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:

- A study of Future Data Access and Analysis Architectures
- A study of Non-meteorological applications for next generation geostationary satellites

This paper introduces the first topic, explains the purpose and objectives of the initiative, and the anticipated and schedule for the process leading to a kick-off of the effort at the Kyoto CEOS Plenary in November. The paper and proposed approach has been prepared in accordance with the *CEOS New Initiatives Process Paper.*

This first draft has been prepared to identify opportunities for improving the scope and definition of the activity, and as a basis for discussing potential contributions with specific CEOS Entities (WGs – especially WGISS for this topic, VCs, Ad-Hoc Teams, Members, Associates, etc).

Context

New generation 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' and highlight the profile of EO to Minsters and other key people.

However, for EO to make the most of this enormous 'potential', the key 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 sits under-used, on tapes. Significant application potential remains consigned to prototypes, exemplars and test-beds.

It will simply not be technically feasible or financially affordable to consider traditional processing and data distribution methods to address this 'scaling' challenge. The size of the data and the complexities in its preparation, handling, storage, analysis and basic processing remain significant obstacles in many countries, including in support of key GEO/CEOS initiatives such as GFOI, Disasters, Water Resources and GEOGLAM.

Leaving this problem in the hands of individual users has not thus far provided optimal results and misses the opportunities offered through collaborative environments where both data providers and users can work together across domains and across geographic boundaries.

The data management and analysis challenges arising from the explosion in free and open data volumes can be met with the opportunities offered by new high-performance ICT infrastructure and architectures aimed at improving data management for providers and removing obstacles to data uptake by users, helping this data deliver economic, environmental and societal benefits.

Proposal

CSIRO, with support from Geoscience Australia, propose the establishment an Ad-hoc Study Team to assess the potential of these new technologies and approaches, and develop a report that identifies key issue and opportunities and propose a plan of action for consideration by CEOS.

It is suggested that the Study Team be co-chaired by volunteers from space agencies supplying free and open access to comprehensive global data, and include participants from a range of other CEOS Entities. An Ad-hoc Study Team is an appropriate mechanism for CEOS 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 (eg GFOI SDCG) as representatives of user groups whose activities could be enhanced by better data infrastructure;
    e. Systems Engineering Office.

Alignment with CEOS Strategic Goals

Space agencies are convinced as to the potential of satellite Earth observations as an information source in support of many sectors of government and industry; Earth observation 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 they have yet to fully address the major obstacles faced by potential users of such 'big' data. 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 involved in extracting the information they require 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 across these technicians. CEOS member agencies specialise in these skills, and it makes sense for space agencies to bring their data to the maturity level needed to make satellite data 'analysis ready'.

This initiative aligns directly with the following 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 current data handling and analysis approaches and the obstacles that users face. CEOS investment in global initiatives such as the Global Forest Observations Initiative (GFOI) and the GEO Global Agricultural Monitoring initiative (GEOGLAM) has only underlined the difficulties that countries without developed national spatial data infrastructures face in terms of capacity building to be able to handle EO satellite data; countries that could otherwise benefit significantly from its application. This capacity gap is a major hindrance to the uptake of EO data in global initiatives of this kind. Moreover, even many developed countries are struggling to determine how best to capitalise on 'big space data' and would appreciate guidance on 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 sooner by working with CEOS capacity building partners, as we also work toward long-term solutions.

CEOS initiatives in areas such as disasters and forest monitoring have identified that the obstacles to uptake of EO satellite data are not always technical. User and intermediary awareness, understanding and capacity to exploit data are just as significant. The proposed studies should include substantial engagement with external stakeholders, including typical user groups, UN agencies, financing bodies such as World Bank, to ensure their perspective is fully understood and reflected as we plot 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

This activity will build on promising work already underway to ensure investment in space infrastructure more readily translates into application benefits on Earth. It will build on USGS work on Analysis Ready Data, on work undertaken on the Australian Geoscience Data Cube, on ESA's Thematic Exploitation Platform work, on Europe's Big Data Study and on projects initiated with the Global Forest Observations Initiative, including the Global Data Flows Study, and 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 and ensure the necessary high profile and support from CEOS Principals and agencies.

A cross-cutting and multi-disciplinary study team, led by 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 aims to scope out the challenges and opportunities and to propose 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, as appropriate, at the 2016 CEOS Plenary.

Next Steps

As required by the New Initiatives Process Paper, CSIRO has provided this paper for consideration of CEOS SEC. If SEC is favourable, the next steps are suggested to be:

- Discussion at CEOS SEC 204 telcon (4 Sep)
- Short briefing presentation to SIT Technical Workshop (17-18 Sep, Darmstadt)
- Circulation of paper to Contacts, WGs and VCs to identify in-principle indications of support and contribution to the activity
- Side meetings at WGISS, GFOI-SDCG and WGCV meetings to confirm and clarify contributions
- Updated proposal paper circulated to Principals at least 2 weeks prior to Plenary (mid-Oct) to confirm agency input
- Presentation and discussion at CEOS Plenary (5-6 Nov, Kyoto)