Candidate "Threads" for Observation Gaps Analysis

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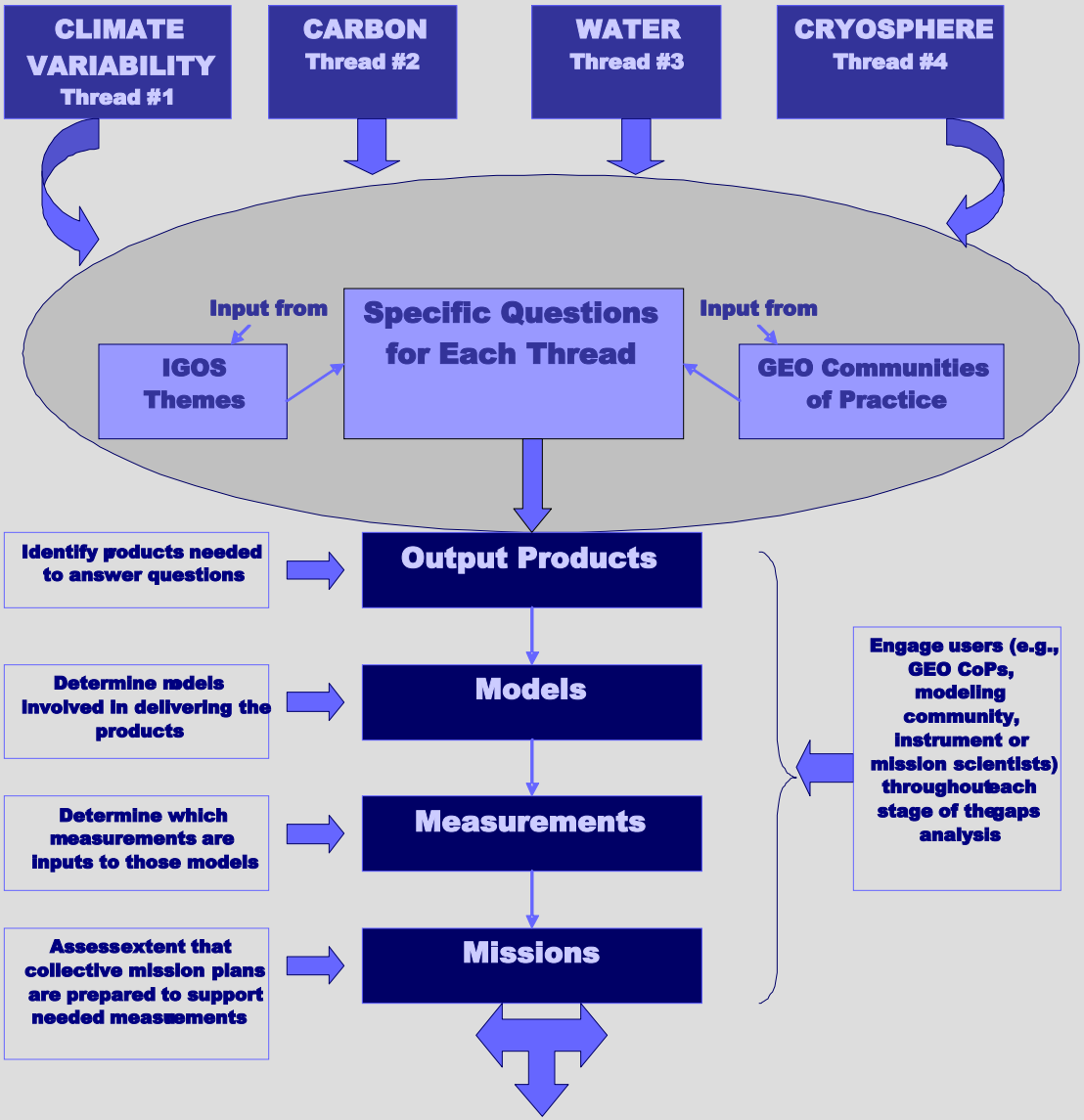
Strategic versus Tactical

Definition:

- Given a specific question in a given area, we will follow the "thread" to determine the products needed to answer the question, the models involved in delivering those products, and the measurements which are inputs to those models. Our aim with systematic analysis is to understand where the gaps are in terms of GEO's ability to answer important questions, and to identify what CEOS can contribute to filling any associated observational gaps.

CEOS Candidate Threads



Candidate Thread Topics

Climate: What is the impact of climate change and its uncertainty on agriculture yield in Central America and its impact to water resource management decisions?

Carbon: What is the impact of industrialized emissions and deforestation on global CO2 and how can we reduce its uncertainty to benefit climate model forecasts and policy decisions of individual nations ?

Water: What is the spatial and temporal variability of the water cycle in Asia due to droughts and floods?

Cryosphere/Sea Level Rise: How does ice sheet melt in Greenland, Antarctica, or Mountain Glaciers, and its relative uncertainty, impact sea level rise forecasts?

Thread Approach

Approach

- Gap analyses will be conducted on focused topics or "**threads**" across the complete systems framework (societal benefit to missions).
- Though broader topics are important, assessing a focused "**thread**" is more manageable with good potential for achievable actions.

Benefit

- Enhances our understanding of the requirements, the impact of missions, and potential measurement gaps.
- Serves CEOS as well as broader applications to GEO and others within the framework.
- Enhances collaborative planning and cooperation among space agencies for the implementation of future missions.

Societal Benefit

Decision Makers

Information products & services

Knowledge & Models

Measurements

Instruments and Missions

Implementation Plan

- Engage appropriate GEO Communities of Practice (**Societal Benefit Areas**) to determine societal benefit area impact
- Engage appropriate users to determine applicable **information products** and **services** or **models**
- Determine applicable space-based CEOS **measurements**, **instruments**, and measurement technologies
- Determine relevant current and planned CEOS **missions**
- Determine the availability and functionality of **data** (policy, access, delivery, format, calibration, algorithms, etc)
- Perform **gap analyses** at all levels (Societal Benefit to Missions) to determine missing or inadequate elements and relative value of CEOS contributions
- Develop a **final report** and display results online
- Develop **recommendations** to CEOS members including future space-based measurement needs or collaboration opportunities

Climate Thread

Societal Benefit

Decision Topic

What is the impact of climate change (temperature and precipitation) and its uncertainty on the change to agriculture yield in Central America and how will it impact water resource management decisions in that region?

Uncertainty Analysis

Examine the uncertainty at every level (measurements to forecasts) and determine the impact on a specific decision.

Information Products and Services

- Temperature Forecasts
- Precipitation Forecasts
- Decision Support Tools

→ IPCC Scenario Impact Assessments

→ SERVIR – Central America and Mexico

Science Knowledge and Models

- Regional Climate Models (RCM) → WRF – Central America
- Global Climate Models (GCM) →
  - NCAR Community Climate System Model (CCSM)
  - NASA GISS Global Climate Model

Measurements

Global Temp and Humidity
Global Precipitation
Soil Moisture
Lake Levels
NDVI

Instruments and Missions

Contributions from XX of 635 CEOS **instruments**
Contributions from XX of 316 CEOS **missions.**

Relevant GEO Tasks and CEOS Actions*

- CL-09-01 Environmental Information for Decision-making, Risk Management and Adaptation
- WA-06-02 Droughts, Floods, and Water Resource Management
- WA-06-07 Capacity Building for Water Resource Management
  WA-06-07d_3* Space observations and modeling for land hydrology
- WA-08-01 Integrated Products for Water Resource Management and Research
- AG-07-03 Global Agricultural Monitoring
  AG-07-03a_4* Integrate remote sensing into selected models for agricultural mgmt
- AR-09-02 Interoperable Systems for GEOSS
  AR-09-02b_1* AVHRR vegetation data product generation

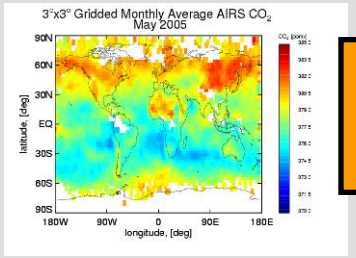
Lead: DeWayne Cecil (USGS,SEO)
Contacts: Mitch Goldberg (NOAA), Radley Horton (GISS), Alex Ruane (GISS), Peter Parker (NASA), Brian Killough (SEO)

Carbon Thread

Societal Benefit

Decision Topic

What is the impact of industrialized emissions and deforestation on global CO_2 and how can we reduce its uncertainty to benefit climate model forecasts and policy decisions of individual nations ?



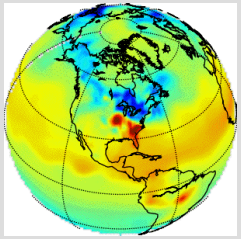
Information Products and Services

- Global Carbon Maps
- Temperature Forecasts
- Precipitation Forecasts

→ Deforestation Reports

→ Regional Emission Reports

→ IPCC Scenario Impact Assessments



Science Knowledge and Models

- Nested atmospheric transport model (TM5, ECMWF)
- Fossil fuel emissions and surface exchange processes specified
- Surface fluxes are optimized using surface and tower msmts
- Identify/Quantify GCM Model Processes

→ CarbonTracker Model Analysis

Primary Climate models:
- NCAR Community Climate System Model (CCSM)
- NOAA GFDL (Princeton) Global Coupled Climate Model
- NASA GISS Global Climate Model

Column and Profile Measurements of GHG's (CO_2, CH_4, CO)

Measurements

Greenhouse Gas Observing Satellite (GOSAT), TANSO-FTS
Orbiting Carbon Observatory (OCO), Spectrometer
Environmental Satellite (ENVISAT), SCIAMACHY
AQUA, Atmospheric Infrared Sounder (AIRS)
Metop, IR Atmospheric Sounding Interferometer (IASI)
ISTAG, MAGIS IR Spectrometer
ASCENDS, CO2 Column and Profile Lidar

Instruments and Missions

Relevant GEO Tasks and CEOS Actions*

- CL-06-01 A Climate Record for Assessing Variability and Change
- CL-09-03 Global Carbon Observation and Analysis System
  CL-09-03b_1* Developing biomass products
  CL-09-03b_2* SAR data for biomass estimation
- AR-09-03 Advocating for Sustained Observing Systems
  AR-09-03a_11* Global carbon dataset

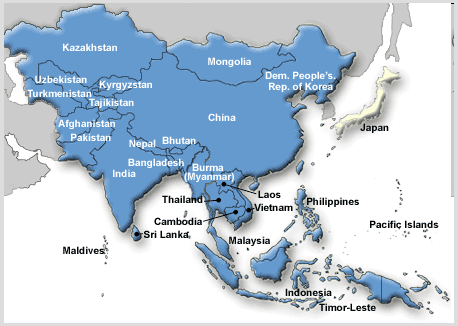
Lead: Mitch Goldberg (NOAA)
Contacts: Chris Barnet (NOAA), Berrien Moore, Chu Ishida (JAXA), Per Erik Skrovseth (NSC), Alex Hold (CSIRO)

Water Thread

Societal Benefit

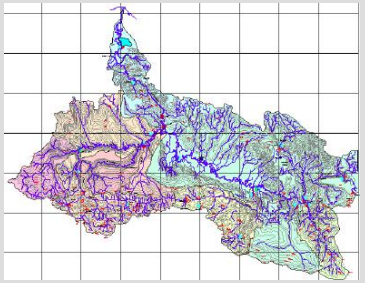
Decision Topic

What is the spatial and temporal variability of the water cycle in Asia due to droughts and floods?



Information Products and Services

- Products needed to determine water cycle variability
  - River Discharge Maps
  - Precipitation Maps



Science Knowledge and Models

- Numerical weather prediction models
- Distributed hydrological models

→ WCRP/GEWEX/CEOP

→ GEOSS/AWCI

Global Temp and Humidity
Global Precipitation
Soil Moisture
Lake Levels

→ **Measurements**

Contributions from XX of 635 CEOS **instruments**
Contributions from XX of 316 CEOS **missions.**

→ **Instruments and Missions**

Relevant GEO Tasks and CEOS Actions*

- CL-06-01 Climate Record for Assessing Variability and Change
- WA-06-02 Droughts, Floods, and Water Resource Management
- WA-06-07 Capacity Building for Water Resource Management
  WA-06-07d_1* Support two AWCI Int'l Coordination Group meetings
  WA-06-07d_3* CYMENT project combining space observations and modeling for land hydrology
- WA-08-01 Integrated Products for Water Resource Management and Research

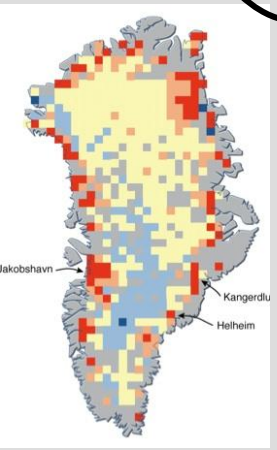
Lead: Rick Lawford (NOAA)
Contacts: Rick Lawford (NOAA, IGOS Water Theme), Osamu Ochiai (JAXA, GEO)

Cryosphere/Sea Level Rise Thread

Societal Benefit

Decision Topic

How does ice sheet melt in Greenland, Antarctica, or Mountain Glaciers, and its relative uncertainty impact sea level rise forecasts?



Information Products and Services

- Glacier and ice sheet state
- Glacier and ice sheet elevation change, surface melt, gravity, etc.
- Cryosphere monitoring and assessments
- Impact Assessments

→ World Glacier Monitoring Service

→ Research products (e.g., GRACE mass change, passive microwave melt, ice velocity)

→ WMO Global Cryosphere Watch

→ IPCC Scenario Impact Assessments

Science Knowledge and Models

- Fully coupled ice sheet models (currently inadequate)
- Regional models that represent glacier variability
- Climate Models (accumulation, ablation currently inadequate)

→ Research models (under development)

→ Climate models & reanalyses:
- ECMWF, NCEP, JMA reanalyses
- NCAR Community Climate System Model (CCSM)
- NOAA GFDL (Princeton) Global Coupled Climate Model
- NASA GISS Global Climate Model

Measurements

CEOS **measurements**

- Ice sheet/cap topography and rate of change
- Ice stream velocity
- Glacier extent
- Glacier and ice sheet mass balance
- Ice sheet calving rate
- Snow cover
- Ice surface energy budget
- Geoid measurements
- Continental rebound

Instruments and Missions

Contributions from *N* CEOS **instruments** and *M* **missions.**

Relevant GEO Tasks and CEOS Actions*
- CL-06-01 A Climate Record for Assessing Variability and Change
  CL-06-01a_7* Reanalyzed global sea ice data
- CL-09-02 Sustained Observing Systems (formerly CL-06-05, International Polar Year)

Lead: Jeff Key (NOAA)
Contacts: TBD