

Committee on Earth Observation Satellites (CEOS)

Proposal for Data Acquisition and Analysis to Support CEOS Strategic Planning

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Purpose, Vision and Scope

Purpose

CEOS is the forum for more than 48 space Agencies, Members and Associates to share progress and to explore collaborative opportunities. A method is needed to capture space-based measurement requirements and compare them with space-based measurement capabilities to help identify measurement gaps. The proposed approach can help define the strategic direction of CEOS and inform collaborative opportunities.

Vision

CEOS employs a robust methodology to support a common understanding of requirements and associated gap assessments. This supports collaborative planning and cooperation among CEOS members for the implementation of future space missions.

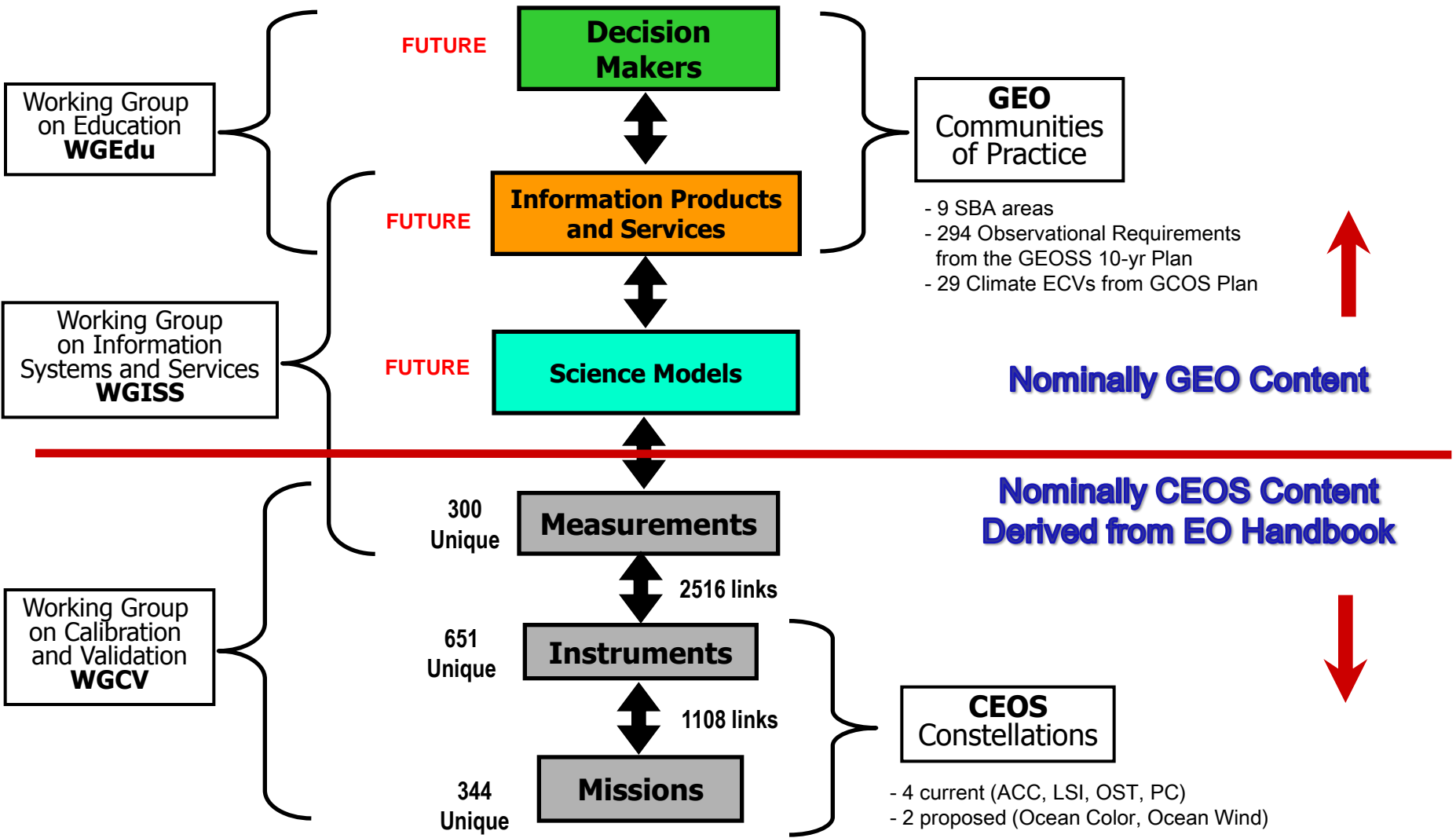
Scope

Develop a web-based database to support and inform CEOS discussions.

Preliminary database developed -- content based on: 2008 Draft EO Handbook (ESA), GEOSS 10-year Implementation Plan (GEO), WMO/CEOS Measurement Database, Bizzarro Bizzarri Gap Analysis Report (WMO, June 2007), and GCOS IP, GCOS-92, GCOS-107 documentation.



Preliminary Database Architecture



■ Approach

- Database developed in MS-ACCESS and MS-SQL.
- Currently hosted at the NASA SEO site
 - Potential for future access via the new CEOS website (hosted by NOAA)

■ Capabilities

- Pre-defined and user-defined queries and reports
 - Potential users - CEOS members, Constellation teams, GEO Communities of Practice
- Consistent with the GEOSS Common Infrastructure (GCI) and Data Sharing Principles

Database can potentially support a range of CEOS information needs

Representative examples include:

- Analysis of Constellation Robustness
 - Identify potential mission contributions to current and future CEOS Constellations
 - Support the identification of potential measurement gaps
 - Help to inform future investment areas for CEOS
- Analysis of Contributions to SBA's/Communities of Practice
 - Increase awareness of which space-based measurements are important to informing decisions made within GEO Communities of Practice
 - Understand the broadness of each constellation's contributions to SBA's/Communities of Practice
- Analysis of Missions/Measurements Supporting the Climate SBA
 - Top level analysis of missions potentially contributing to the Climate SBA for the measurement of Essential Climate Variables (ECVs)
 - Identification of potential future measurement gaps



Example: GEOSS Measurement Robustness

EO Handbook Meas. Type / Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Aerosols																								
Albedo and reflectance																								
Atmospheric humidity																								
Atmospheric temperature																								
Atmospheric winds																								
Cloud particle properties and profile																								
Cloud type, amount, and cloud top temp																								
Gravity, magnetic, and geodynamic																								
Ice sheet topography																								
Landscape topography																								
Lightning detection																								
Liquid water and precipitation rate																								
Multipurpose imagery (land)																								
Multipurpose imagery (ocean)																								
Ocean color																								
Ocean salinity																								
Ocean surface winds																								
Ocean topography / currents																								
Ocean wave height and spectrum																								
Ozone																								
Radiation budget																								
Sea ice cover, edge, and thickness																								
Snow cover, edge, and depth																								
Soil moisture																								
Surface temperature (land)																								
Surface temperature (ocean)																								
Trace gases (excluding ozone)																								
Vegetation																								

Preliminary

Albedo and Reflectance

Ice-Sheet Topography

Lightning

Ocean Salinity

Ocean Topography

Trace Gases

Gap Analysis Results

CEOS potential contribution grouped by EO Handbook Measurement Types (28)

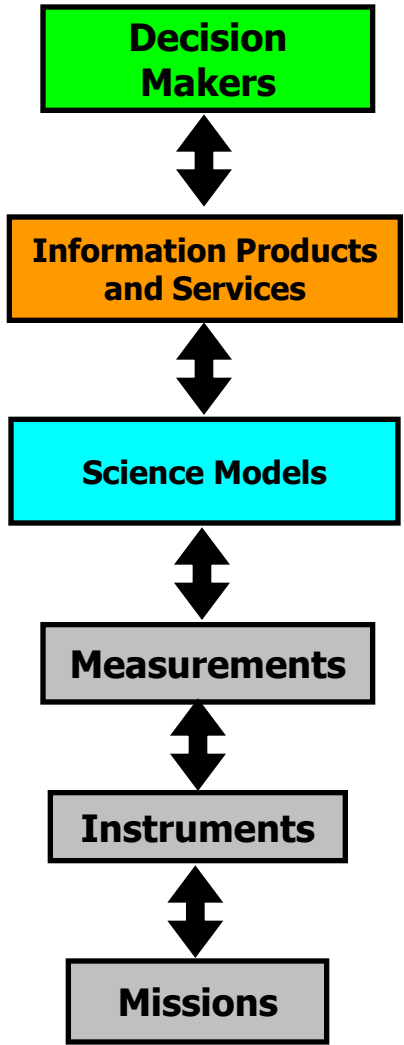
- * Potential near-term (< 5 yrs) gaps for lightning and ocean salinity.
- * Potential long-term (5 to 10 yrs) gaps for albedo and reflectance, ice sheet topography, ocean topography, and trace gases (excluding ozone).

“Stop-Light” Chart
 RED = 0 missions
 YELLOW = 1 to 5 missions
 WHITE = > 5 missions



Example: Measurement Contributions to SBA's/Communities of Practice -- Energy

Decisions	Information Product and Services (Types)	Models (Types)	Measurements (Types)
Exploration of traditional and renewable energy resources (i.e., solar, wind, geothermal, ocean)	Reports	Solar Energy Wind Energy Geothermal Energy Ocean Energy Energy Usage	Landscape topography Atmospheric / Ocean Surface Winds Cloud particle properties and profile ★ Liquid water and precipitation rate ★ Radiation budget Aerosols Trace gases ★
Environmental impacts of energy resource exploration, extraction, and exploitation (i.e., air quality, water quality, land resources, ecosystem health)	Reports Forecasts	Climate Aerosol Transport Atmos Chemistry Energy Usage	Aerosols Trace Gases ★
Energy production impact on global climate change (i.e., greenhouse gases)	Reports Forecasts	Climate Atmos Chemistry Energy Usage	Radiation budget Atmospheric temperature/humidity Cloud particle properties and profile ★ Cloud type, amount, and cloud top temp Aerosols Trace gases ★
Long-term climate impact on energy resource supply and demand	Reports Forecasts	Climate Energy Usage	Radiation budget Atmospheric temperature/humidity Cloud particle properties and profile ★ Cloud type, amount, and cloud top temp Aerosols Trace gases ★
Short- to medium-term weather impact on energy resource supply and demand	Reports Forecasts	Weather Energy Usage	Atmospheric temperature/humidity Cloud particle properties and profile ★ Cloud type, amount, and cloud top temp Land surface temperature Soil moisture Snow cover, edge, and depth
Space Weather impacts on energy transmission systems	Reports Forecasts	Space Weather Energy Usage	Space Weather

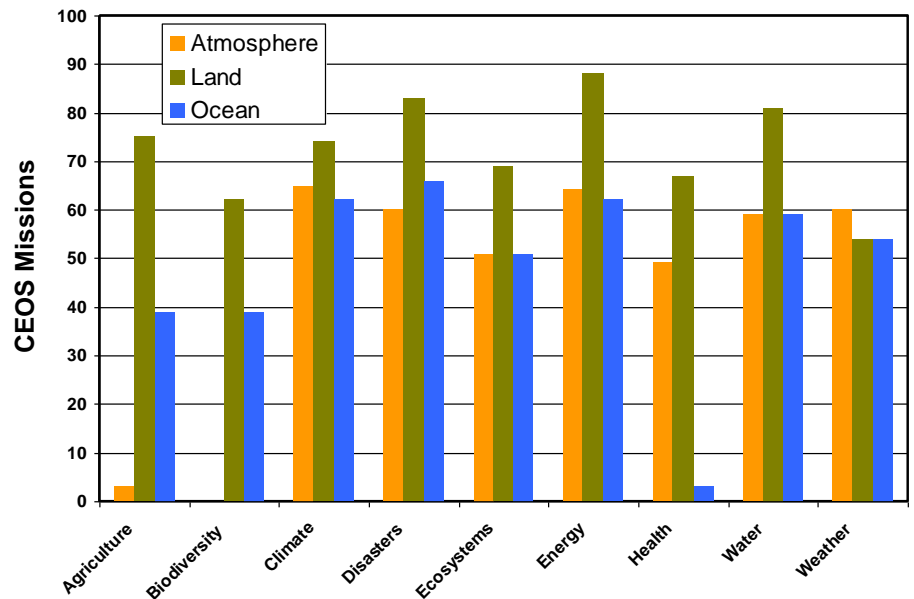


★ Identified in the Energy SBA Gap Analysis as a potential near-term measurement gap.



Example: Measurement Contributions to all SBA's

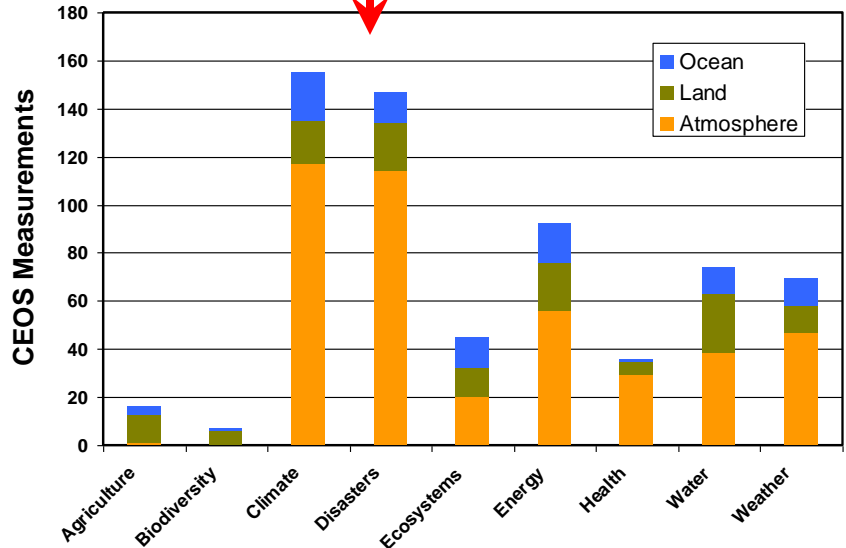
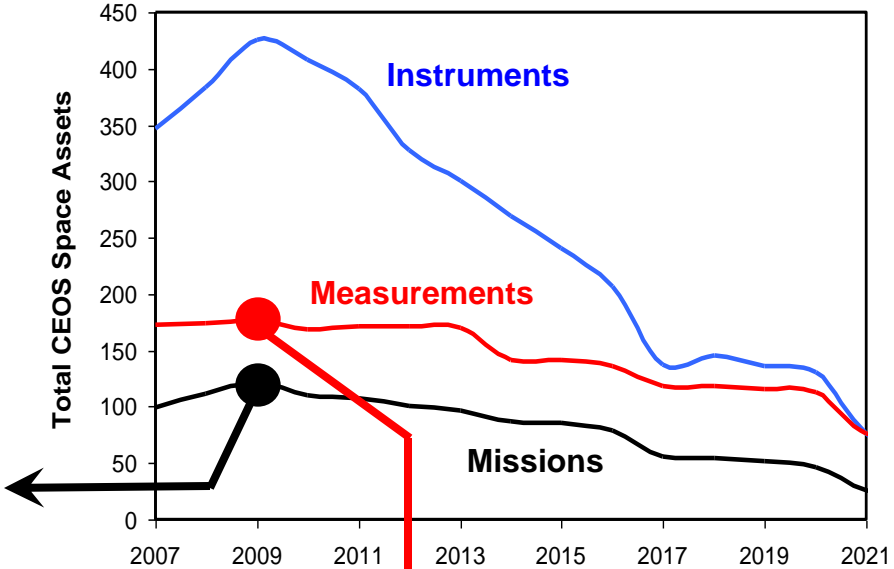
CEOS Potential Mission Contributions to SBA's in 2009



Comments:

* 2009 is the peak year for CEOS with 121 missions, flying 425 instruments, making 177 measurements. The total number of planned CEOS missions falls by 50% within 8 years.

* The CEOS space missions have a great potential to contribute to the GEO SBAs across every domain (Atmosphere, Land and Ocean).





Example: Measurement Contributions to Climate ECVs

Climate ECV / Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Atmosphere																									
Surface Wind																									
Upper-air Temperature																									
Water Vapor																									
Cloud properties																									
Precipitation																									
Earth Radiation Budget																									
Ozone																									
Aerosols																									
CO2, CH4 and other GHG																									
Upper-air Wind																									
Ocean																									
Sea Ice																									
Sea Level																									
Sea Surface Temperature																									
Ocean Color																									
Sea State																									
Ocean Salinity																									
Land																									
Lakes																									
Glaciers, Ice Caps/Sheets																									
Snow Cover																									
Albedo																									
Land Cover																									
fAPAR																									
LAI (Leaf Area Index)																									
Biomass																									
Fire Disturbance																									
Soil moisture																									

Preliminary

<<< Mid-term gap
 <<< Mid-term gap
 <<< Short-term gap
 <<< Mid-term gap
 <<< Mid-term gap
 <<< Mid-term gap
 <<< Mid-term gap

Climate ECV Gap Analysis

- * Atmosphere: Potential mid-term gap for CO2,CH4,GHG.
- * Ocean: Potential short-term gap for ocean salinity, and mid-term gap for sea level
- * Land: Potential mid-term gaps for lakes, albedo, and FAPAR (*Fraction of Absorbed Photosynthetically Active Radiation*)

- Discuss within CEOS the relative value of and support for this type of tool to help inform CEOS deliberations
 - Can such a tool – used in conjunction with focused discussions of need from GEO Communities of Practice – help shape CEOS strategic direction?
 - Would the potential benefit to GEOSS and CEOS be worth the voluntary time investment to maintain the database content?
- If CEOS wishes to further develop the capability
 - Need to verify the data (missions, instruments, measurements) in the current database
 - Nominally CEOS-level contributors (CEOS Agencies, Members and Associates, CEOS Working Groups)
 - Annual update?
 - Need to develop additional content (critical decisions or questions to be answered, supporting models and linkages to needed measurements) specific to the Communities of Practice
 - Nominally GEO-level contributors (Communities of Practice, UIC, etc.)
 - Potential exists to collaborate with periodic EO Handbook update (ESA effort)