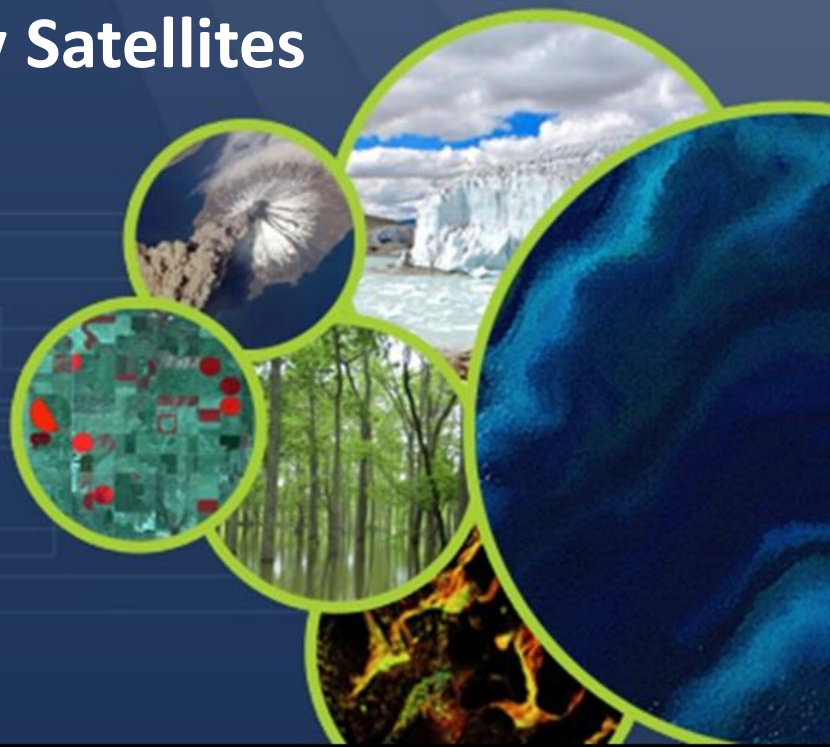
Committee on Earth Observation Satellites

CEOS Chair New Initiative

Non-meteorological Applications for Next Generation Geostationary Satellites

A brief Introduction



Thomas Schroeder, CSIRO

On behalf of the NMA Ad-hoc Task Team

CEOS WGCV-40
Canberra, Australia
15th March 2016

As Chair of CEOS for 2016, CSIRO proposed to provide leadership and coordination on two new initiatives:

1. A study of Future Data Access and Analysis Architectures (co-chaired CSIRO and USGS)

2. A study of Non-meteorological applications for next generation geostationary satellites

Studies will draw upon expertise and capacity from existing CEOS WG's and VCs, as well as member agency experts.

Non Met-Applications Task Team

Established in January 2016, activity period 1 year

Co-chaired by CSIRO, ABoM, EUMETSAT and NOAA

Supported by 14 other CEOS Agencies:

CNES, CSA, DLR, EC, ESA, GA, JAXA, JMA, KARI, NASA, NSMC-CMA, UKSA, USGS, WMO

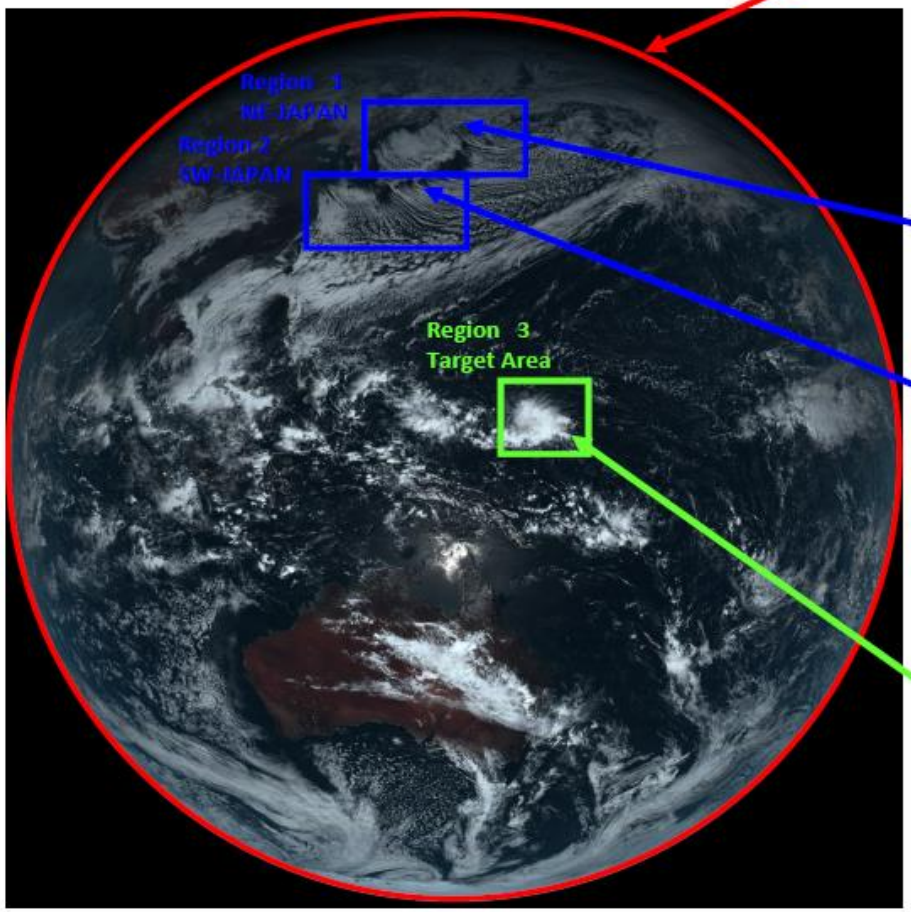
Study will result in a report that provides comprehensive and pragmatic guidance to CEOS on new opportunities arising from **next generation geostationary** satellites and GEO-LEO synergies.

Geo-Leo Corresponding VIS-IR Imagery Bands (μm)

#	Himawari -8/ AHI	MTSAT-2/ IMAGER	MSG/ SEVIRI	MTG/ FCI	KOMPSAT -2A/AMI	FY-4/ AGRI	GOES-R/ABI	GOES -15	GOES -11	SNPP,JPSS/ VIIRS	Terra, Aqua/ MODIS	GCOM-C/SGLI	NOAA/ AVHRR
1	0.47			0.444	0.455	0.47	0.47			0.488 (M03)	0.488	0.490 (VN4)	
2	0.51			0.510	0.511					0.555 (M04)	0.531	0.530 (VN5)	
3	0.64	0.68	0.635	0.640	0.642	0.65	0.64	0.65	0.65	0.672 (M05) 0.64 (I01)	0.667	0.6735 (VN7,VN8,P1)	0.630
4	0.86		0.81	0.865	0.860	0.825	0.86			0.865 (M07) 0.865 (I02)	0.870	0.8685 (VN10, VN11, P2)	0.862
				0.914							0.905		
				1.380	1.38	1.375	1.38			1.378 (M09)	1.375	1.380 (SW2)	
5	1.6		1.64	1.610	1.61	1.61	1.61			1.610 (M10) 1.61 (I03)	1.640	1.630 (SW3)	1.61
6	2.3			2.250		2.25	2.26			2.250 (M11)	2.130	2.210 (SW4)	
7	3.9	3.7	3.92	3.80	3.85	3.75	3.90	3.90	3.90	3.70 (M12) 3.74 (I04)	3.750		3.74
8	6.2	6.8	6.25	6.30	6.24	6.25	6.15	6.55	6.75		6.715		
9	6.9				6.95	7.1	7.00						
10	7.3		7.35	7.35	7.34		7.40				7.325		
11	8.6		8.70	8.70	8.60	8.5	8.50			8.55 (M14)	8.550		
12	9.6		9.66	9.66	9.63		9.70				9.730		
13	10.4	10.8	10.8	10.50	10.43	10.7	10.3	10.70	10.70	10.763 (M15)		10.8 (T1)	10.80
14	11.2				11.20	11.0	11.2			11.45 (I05)	11.030		
15	12.4	12.0	12.0	12.30	12.30		12.3		11.95	12.013 (M16)	12.020	12.0 (T2)	12.00
16	13.3		13.4	13.30	13.30	13.5	13.3	13.35			13.335		

(Credits: T. Kurino, JMA)

AHI Observation Areas and Frequencies in 10 minutes time frame



Full Disk

Interval : **10** minutes (6 times per hour)

Interval: 60 min. ⇨ 10 min.

MTSAT Himawari-8

Region 1 : JAPAN & Vicinity (North-East)

Interval : **2.5** minutes (4 times in 10 min)

Dimension : EW x NS: 2000 x 1000 km

Region 2: JAPAN & Vicinity (South-West)

Interval : **2.5** minutes (4 times in 10 min)

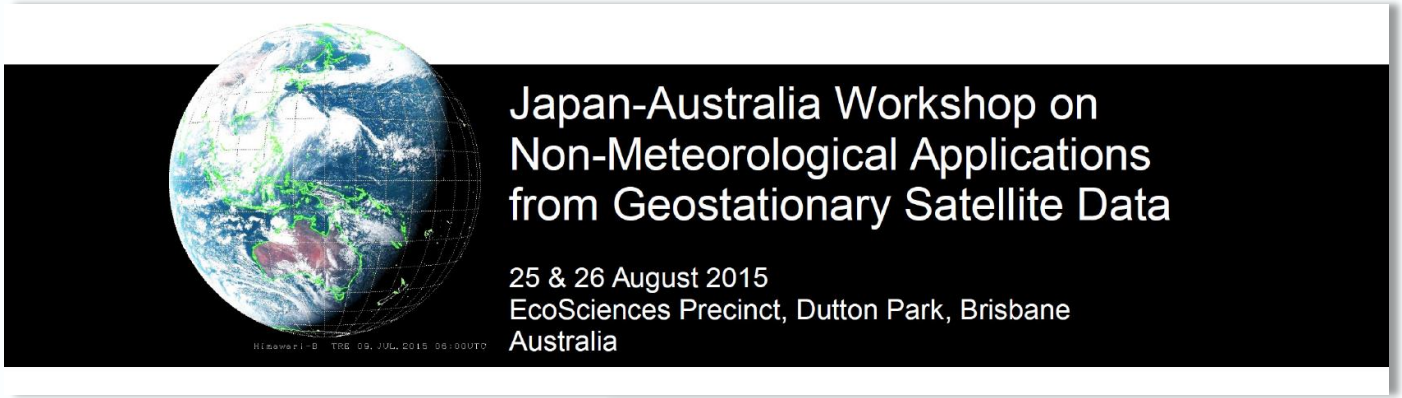
Dimension : EW x NS: 2000 x 1000 km

Region 3: Targeted Area

Interval : **2.5** minutes (4 times in 10 min)

Dimension : EW x NS: 1000 x 1000 km

(Credits: T. Kurino, JMA)



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

Outcome: Detailed catalogue of potential products

http://geoapplications.org/

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
Water-leaving radiance Remote Sensing Reflectance	Artificial Neural Network	CSIRO (4) JCU (5)	0.3 FTE	Yes	Validation data Cloud masking algorithm Glint masking algorithm Glint correction algorithm	GBRMPA BoM CSIRO JCU
	Iterative coupled atmosphere-ocean inversion model	CU (1)	TBD	No		

Land

Coordination: Yoshiaki Honda (Chiba University), Koji Kajiwara (Chiba University), Luigi Renzullo (CSIRO)

Product & Advisory Leads: **(1)** Tom Cudahy (CSIRO), **(2)** Ian Grant (BoM), **(3)** Yoshiaki Honda (Chiba University), **(4)** Koji Kajiwara (Chiba University), **(5)** Tim McVicar (CSIRO), **(6)** Masao Moriyama (University Nagasaki), **(7)** Norman Mueller (GA), **(8)** Luigi Renzullo (CSIRO), **(9)** Peter Scarth (UQ), **(10)** Medhavy Thankappan (GA), **(11)** Catherine Ticehurst (CSIRO), **(12)** Tom Van Neil (CSIRO)

Product/Application	Algorithm type	Developing Institution	Estimated resources	Currently funded	Dependencies	Potential end users
Land Surface Temperature & Emissivity	SWA e.g. adapted from GOES-ABI	CSIRO (with NOAA) (8)	0.3 FTE	No	Solar zenith, view zenith, cloud mask, land mask, precipitable water, water vapour profile,	BoM CSIRO JMA
	Semi-analytical	Nagasaki University (6)	0.2 FTE (TBC)	Yes (partially)		

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 optical depth Aerosol type Ångström exponent Surface reflectance BRDF Cloud mask (BoM only)	CSIRO GEO-LEO Algorithm (physical model via look-up tables)	CSIRO (8)	0.2 FTE	TBD	Validation data Cloud masking (algorithm or product)	CSIRO GA BoM NSW DEH JMA MOE
	MAIAC Algorithm (physical model via look-up tables)	BoM (with NASA) (1)	0.2 FTE + $15k	TBD		
	Deep-Blue (physical model via look-up tables)	UQ (with NASA) (2)	1 FTE	If DECRA		

Non met-applications Himawari-8

Land

Land surface temperature
Flood mapping
Surface reflectance – BRDF corrected
Vegetation Indices
Evapotranspiration
Land surface silicate – mineral particle size
Hot spots (wild fire)

Oceans

Water-leaving radiance
Chlorophyll-a
Total Suspended Matter
Turbid flood plume mapping
Algal bloom detection

Atmosphere

Aerosol optical depth, type
Volcanic ash
Surface reflectance – BRDF corrected

Envisioned NMA study outcomes

1. Trends & Outlook for Geostationary EO Satellite Capabilities – Catalogue of CEOS/CGMS agency missions, instruments, measurements, data volumes etc.
2. Inventory of relevant non-met applications and review of initiatives being undertaken by CEOS and related agencies – atmosphere, land and ocean (build on Japan-Australia bilateral effort initiated in 2015)
3. Benefits of synergistic use of GEO-LEO systems
4. Identify key opportunities and benefits to CEOS and CGMS agencies as well as challenges
5. Recommendations for the way forward tactically and strategically for CEOS and its agencies

Opportunities & Challenges

Constellations of EO satellites are expanding – becoming more diversified

MTG, Kompsat-2A, GOES-R, Feng-Yun-4, (India, Russia?)

Satellite inter/cross-calibration,

Data harmonization

With standards agreed by GSICS

Inputs from WGCV, CGMS agencies and GSICS

(side meeting at CGMS-44, June)

Synergies with LEO satellites

Algorithm advancements

Inter/cross-calibration

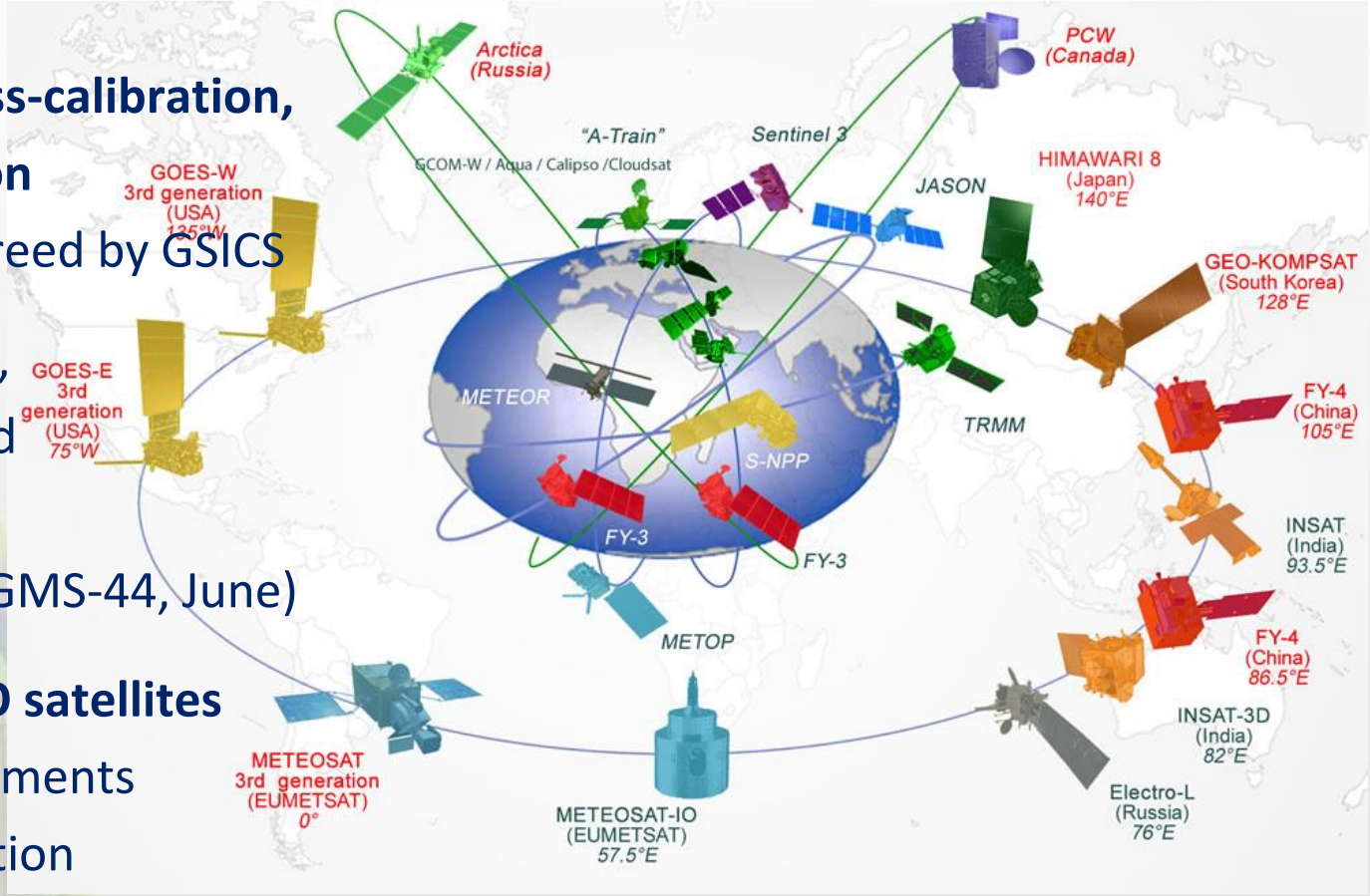


Image credit WMO