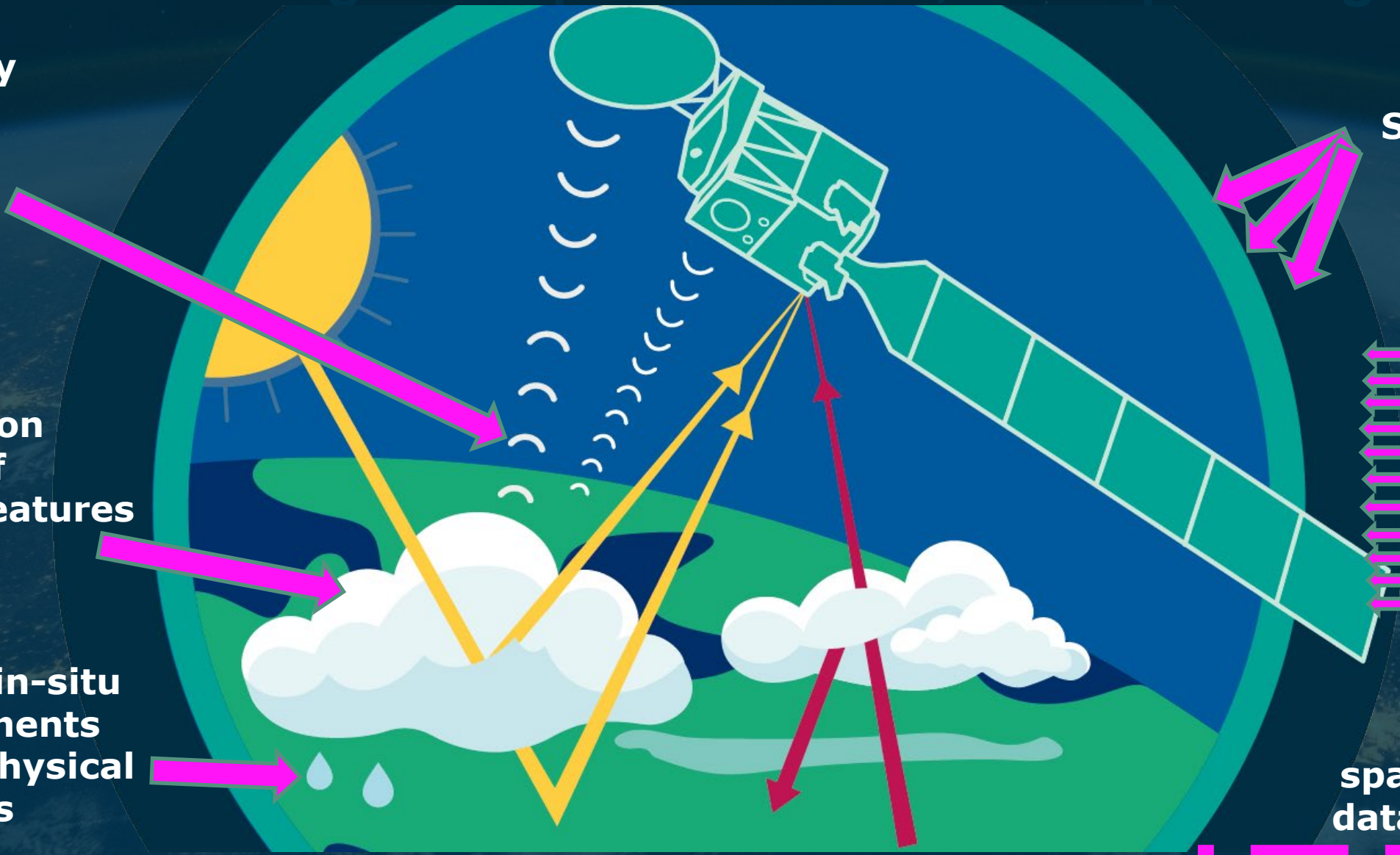
Best practice protocol for validation of aerosol, cloud, and precipitation profiles

CEOS WGCV Action CV-22-01

Status update for WGCV#52

Rob Koopman, Stephanie Rusli, Jonas von Bismarck, Eleni Marinou, Holger Baars, Philippe Goryl

Validation challenges unique to aerosol, cloud profiling



Extremely narrow sampling volume

Small correlation length of Target features

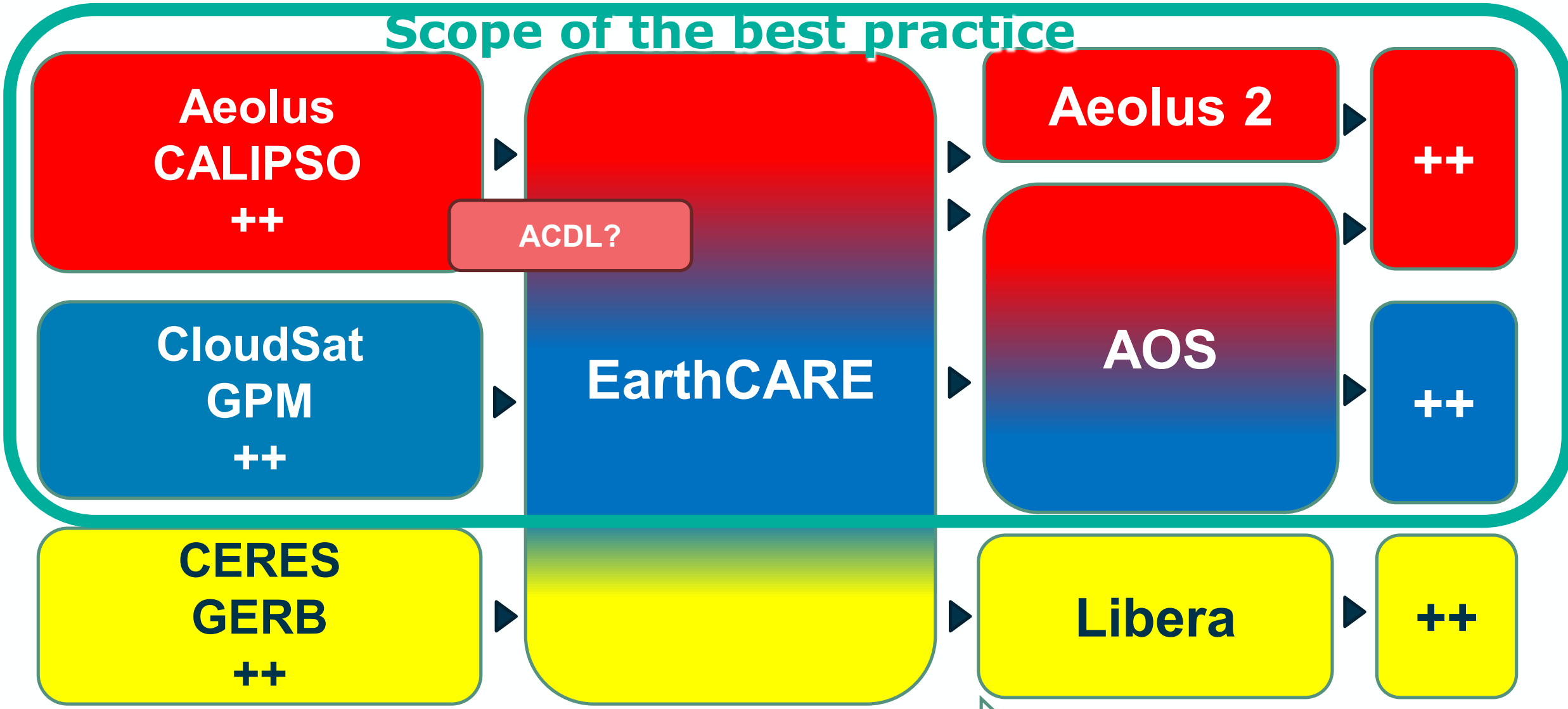
Need for in-situ Measurements of microphysical properties

Synergistic validation

Product Diversity

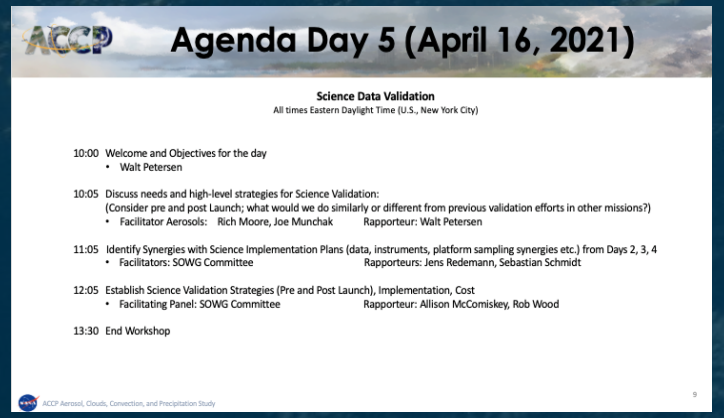
Gaps in spaceborne data records

Common challenges (aerosol, cloud/precip radiation)



AOS and EarthCARE scientists highlighted validation synergies:

ACCP (now **AOS**) 2nd Sub-orbital Workshop, April 2021



2nd ESA EarthCARE Cal/Val Workshop Report
EC-RP-ESA-SYS-1229

Online Event
24-28 May 2021

esa

- Lessons Learned
- Methods and Approaches
- In-orbit validation ⇔ pre-launch validation/verification
- Airborne campaigns & Networks

Many of 2nd ESA **workshop recommendations** involved

COMMON PRACTICE CONVERGENCE

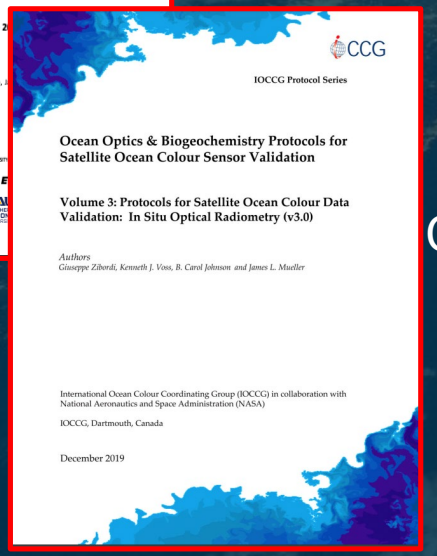
Best practice protocols for validation of...

Soil Moisture

Albedo

Biomass

LAI



Oceanographi

LST

?

Aerosol, Cloud, and Precipitation Profiles

Objectives

Capture
Lessons Learned

Community
Converge on Approaches
-
Study open issues
-
Deliverable 1:Document
Deliverable 2: Tools

Evolution:
Update
Process

Descriptive, not directive

- Several methods can co-exist, distinctions should be unambigous
- ‘Baseline’ methods serve as reference for alternative approaches

Publicly available - Open Source

- Sub-orbital to orbital signal conversion

CEOS WGCV

- no dedicated subgroup today
- endorses initiative
- monitors its progress under action item CV-22-01

Improved data quality from upcoming EO missions

- Knowledge transfer and exchange:
  - Between successive missions ("*pensioner to postdoc*")
  - Between correlative instrument providers and validation teams
  - Between algorithm developers and validation teams
- Optimised/harmonised (super)site equipment (serving multiple missions)
- Global network of networks, in terms of correlative data QA/QC
- Disambiguation of validation results/interpretation from different teams
- Improving data record continuity (e.g. handling of wavelength differences)
- Python code for broader community, easily adaptable to multiple missions, under permissive open source licence (compliant with NASA-ESA Multi-Mission Algorithm and Analysis Platform)

Organisation

- Broad community-led effort: participation of scientists from AOS Sub-Orbital Working Group and past and present missions, Aeolus and EarthCARE Validation Teams, and further scientists through JAXA and EUMETSAT
- Involvement of space agencies: ESA, NASA, JAXA, EUMETSAT

- 83+ contributors at present

- Each chapter is co-lead by at least one scientist from NASA missions and one from ESA missions
- Monthly video conferences of co-leads and agencies

- ESA supports some key scientists from EarthCARE and Aeolus through
    - Scientists involved in coordination and convergence process (lead: Vassilis Amiridis, NOA)
    - Developers of open-source tools for sub-orbital to orbital transformation (Lidar, Radar, Imager)
    - Studies on open issues
    - Experts from related contracts (algorithm development, assimilation)

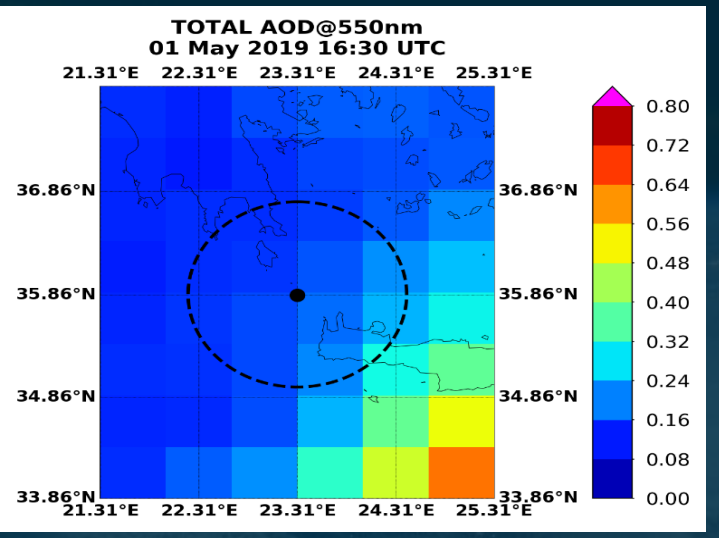
Top-level topics

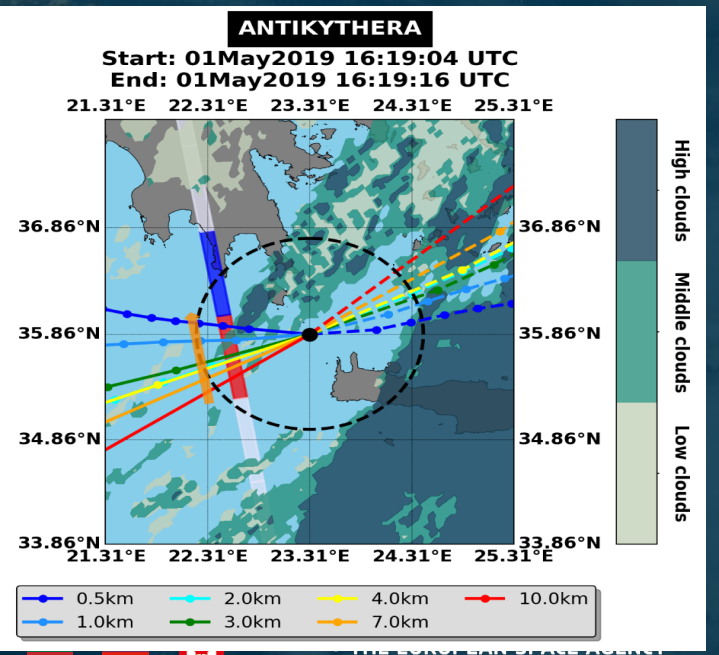
Table of Content:

1. Introduction
2. Validation needs for space profilers
3. Survey of validation measurements
4. Correlative metadata and data format
5. Guidance for validation analysis
6. Near-real time validation through data assimilation
7. Knowledge and data gaps

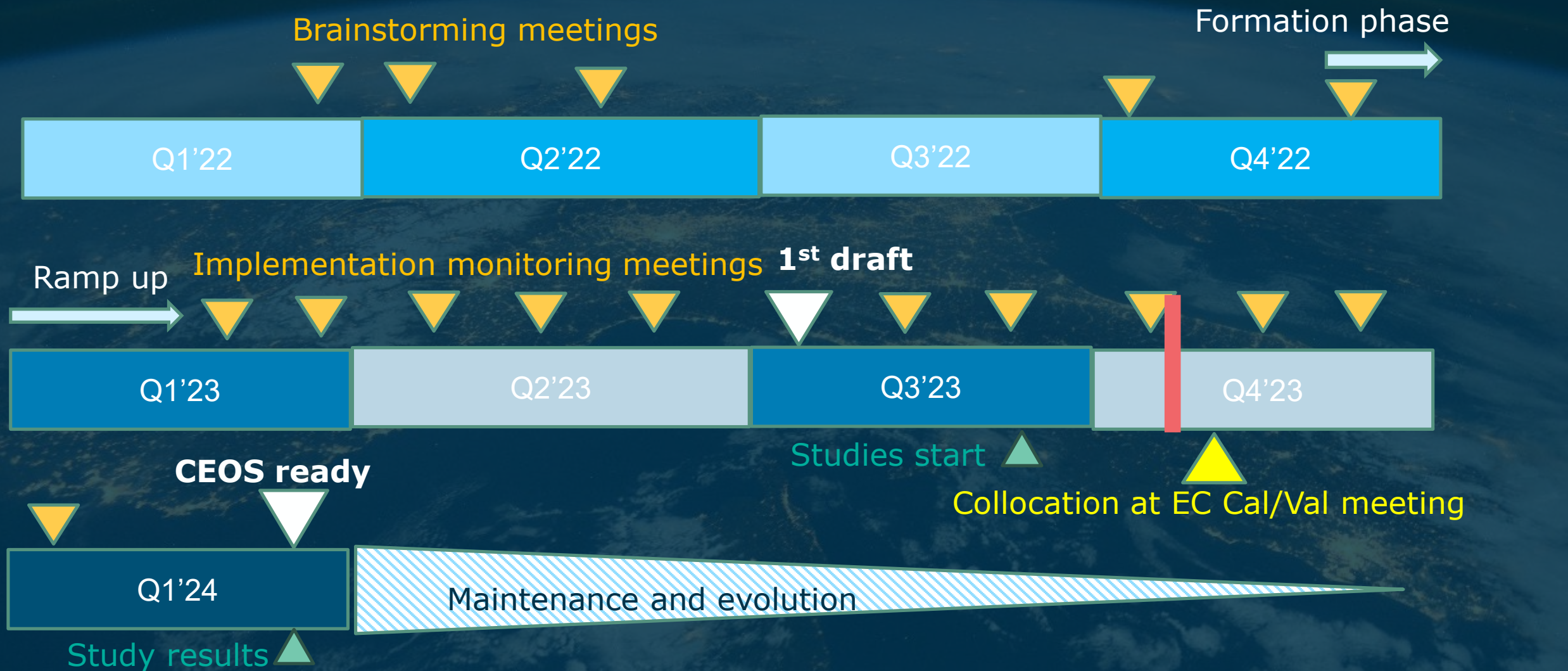
Status

- 7 chapters: contributions nearing completion for first draft
- The interaction between the chapters ongoing to eliminate overlaps between the chapters.
- A special issue has been agreed, in AMT journal, with an overview paper to be submitted to BAMS. Editors of AMT have agreed and wait for the list of papers.
- Dedicated session proposed for IGARSS'24
- Three studies identified and underway:
  - spatiotemporal variabilities that should be tackled in common homogenized ways for aerosol and clouds.
  - Sensitivity study on validation of level 1 Lidar data
  - Wavelength conversion for aerosol mixtures including depolarization ratio, extinction and backscatter coefficient





Schedule


Brainstorming meetings
Formation phase
Q1'22
Q2'22
Q3'22
Q4'22
Ramp up
Implementation monitoring meetings
1st draft
Q1'23
Q2'23
Q3'23
Q4'23
Studies start
Collocation at EC Cal/Val meeting
CEOS ready
Q1'24
Maintenance and evolution
Study results

Summary

- High-resolution profile validation of aersol, cloud, and precipitation is challenging
- A need for intense community exchange on methods and approaches has been identified at EarthCARE and AOS workshops
- Implementation approach (reported at CEOS-WGCV) is a self-organised community model, with involvement of space agencies (thus far ESA, NASA, JAXA, EUMETSAT).
- Athough the bulk of the work remains voluntary, ESA supports some key scientists from EarthCARE and Aeolus that are engaging the broader community, and developers of the *open-source* tools implementing suborbital-to-orbital transformation best practices.
- The contributors are working towards a target release of the first draft by November ’23 with final document contributed to CEOS by April ’24.