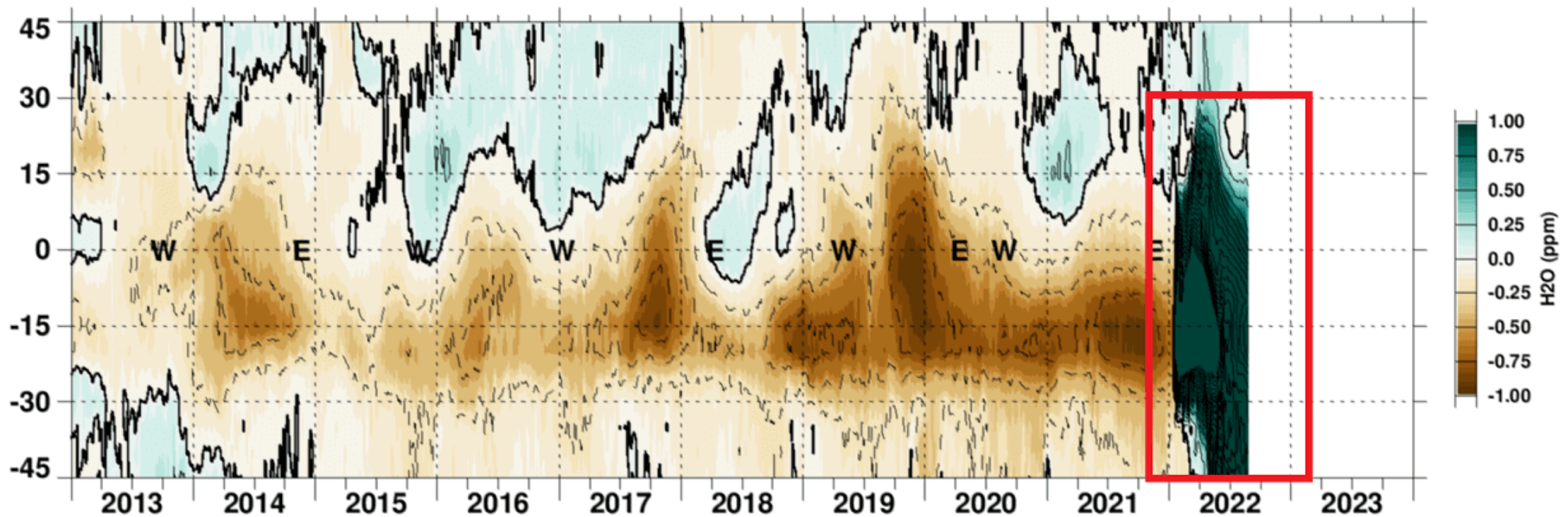
- The Hunga-Tonga volcanic eruption in early 2022 added 50-100 Tg of WV to the stratosphere, and stratospheric WV is currently more abundant than ever before
  - This presents a unique opportunity to study the impacts of a very wet stratosphere on ozone, aerosols and other radiatively and chemically active constituents of the stratosphere
  - The gradual drying of the stratosphere through photolytic loss and recirculation of water vapor will provide a natural testbed for quantifying how substantial changes in UTLS water vapor abundance affect outgoing longwave radiation





# H<sub>2</sub>O

# 26.1hPa



Paul A. Newman, Natalya Kramarova (NASA/GSFC) Thu Aug 25 09:58:03 2022 GMT

## Aura MLS

# Coordinated work on sub-orbital reference measurements (B1)

- Numerous players in sub-orbital reference measurements
- Sometimes includes measures that are high-quality but not strictly metrologically traceable
- Programs do not talk to each other -> lack of synergies
- Need for coordination between funders and sustained networks globally coordinated including GSRN and GRUAN.
- Fund and support long-term FRMs from these sustained networks to realise synergistic benefits of looking at multiple ECVs together

In other words lets try to make order out of chaos



# Space-based reference measurements (B1)

- To ensure calibration and comparability of the range of EO techniques need to build and sustain program of metrologically traceable space-based measurements
- Act in concert with sub-orbital reference capabilities
- Several pathfinder style missions but lacks long-term sustained support as yet

# Continuous reprocessing (C2)

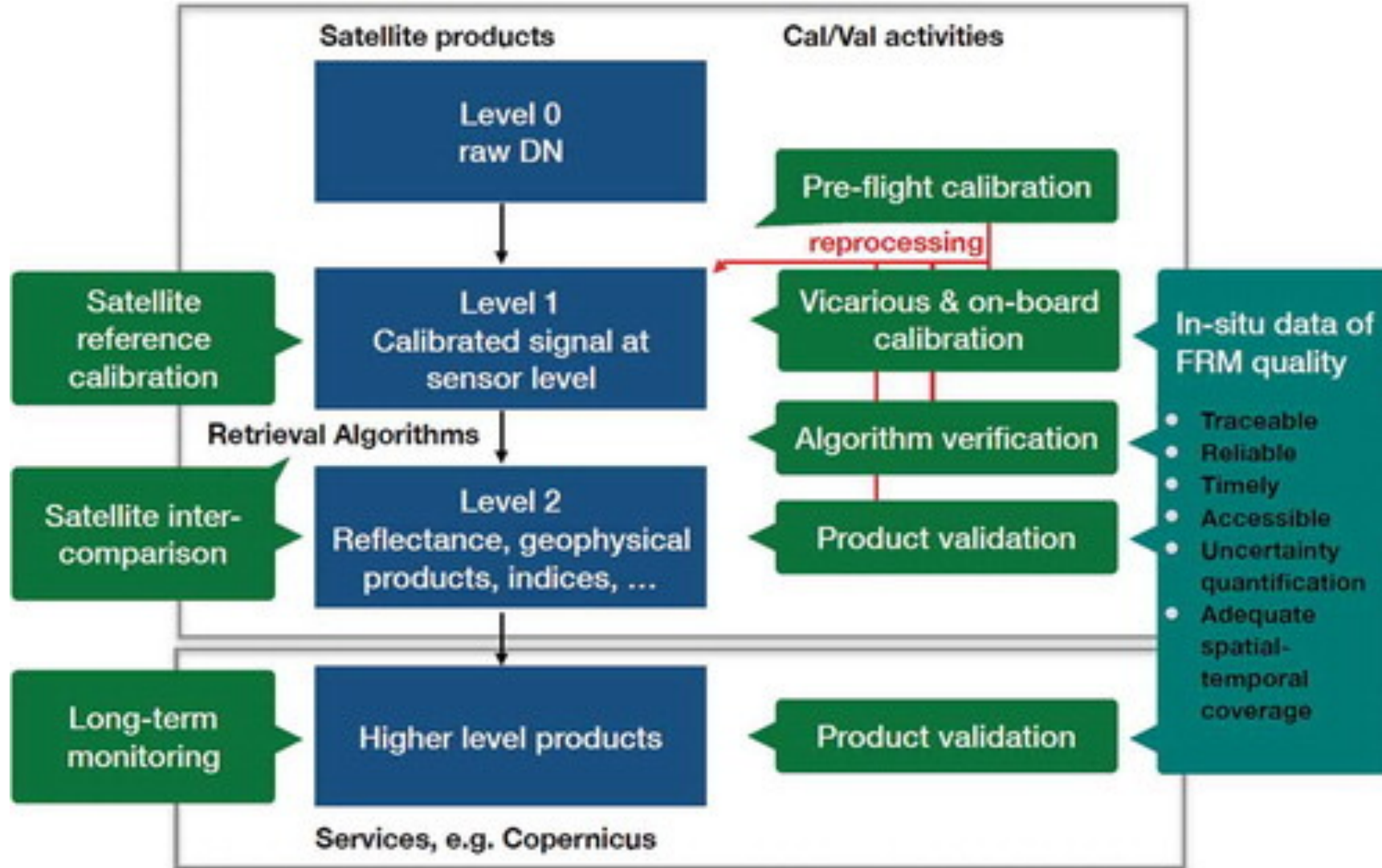
- This is ESA CCI's bread and butter but worth repeating here
- It is critical that we have sustained programs that process and reprocess CDRs of ECVs and ECV products
- Knowledge is not some static thing – as we learn more we need to reprocess and improve our products. Also need to maintain necessary metadata so that knowledge of past missions not lost.
- Sustained and continuous investment in capabilities (personnel and hardware) necessary to maximise exploitation of observations that have cost us billions of euros to make.



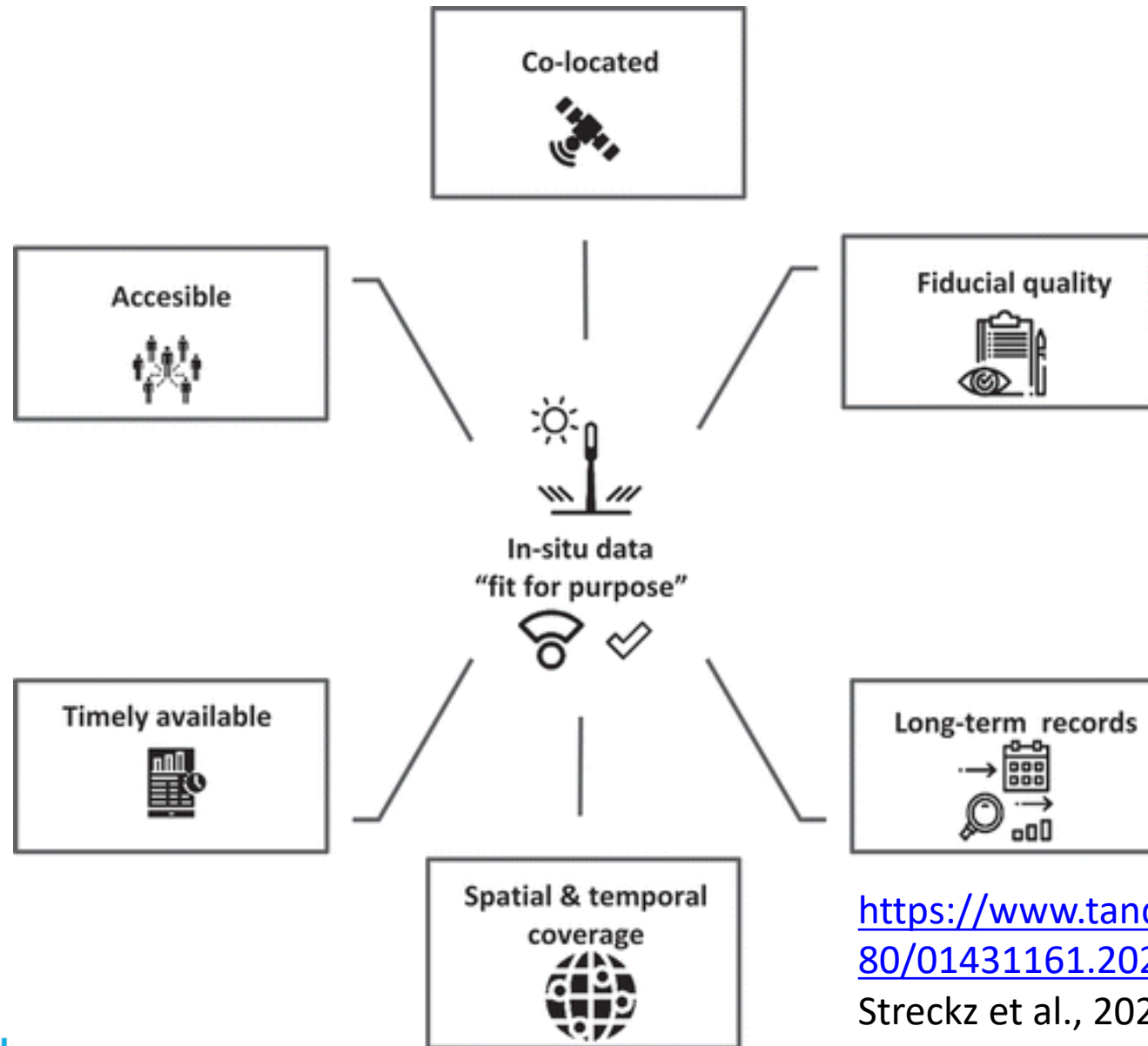
# Facility to access in-situ satellite co-locations (D4)

- Currently there is no single access point to be able to compare satellite to in-situ data
- Multiple mission-specific efforts
  - Redundancy in development of tools
  - Insufficiency of resourcing
  - Heterogeneity of approaches
  - Very hard to find and access relevant data
- A single unified facility could enable a step-change in exploitation of in-situ satellite data co-locations leading to improved science outcomes

# Potential applications







<https://www.tandfonline.com/doi/full/10.1080/01431161.2020.1718240>

Streckz et al., 2020 – call for a European entity to undertake this work

# Diurnal sampling (B3) and polar sampling (F2)

- Actions around diurnal and polar sampling call to consider orbital configurations e.g. role of
  - True pole-2-pole orbits deliberately precessing
  - Increased use of low-latitude orbits
- Such orbits supplementing current GEO and SSO capabilities would:
  - Enable SNO type observations at multiple times and latitudes enabling more robust assessments of comparability and instrument quality both in NRT and delayed mode
  - Better sample the highest and lowest latitudes including the polar holes
  - Better sample the diurnal cycle potentially yielding improved opportunities to reprocess historical data afflicted by poor station keeping
- Need to also grapple with how to use cubesats / nanosats and commercial providers

# Thank you



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OBSERVING SYSTEM**

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