

Proposed CEOS Chair Initiative for 2016
Future Data Access & Analysis Architectures Study

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Introduction

As the Chair Agency for CEOS for 2016, CSIRO proposes to provide leadership on two new initiatives:

1. Study of future data access and analysis architectures; and
2. Study of non-meteorological applications for next generation geostationary satellites

This paper introduces the first topic and explains the purpose and objectives of the initiative to support a decision on the way forward at the CEOS 29th Plenary. The paper and proposed approach have been prepared in accordance with the *CEOS New Initiatives Process Paper*.

Context

New generation Earth observation (EO) satellites will create such significant volumes of data with such comprehensive global coverage that for many important applications, a 'lack of data' will no longer be the limiting factor.

Extensive research and development activity has resulted in new applications that offer significant potential to deliver great impact to important environmental, economic and social challenges, including at the regional and global scales necessary to tackle 'the big issues'. Such applications highlight the profile of EO to Ministers and other key people. However, for EO to make the most of this enormous potential, the gap between data and application needs to be bridged. Currently, many applications fail to successfully scale up from small-scale research to global or regional operations because of a lack of suitable data infrastructure. Much EO satellite data sit under-used on tapes. Significant application potential remains consigned to prototypes, exemplars and test-beds.

It would not be technically feasible or financially affordable to consider traditional processing and data distribution methods to address this 'scaling' challenge, as the size of the data and complexities in preparation, handling, storage, analysis and basic processing remain significant obstacles in many countries, including as they support key GEO/CEOS initiatives such as the Global Forest Observations Initiative (GFOI), Disasters, Water Resources and the GEO Global Agricultural Monitoring initiative (GEOGLAM).

Addressing of this problem by individual users has not thus far resulted in an optimal solution and misses the opportunities offered through collaborative environments where both data providers and users can work together across domains and across geographic boundaries. However, the data management and analysis challenges arising from the explosion in free and open data volumes can be overcome with the opportunities offered by new, high-performance Information and Communications Technologies (ICT) infrastructure and architectures aimed at improving data management for providers and removing obstacles to data uptake by users.

Proposal

CSIRO, with support from Geoscience Australia (GA), proposes a CEOS Chair's initiative, executed for maximum flexibility by an Ad-hoc Team to assess the potential of these new technologies and approaches, and develop a report that identifies key issues and opportunities, and proposes a plan of action for consideration by CEOS.

It is suggested that the Team be co-led by volunteers from space agencies supplying free and open access to comprehensive global data, and include participants from a range of other CEOS Agencies. An Ad-hoc Team is an appropriate mechanism for this CEOS Chair's initiative since:

- 1) The scope of the work is well defined and time-limited;
- 2) The nature of the topic is cross-cutting, and may require input from:

- a. the Virtual Constellations (from the data supply and processing perspective), in particular LSI-VC;
- b. WGISS (from the data distribution and analysis systems development and coordination perspective);
- c. WGCV (from the perspective of data consistency and compatibility);
- d. thematic groups (e.g. GFOI and SDCG) as representatives of user groups whose activities could be enhanced by better data infrastructure;
- e. the Systems Engineering Office.

The outcomes envisioned for the study are:

- 1) an inventory of relevant initiatives and plans being undertaken by CEOS and related agencies;
- 2) a report on lessons from the early prototypes currently underway with the governments of Kenya and Colombia;
- 3) a report identifying key issues and opportunities resulting from the trend towards Big Data, Analysis Ready Data, etc;
- 4) a report listing recommendations for the way forward for CEOS and its agencies, including in relation to standardisation, interoperability etc, and how the current CEOS priorities might benefit from the proposed activities.

Alignment with CEOS Strategic Goals

Space agencies are convinced as to the potential of satellite EO as an information source in support of many sectors of government and industry. EO is globally the single largest civil space activity - with CEOS Agencies collectively investing billions of dollars in space infrastructure with the capability to provide sophisticated, continuous and sustained observations of the entire planet.

The agencies would concede however that the major obstacles faced by potential users of such 'big' data have yet to be addressed. Significant, specialised and expensive technologies and skills are needed before satellite data can be used, and many key users do not have the financial or technical capacity required to undertake the data handling, calibration and processing required to extract the information required from the data. Ensuring complementarity of data across different missions - a prerequisite to developing products and services that can harness the CEOS 'family' of missions, rather than being dependent on a specific satellite or sensor - requires further coordination among these technicians. CEOS Member Agencies specialise in these skills, and it makes sense for space agencies to process their data to the maturity level required to make satellite data 'analysis ready'.

This initiative aligns directly with the following Opportunities and Strategic Directions from CEOS Strategic Guidance:

Opportunity: Build Capacity for Earth Observation Products – With urgency for CEOS Earth observation data products increasing more quickly than the capacity for use, CEOS will actively promote availability of civil Earth observation data and endeavor to build capacity to use the resulting products. Broader geographic representation will remain a strategic and capacity-building priority for CEOS with respect to both the end user community and the Earth observation data providers.

Opportunity: Identify Gaps and Promote Complementarity – CEOS will remain a leader in the Earth observation community through the guidance and complementarity it achieves with others to accomplish its mission. CEOS will continue to fill a critical need in the global community to reduce unnecessary duplication and to identify gaps to be bridged so that resources can be put to best use.

Strategic Direction: Optimize the Societal Benefit of Space-based Earth Observation – CEOS

will actively identify specific avenues through which its contributions for global societal benefit are showcased and communicated at Ministerial and other global forums. Guided by its founding principles and mission, CEOS will remain a forward-thinking and adaptive participant in the Earth observing community and intergovernmental forums. To further facilitate the accomplishment of its mission and maximize the societal benefits it delivers, CEOS will explore avenues for engagement with Earth observation communities of practice and other contributors to space-based activities.

Strategic Direction: Remain the Focal Point for International Coordination of Space-based Earth Observations - Now and in the future, the global community will continue to study the Earth system using space-based and *in situ* observations for the benefit of the planet. As the unique international forum coordinating the full spectrum of civil space-based Earth observing systems, CEOS reaffirms its commitment to lead as a catalyst for change by fostering new technologies, measurement capabilities, improved data access strategies, innovative and integrated approaches to satellite data, and mission coordination for the global community.

Benefit to Internal & External Stakeholders

The initiative is of value both to CEOS Agencies as data providers and to existing and prospective users of EO satellite data. The full potential of EO satellite data will not be realised with the obstacles that users face in current data handling and analysis approaches.. Global initiatives such as GFOI and GEOGLAM exemplify the difficulties that countries without developed national spatial data infrastructures face in terms of lack of capacity in their ability able to handle EO satellite data.. This capacity gap is a major hindrance to the uptake of EO data in global initiatives.. Moreover, even many developed countries are struggling to determine how best to capitalise on 'big space data' and would appreciate guidance on both best practice and more streamlined approaches to maximise value from different satellites.

CEOS investigations into next generation data systems must consider innovative solutions to the 'last mile' problem, where technological solutions have tended to fail. It should consider phased solutions that can help many countries in the near-term by working with CEOS capacity building partners, as we also work toward long-term solutions.

CEOS initiatives in areas such as disaster management and forest monitoring have identified that the obstacles to uptake of EO satellite data are not only technical. Issues relating to user and intermediary awareness, understanding and capacity to exploit data are just as significant. The proposed studies would ideally include substantial engagement with external stakeholders including typical user groups, UN agencies and financing bodies such as the World Bank to ensure their perspectives are fully understood and reflected as we plan the way forward. These bodies are where we hope the benefits will ultimately be realised, and they should be engaged early and fully.

Feasibility & Affordability

To ensure investment in space infrastructure more readily translates into application benefits on Earth, this activity will build on promising work already underway, It will build on USGS work on Analysis Ready Data, work undertaken on the Australian Geoscience Data Cube, ESA's Thematic Exploitation Platform work, Europe's Big Data Study and on projects initiated with the Global Forest Observations Initiative including the Global Data Flows Study and on pilot projects of the CEOS SEO.

CSIRO and GA seek to ensure these various efforts are all fully understood, considered and connected so that the bigger picture can be established and a suitable CEOS strategy agreed that might benefit all initiatives while ensuring the necessary high profile and support from CEOS Principals and Agencies.

A cross-cutting and multi-disciplinary study team, led by the CEOS Chair, will be assembled which includes representation from interested CEOS Agencies, as well as from SDCG, GEOGLAM and WGISS. The proposed effort during 2016 will scope out the challenges and opportunities and

determine further effort as appropriate by CEOS and its groups. The 2016 effort should be achievable without placing a significant burden on CEOS resources. It will borrow where needed from the progress and reporting of the related work underway within GFOI etc.

Expected Duration

The initial activity period is for 1 year – the duration of the CSIRO CEOS Chairmanship - with a decision on the way forward at the 2016 CEOS Plenary.

Next Steps

As required by the New Initiatives Process Paper, CSIRO has provided this paper for a decision at the 2015 CEOS Plenary, following extensive outreach and consultation with relevant CEOS groups including CEOS SEC and at the SIT Technical Workshop. The incoming CEOS Chair encourages active participation in the Study by the relevant CEOS groups and Agencies and urges Principals to approve the establishment of the proposed Ad-hoc Team at the Kyoto Plenary.