Japan Australia workshop on Non-Meteorological applications for Next Generation Geostationary Satellites: 25-26 August 2015

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## A Japan - Australia collaboration

There is a need and opportunity to make the most of Japan's Himawari-8 satellite and Australia and Japan's applications capabilities.

To initiate inter-agency collaboration on the development of non-meteorological GEO products a joint workshop was held in Brisbane 25-26 Aug 2015, Australia.

Main workshop focus was on developing "application teams" across land, marine and atmosphere domains and to develop a non-met product catalogue.



Japan Australia workshop on Non-Meteorological applications for Next Generation Geostationary Satellites: 25-26 August 2015

- Attended by 50 people from:
  - JAXA
  - JMA
  - Chiba University
  - Tokai University
  - CSIRO
  - Bureau of Meteorology
  - Geoscience Australia
  - Symbios Communications
  - Department of Environment
  - Curtin University
  - Charles Darwin University
  - University of Queensland
  - University of Southern Queensland
  - Wollongong University
  - James Cook University
  - University of Melbourne
  - Dept. of Science Information Technology and Innovation





Ecosciences Precinct Brisbane ,Australia

## Breakout session: Atmosphere (1)

Key products: aerosol and solar radiation. Lower priority: total column ozone and trace gases (SO2, CO2).

Retrievals over land from an advanced GEO are challenging and new. Will need to support the development and evaluation of multiple algorithms before choosing an approach for operational use.



## Breakout session: Atmosphere (2)

### Future users:

- Aerosol (including smoke) as an input to air quality monitoring and forecasting systems run in Australia by the BOM/CSIRO and by universities.
- Initialisation and validation of BOM smoke dispersion model.
- Assimilation of aerosol into atmospheric modelling systems such as SPRINTARS (Kyushu U) and possibly internationally such as the European MACC system.
- Validation of aerosol output from models such as MACC (needed by BOM).
- Dust aerosol monitoring is a high priority in east Asia and Japan, and in Australia the NSW Department of Environment and Heritage would use it for air quality and as an indicator of land condition.
- The JAXA supported SAFE project has an interest in air pollution.
- Geoscience Australia would use an operational stream of BRDF model coefficients resulting from joint aerosol and surface reflectance retrieval, and potentially the aerosol product, in the Landsat processing.
- Total column ozone at subdaily time resolution is of interest for air quality (troposhere, urban, e.g. U Melbourne) and stratospheric dynamics (specific users to be identified).



## Breakout session: Land

Key products: surface Reflectance products with geometric correction, vegetation parameters, cloud mask information, pixel quality metrics, land surface temp, dynamic tracking of fire spread and associated modeling, real time flood warning.



## Breakout session: Oceans (1)

## Key products:

Water-leaving radiance, reflectance
Total Suspended Matter (TSS)
Chlorophyll-a
Diffuse attenuation coefficient (Kd)
Particle backscattering
Photosynthetically available radiation (PAR)
Mapping extent of coastal flood plumes
Algal bloom detection
Sea Surface Temperature (SST)



## Breakout session: Oceans (2)

### Potential future end users:

- Great Barrier Reef Marine Authority, e.g. for monitoring water quality (WQ)
- eReefs dashboard users, e.g. linking WQ with Crown of Thorns outbreaks
- James Cook University , e.g. for ecosystem health assessments understanding and river outflows



# Outcome: Detailed catalogue of potential products <a href="http://geoapplications.org/">http://geoapplications.org/</a>

Ocean						
Coordination:	Hiroshi Murakami (JAXA), Thomas Schroeder (CSIRO)					
Product & Advisory Leads:	(1) David Antoine (Curtin University), (2) Leon Majewski (BoM), (3) Hiroshi Murakami (JAXA), (4) Thomas Schroeder (CSIRO), (5) Larissa Valerio (JCU)					
Product/Application	Algorithm type	Developing Institution	Estimated resources	Currently funded	Dependencies	Potential end users
	Artificial Neural Network	CSIRO (4) JCU (5)	0.3 FTE	Yes	Validation data	GBRMPA
Water-leaving radiance Remote Sensing Reflectance	Iterative coupled atmosphere-ocean inversion model	CU (1)	TBD	No	Glint masking algorithm Glint correction algorithm	CSIRO JCU
Land						
Coordination:	Yoshiaki Honda (Chiba University), Koji Kajiwara (Chiba University), Luigi Renzullo (CSIRO)					
Product & Advisory Leads:	<ol> <li>Tom Cudahy (CSIRO), (2) Ian Grant (BoM), (3) Yoshiaki Honda (Chiba University), (4) Koji Kajiwara (Chiba University), (5) Tim McVicar (CSIRO),</li> <li>Masao Moriyama (University Nagasaki), (7) Norman Mueller (GA), (8) Luigi Renzullo (CSIRO), (9) Peter Scarth (UQ), (10) Medhavy Thankappan (GA),</li> <li>Catherine Ticehurst (CSIRO), (12) Tom Van Neil (CSIRO)</li> </ol>					
Product/Application	Algorithm type	Developing Institution	Estimated resources	Currently funded	Dependencies	Potential end users
Land Surface Temperature	SWA e.g. adapted from GOES-ABI	CSIRO (with NOAA) (8)	0.3 FTE	No	Solar zenith, view zenith, cloud mask, land mask, precipitable	BoM CSIRO
& Emissivity	Semi-analytical	Nagasaki University (6)	0.2 FTE (TBC)	Yes (partially)	water, water vapour profile,	JMA
Atmosphere						
Coordination:	Takashi Nakajima (Tokai University), Ian Grant (BoM)					
Product & Advisory Leads:	(1) Ian Grant (BoM), (2) Michael Hewson (UQ), (3) Atsushi Higuchi (Chiba University), (4) Fuqin Li (GA), (5) Takashi Nakajima (Tokai University), (6) Teruyuki Nakajima (University of Tokyo, JAXA), (7) Hideaki Takenaka (University of Tokyo, JAXA), (8) Yi Qin (CSIRO), + Japan TBD					
Product/Application	Algorithm type	Developing Institution	Estimated resources	Currently funded	Dependencies	Potential end users
Aerosol ontical denth	CSIRO GEO-LEO Algorithm (physical model via look- up tables)	CSIRO (8)	0.2 FTE	TBD		
Aerosol type Ångström exponent Surface reflectance	MAIAC Algorithm (physical model via look- up tables)	BoM (with NASA) (1)	0.2 FTE + \$15k	TBD	Validation data	CSIRO GA BoM
BRDF Cloud mask (BoM only)	Deep-Blue (physical model via look- up tables)	UQ (with NASA) (2)	1 FTE	If DECRA	product)	JMA MOE

### Japan-Australia collaboration framework now in place Next Steps ...

Identify funding opportunities to develop products

Only ~50% of proposed products are currently funded!

- Progress implementation of funded products
- Hold annual workshop to exchange information and progress across all domains
- Expand collaboration framework to wider
   Asia-Pacific region



# A major initiative under the Australian Chairmanship year of CEOS.

The outcomes envisioned for the study are:

- a report which identifying future GEO and LEO mission and instrument plans of relevance to understand the scope and scale of the topic;
- a report which inventories relevant non-meteorological GEO algorithm and application initiatives and plans being undertaken by CEOS and related agencies, building on the Japan-Australia bilateral effort initiated in 2015 (see <u>www.geoapplications.org</u>) and consider whether further algorithms are required;
- A report which assesses and prioritises the various GEO and GEO-LEO combined applications and algorithms for coordination through CEOS;
- a report on lessons from the early collaboration on non-met GEO algorithms resulting from the Japan-Australia bilateral efforts;
- a report identifying key issues and opportunities, including in the specification of requirements for relevant future missions and instruments;
- 6) a report listing recommendations for the way forward for CEOS and its agencies.

# Initiate Task Team under CEOS to assess the potential of synergistic GEO-LEO approaches



# More information at: <a href="http://geoapplications.org/">http://geoapplications.org/</a>

Sign up to the land, atmosphere or oceans list to hear the latest news and developments



### LAND

Time series from next generation geostationary satellites present opportunities to extract new and unique information in support of disaster response and management. Land Surface Temperature (LST) and surface energy balance monitoring, and vegetation process/carbon cycle observation, among many others.

#### Read more >>

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A number of atmospheric products are currently being generated including cloud and aerosol properties and water vapour, with additional products under consideration.

#### Read more >>

### 😂 OCEANS

There are numerous ocean applications that can be achieved with measurements of Sea Surface Temperature (SST) and ocean colour including physical processes such as tides, monitoring and forecasting of flood plumes and algal blooms, data assimilation of biological phenomena, and water quality and river plume monitoring.

Read more >>

### Background

While the primary mission of the new GEO satellites is to support operational meteorological services, they offer opportunities for non-meteorological applications that can enhance and complement the LEO-based applications that have been the workhorse for monitoring of the broader environment. The characteristics of the advanced GEO sensors complement current moderate resolution LEO sensors, approaching the LEOs in spatial and spectral resolution while offering far greater temporal resolution, and complementary view and illumination geometries.

GEOs can fill gaps in LEO coverage due to cloud. They are particularly well suited to monitoring rapid changes in the land surface (such as snow, burns and harvest), ocean (such as ocean color, including algal blooms and sediment plumes, and sea surface temperature), and non-meteorological characteristics of the atmosphere (such as aerosol, including smoke and dust events, ozone and potentially air quality).

### Unique GEO-LEO Opportunities

Even further enhancements in observation capability can potentially come from applications that use data from both the advanced GEO and LEO sensors together, by exploiting their complementarity. Possibilities include merging the finer spatial resolution of the LEOs with the fine temporal resolution of the GEOs, or exploiting the availability of simultaneous observations with different view or illumination conditions, and the fusion of GEO and LEO products into global products that address sampling issues at high latitudes.

### Gap and Purpose

The development of meteorological applications of the advanced GEOs is well addressed by the meteorological community. The development of non-meteorological applications from the advanced GEOS including in conjunction with EOS is a new area of EO application develop that shows much promise but will be neitrification a systematic of the notantial applications their experits and Experits to metal, comments and their relation on the other EO applications.

