Comparison between MERIS and GOCI in regional seas around Korea

Young-Je Park, Yu-Hwan Ahn, Jung-Mi Yoo
KOSC staff

Korea Ocean Satellite Center (KOSC),
Korea Ocean Research and Development Institute (KODI)

19-20 Oct 2011 CoastColour UCM3, Lisbon, Portugal

Outline

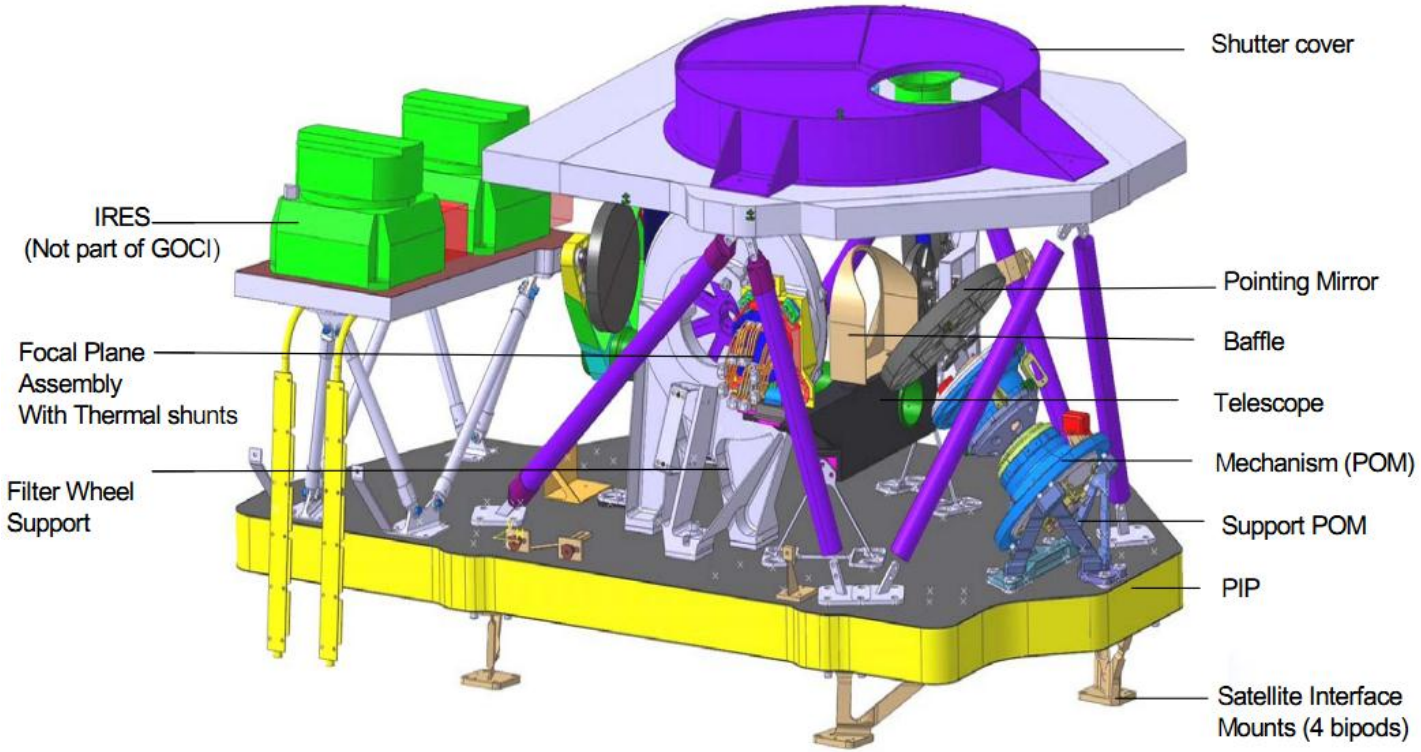
- GOCI overview
- Some interesting GOCI images
- Inter-slot radiance discrepancy in GOCI L1B image
- Image-based GOCI and MERIS comparison

GOCI (Geostationary Ocean Colour Imager) Project

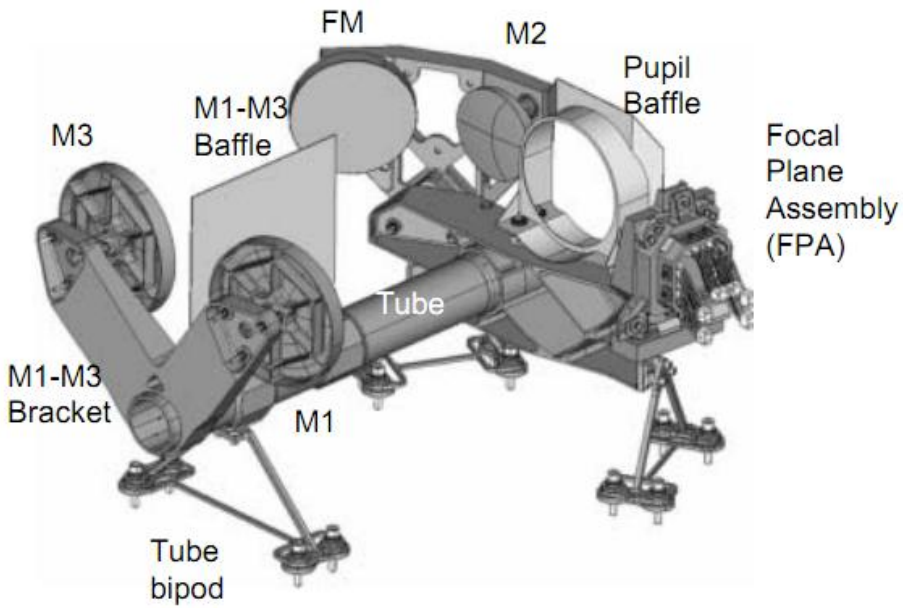
- GOCI is on board the Korean geostationary satellite, COMS, with other two payloads, **Meteorological Imager** **and** **Ka-band satellite communication**.
- GOCI was developed for 2003-2010 by **Korea Aerospace Research Institute (KARI)** and **Astrium, France** as a Korean space program. Supported by Ministry of Land, Transport and Maritime affairs and supervised by **Yu-Hwan Ahn**, KORDI.
- GOCI was **successfully launched** on 27 June 2010 by Ariane-V at the Kourou space centre.

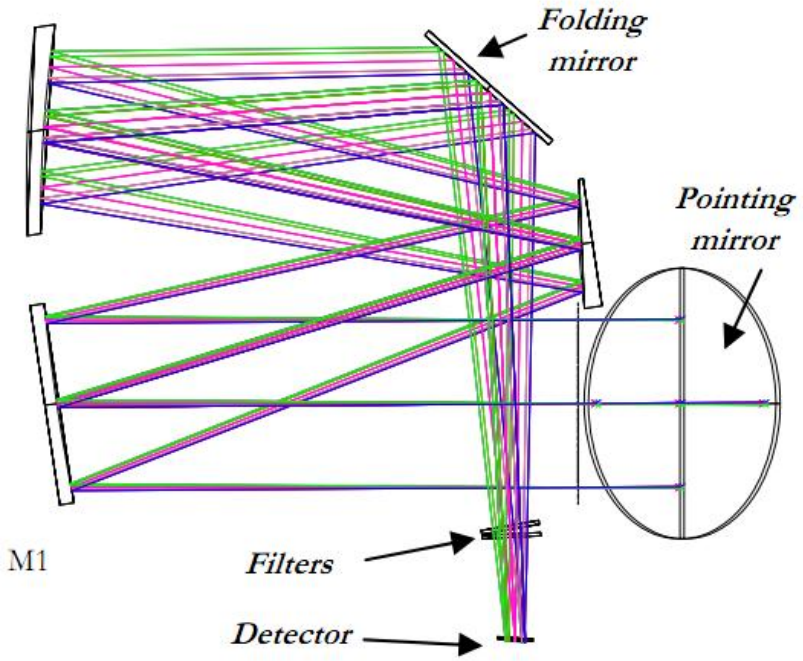
- KOSC (Korea Ocean Satellite Center) of KORDI is in charge of **initial test and follow-on operational mission** (mission planning, data acquisition and distribution, Cal/Val, algorithm development and applications).

GOCI sensor


Shutter cover
IRES
(Not part of GOCI)
Pointing Mirror
Focal Plane
Assembly
With Thermal shunts
Baffle
Telescope
Filter Wheel
Support
Mechanism (POM)
Support POM
PIP
Satellite Interface
Mounts (4 bipods)

GOCI optical layout

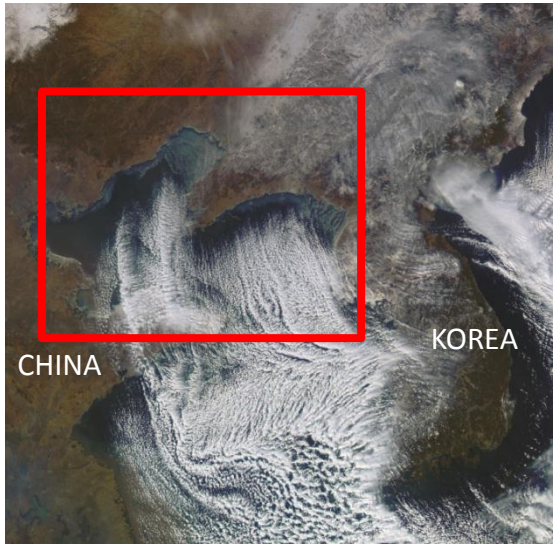




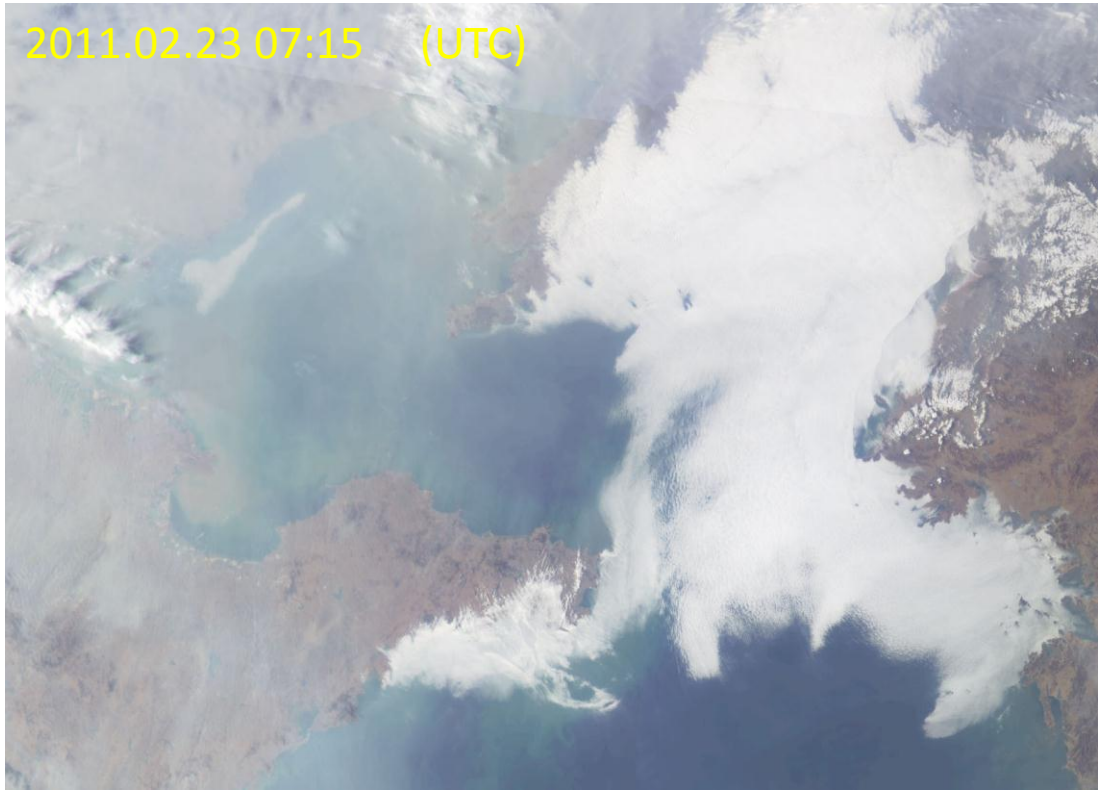
Three Mirror Anastigmatic Telescope

GOCI image example: Sea fog in the northern Yellow Sea

19~23 Feb 2011



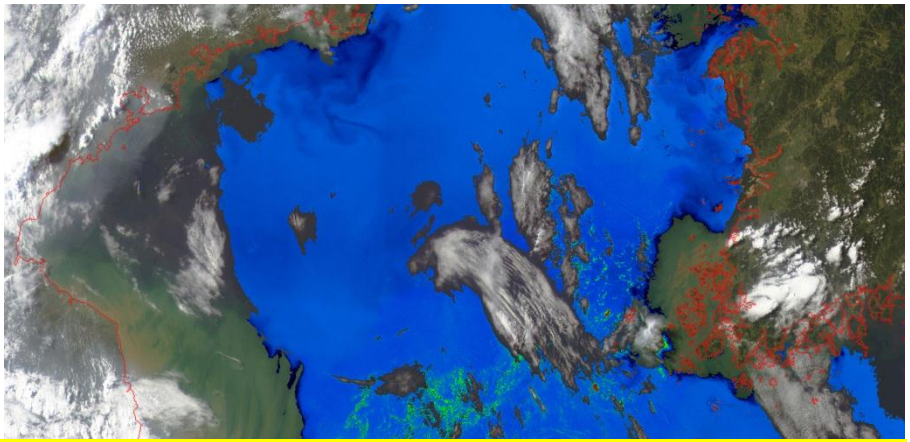
GOCI observed dynamic movement of sea fog



GOCI image example: Massive green algae floating on Yellow Sea

13 June, 19-20 July, 2011

13 June : First observed near Chinese coast
19-20 July: Widely spread over southern Yellow Sea



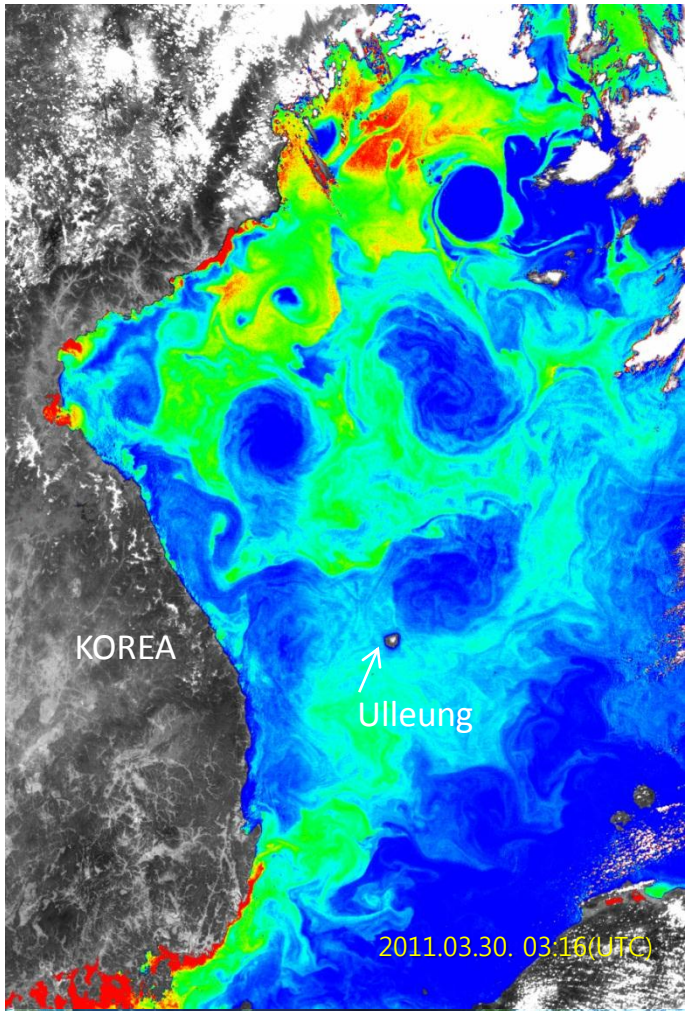
(a) 7월 10일 흑산도 인근 해역
한국해양연구원 온누리호 촬영

(b) 7월 16일 동중국해(31N, 125E)
한국해양연구원과 일본 나가사키 대학 합동 조사에서 촬영

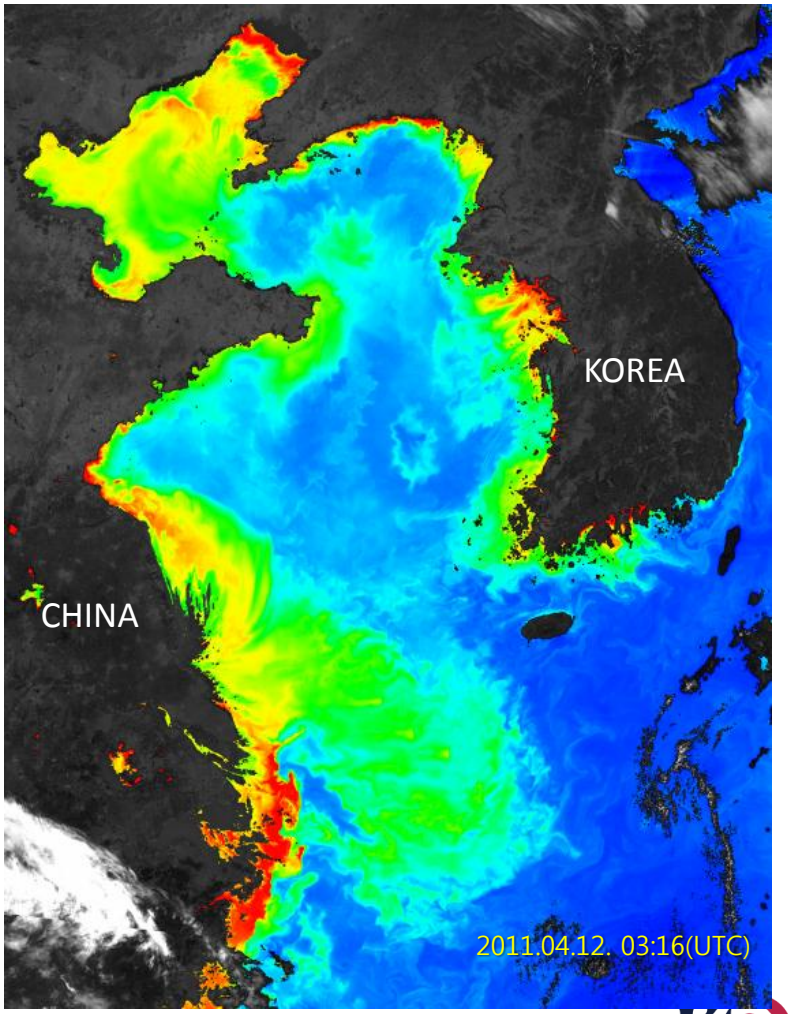
(c) 7월 21일 흑산도 인근 해역
(34N°31.9, 125E°27.8)
전남대학교 김광용 교수 연구팀 서해어업관리단 무궁화 2호에서 촬영

GOCI image example: Spring algal blooms in East Sea and Yellow Sea

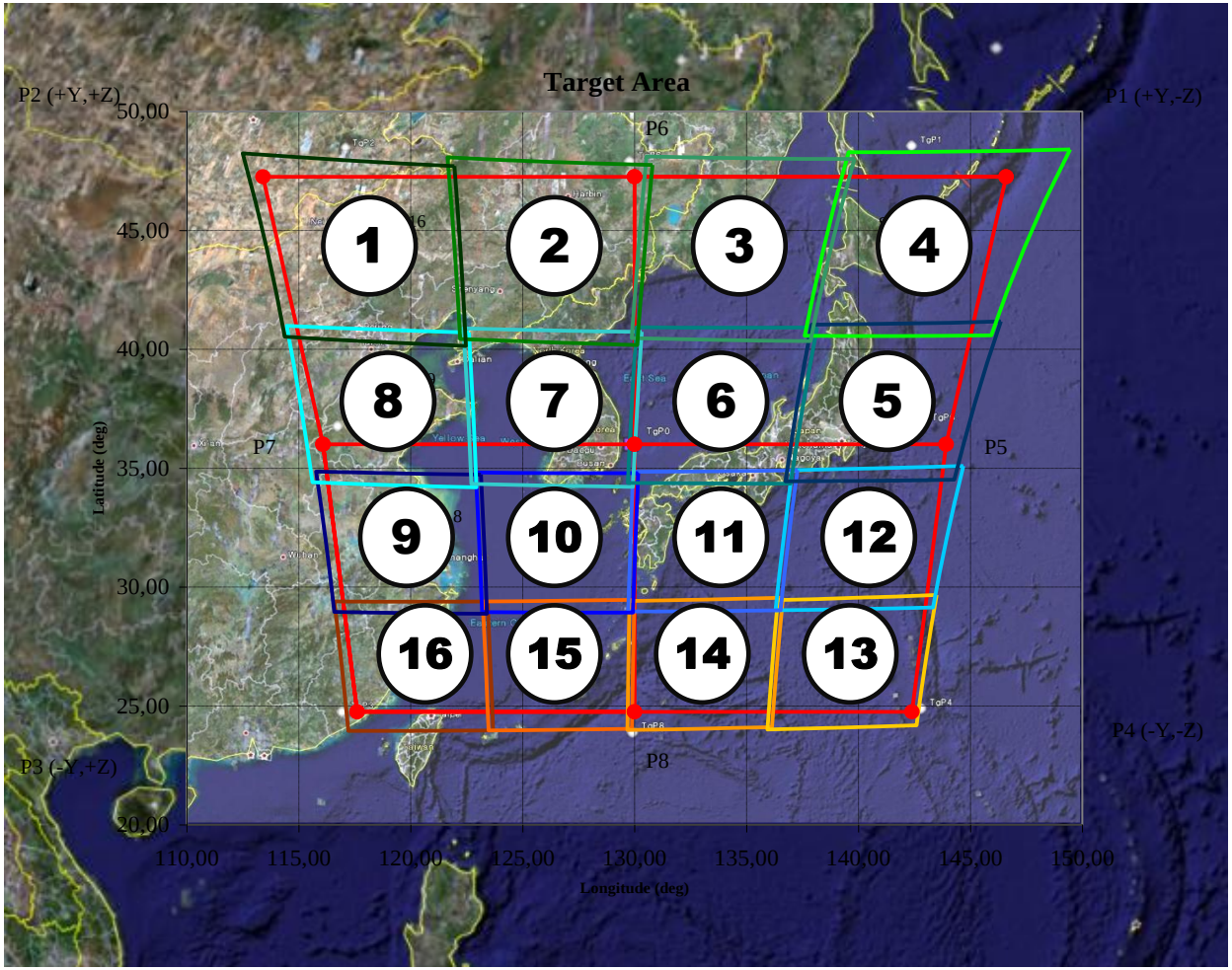
30 Mar 2011 (East Sea)



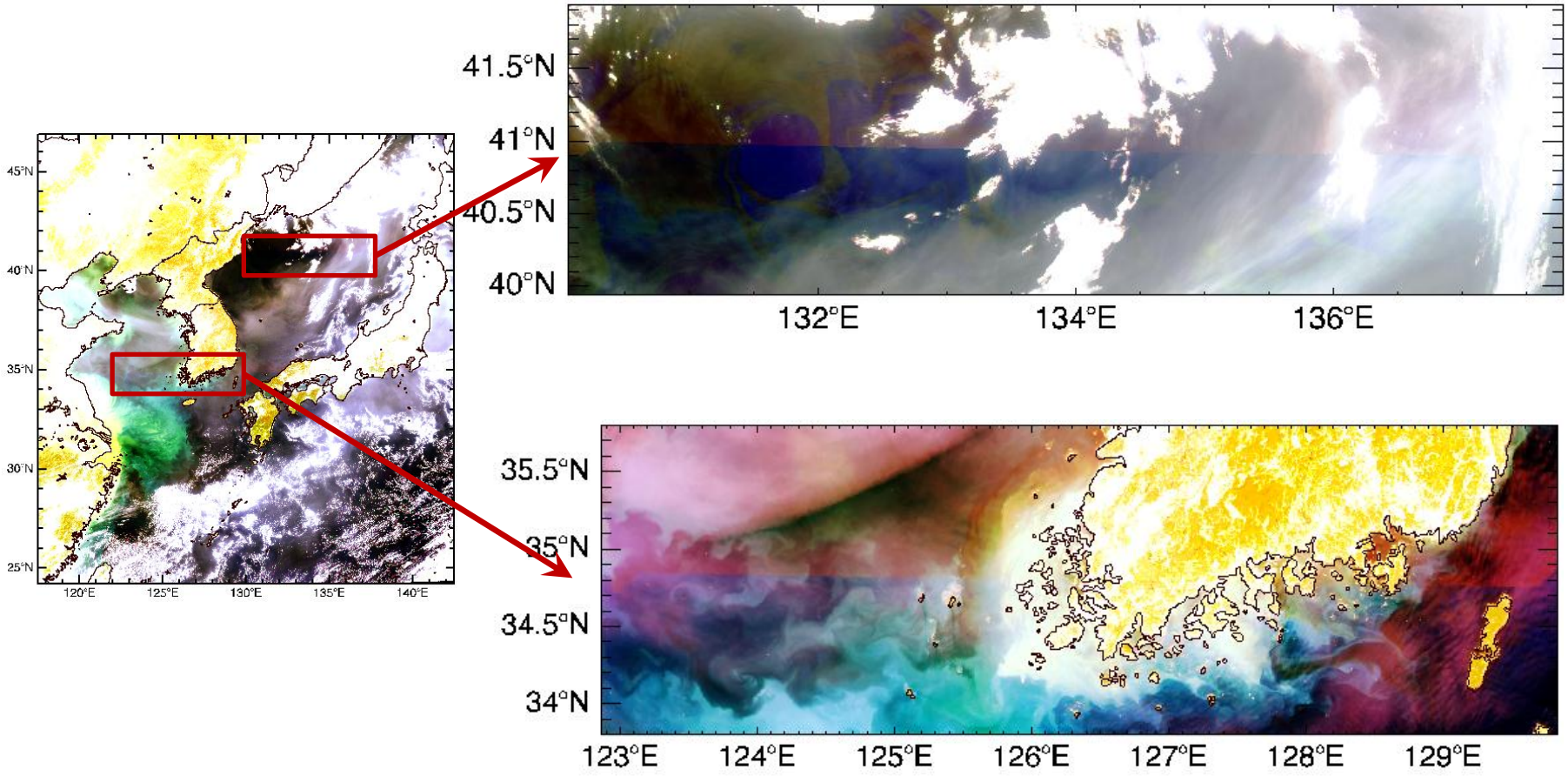
12 April 2011 (Yellow Sea)



GOCI slots imaging sequence

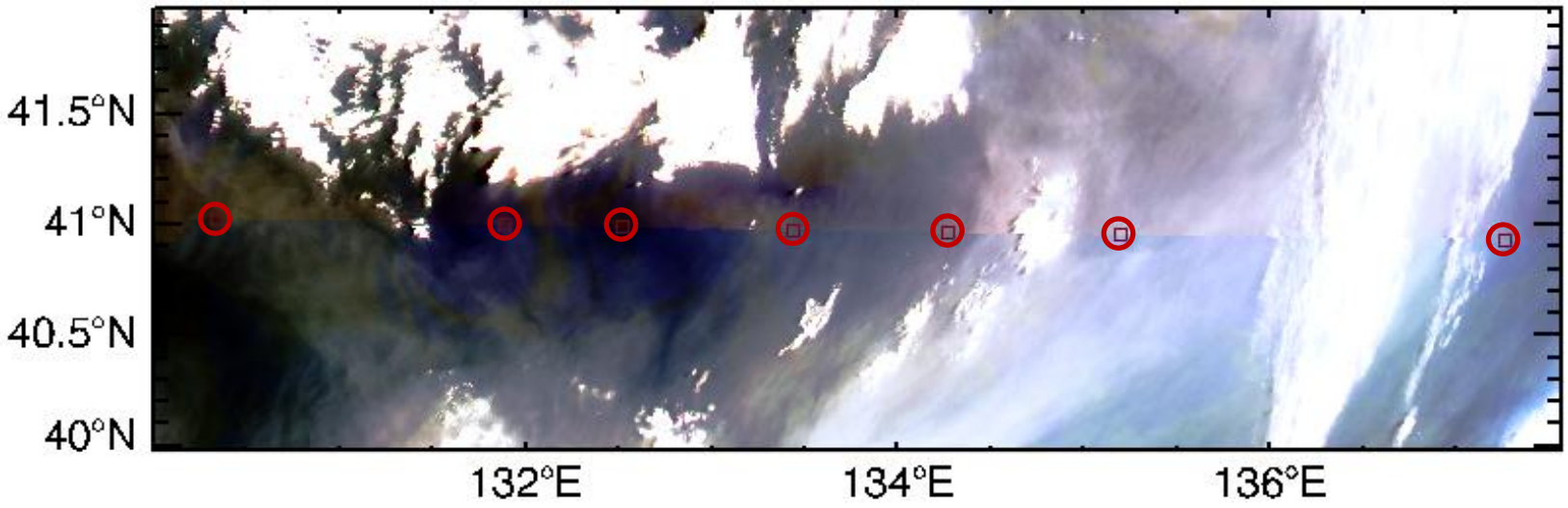


Inter-slot discrepancy

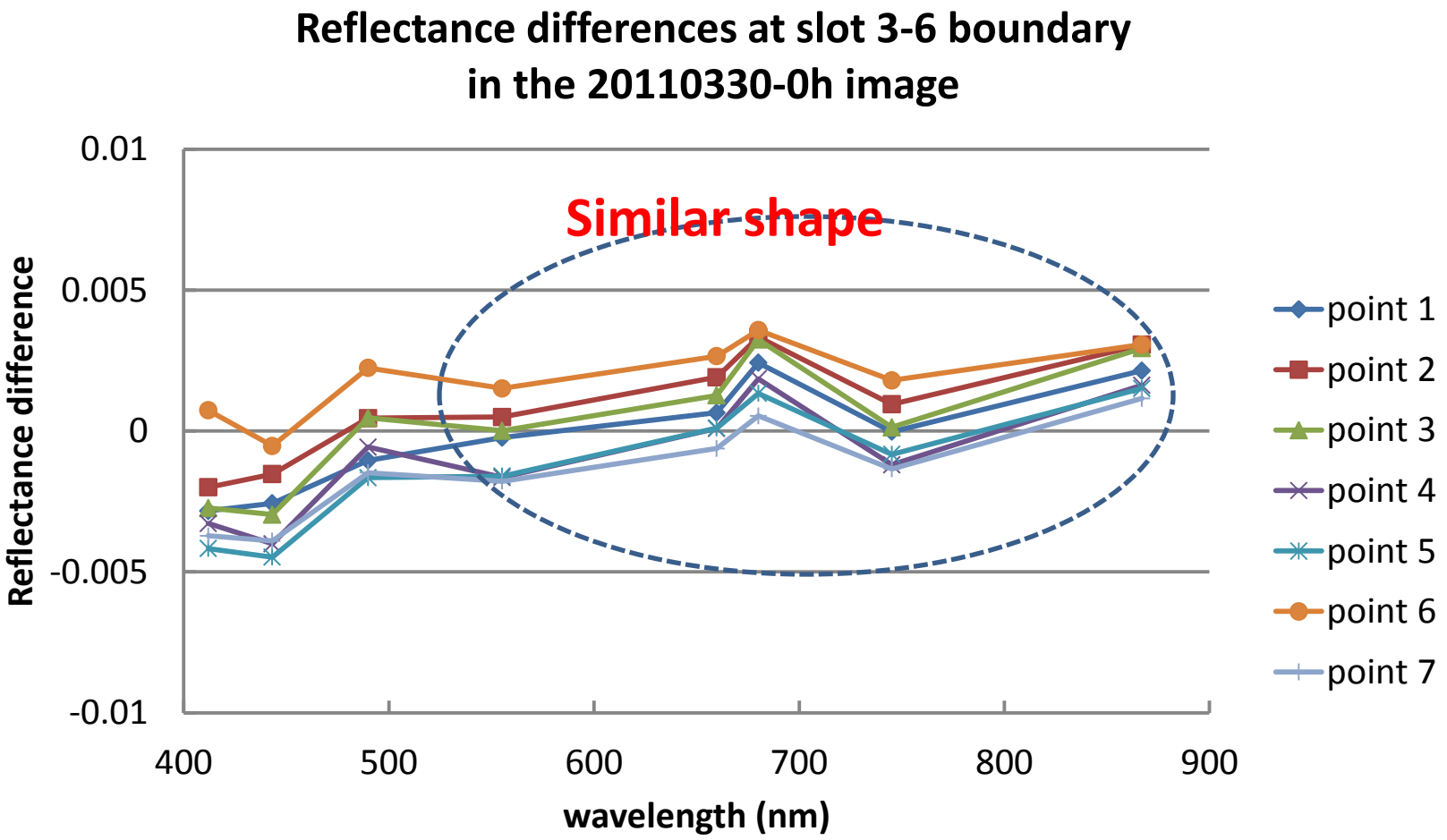


Inter-slot difference:
Variability within a slot border

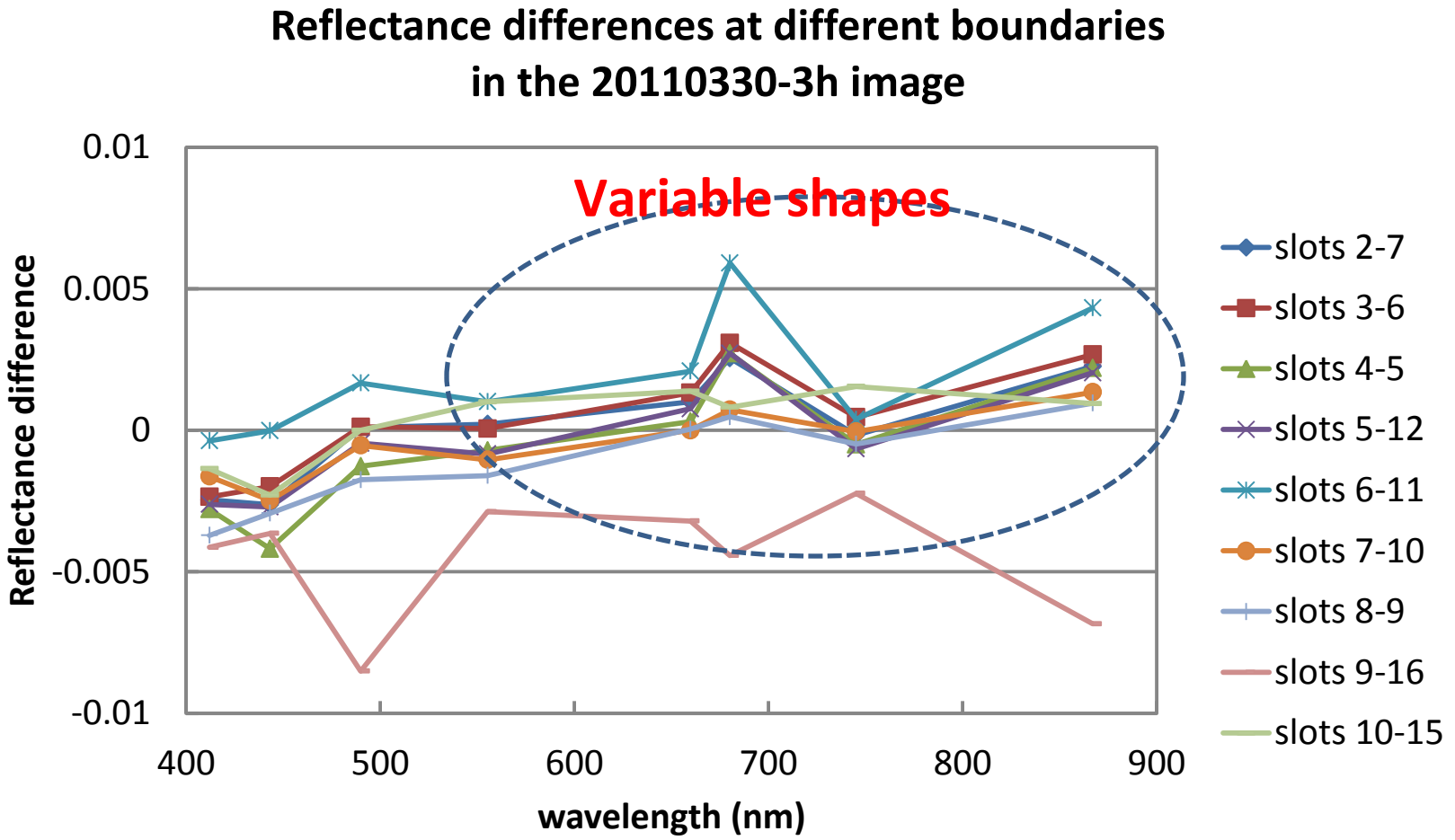
- 20110330_0h image: slot 3-6 border



Inter-slot difference
Variability within a slot border

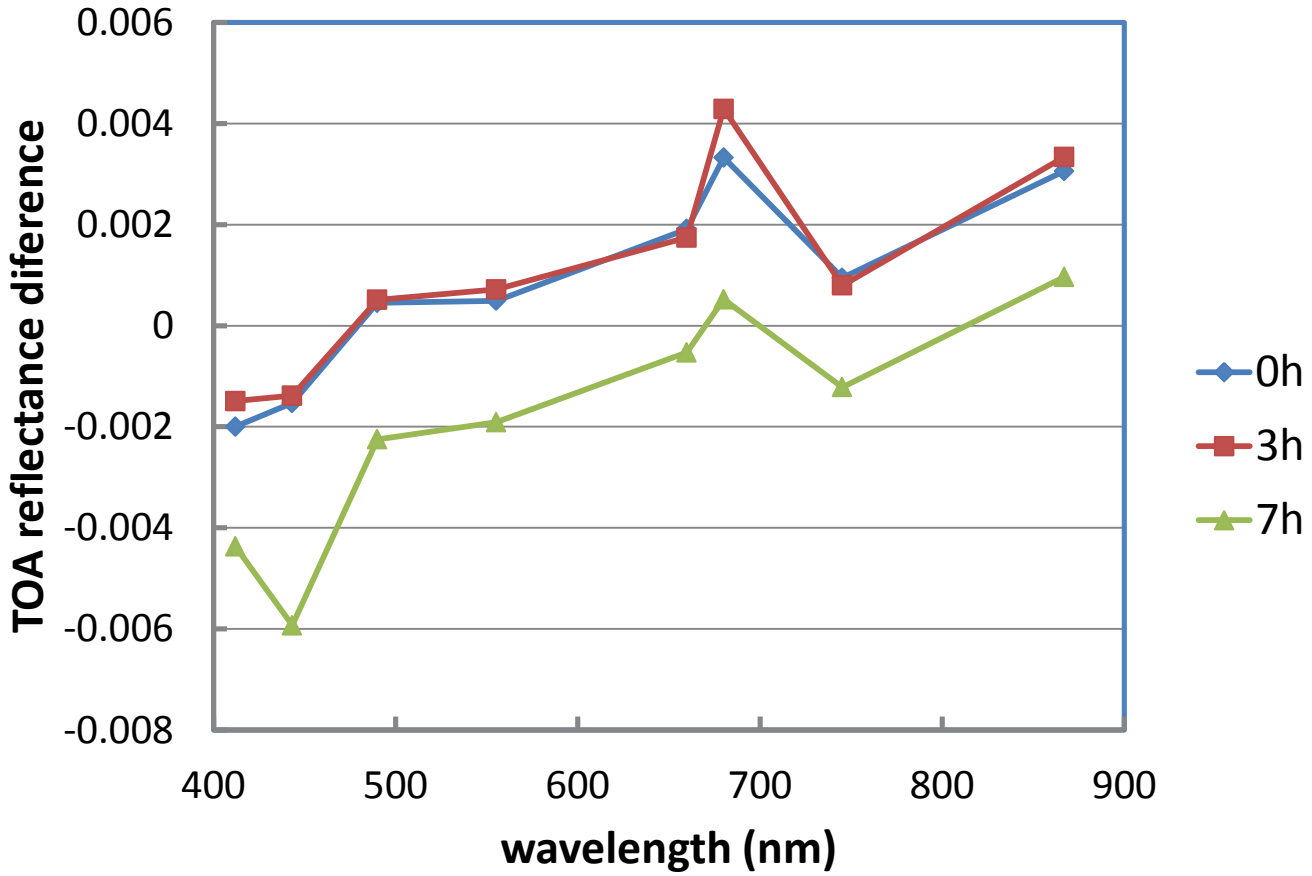


Inter-slot difference
Variability across different slot borders



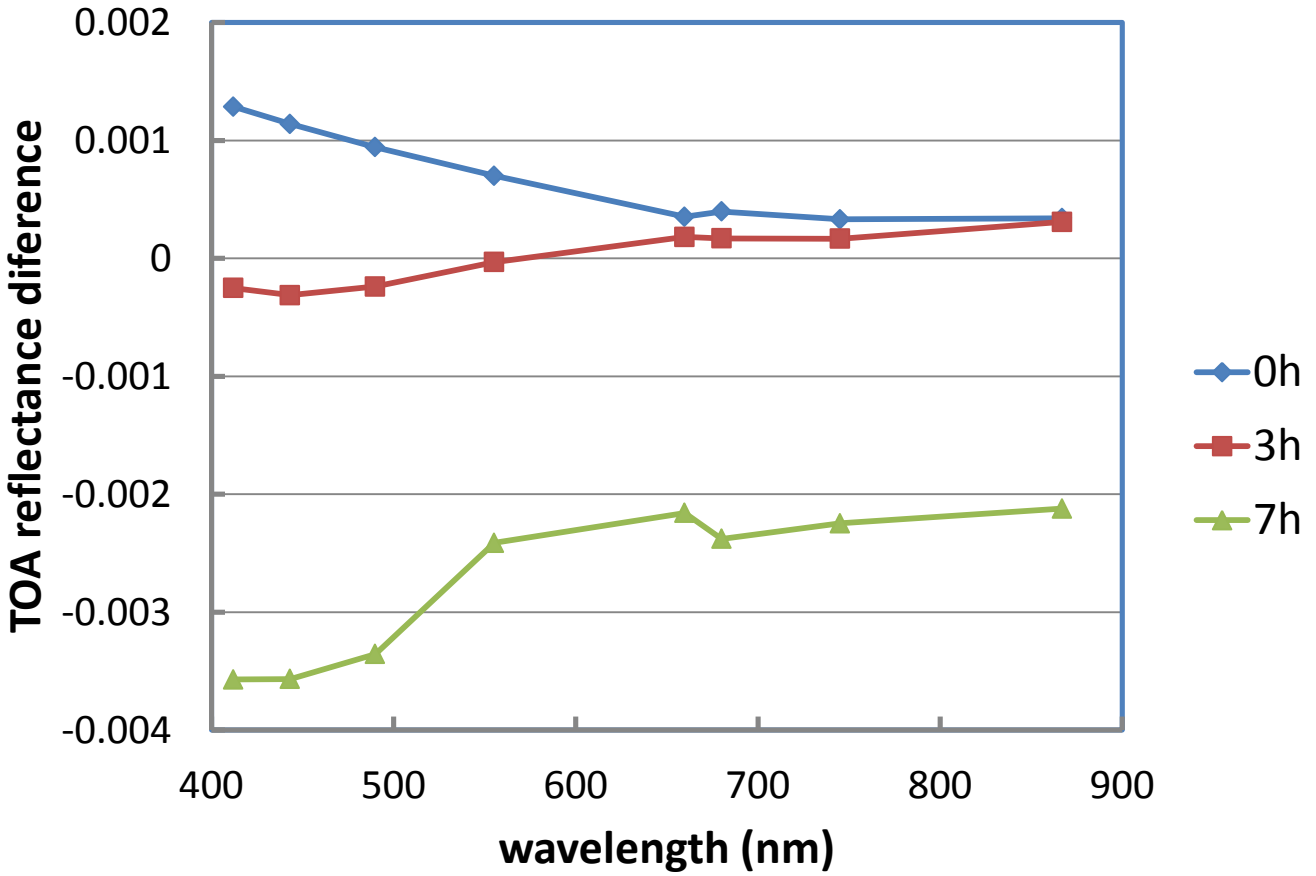
Inter-slot difference:

Variability with observation hours from GOCI image



Inter-slot difference:

Variation with observation hours - 6S Simulation with AOT550=0.5



Weighted average technique
(GOCI 20110412-07h, South Japan)

[Original]

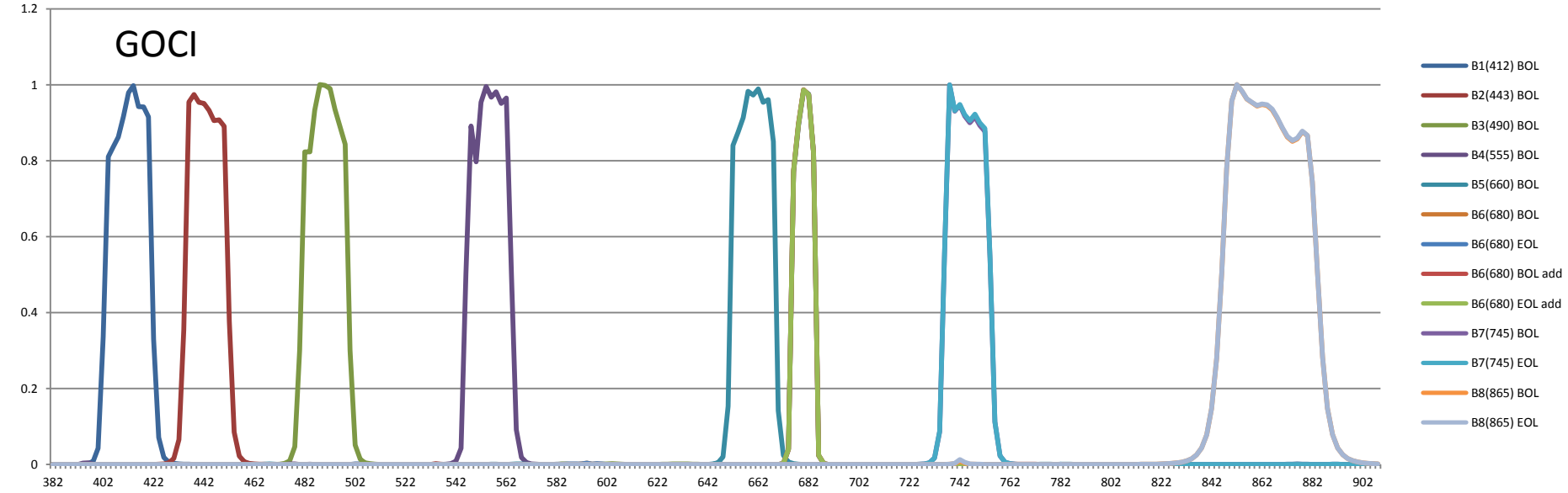
[Weighted average]

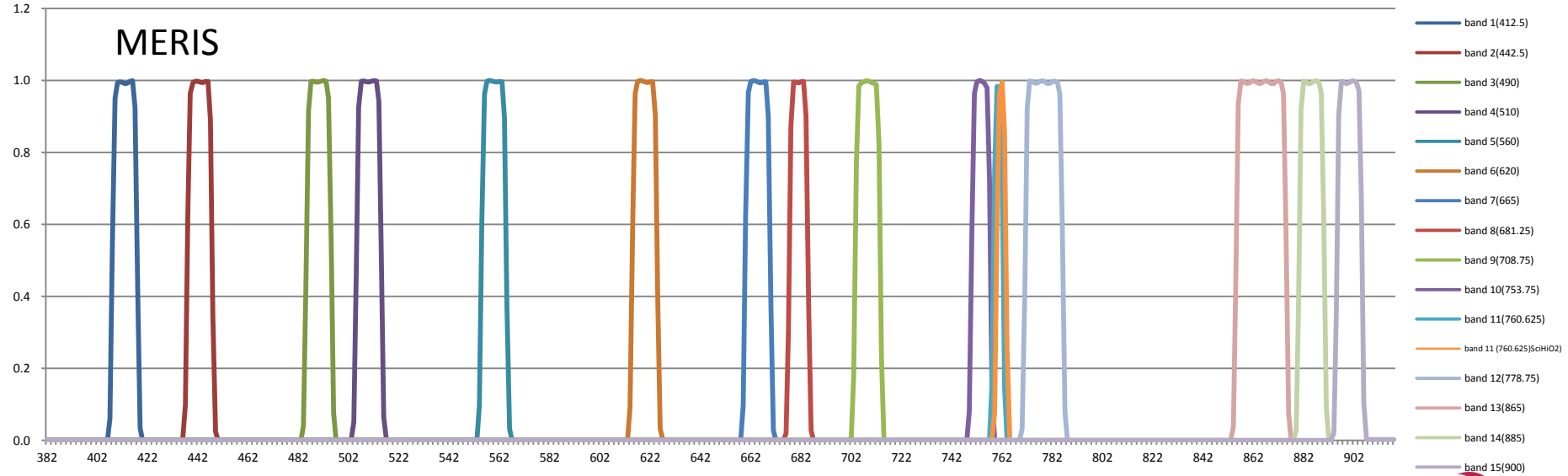
GOCI and MERIS

	GEO/GOCI	LEO/MERIS
Altitude	35,857 km	800 km
Sensor type	Staring-frame capture	Push-broom
Spatial resolution	500 m	300m – 1200 m
Spectral range	400-900 nm	390-1040 nm
Temporal resolution	1 hour	3 day
Sun-Satellite position	Variable	Stable
Coverage	Local (2500km x 2500km)	Global (296km x 296km(FR), 575km x 575km(FR), 1150km x 1150km(RR))
Bio-optical algorithm	Local	Global

Comparison spectral band of GOCI and MERIS

GOCI			MERIS		
Ch.	Band Center(nm)	Band width(nm)	Ch.	Band Center(nm)	Band width(nm)
B1	412	20	B1	412.5	10
B2	443	20	B2	442.5	10
B3	490	20	B3	490	10
			B4	510	10
B4	555	20	B5	560	10
			B6	620	10
B5	660	20	B7	665	10
B6	680	10	B8	681.25	7.5
			B9	708.75	10
B7	745	20	B10	753.75	7.5
			B11	760.625	3.75
			B12	778.75	15
B8	865	40	B13	865	20
			B14	885	10
			B15	900	10

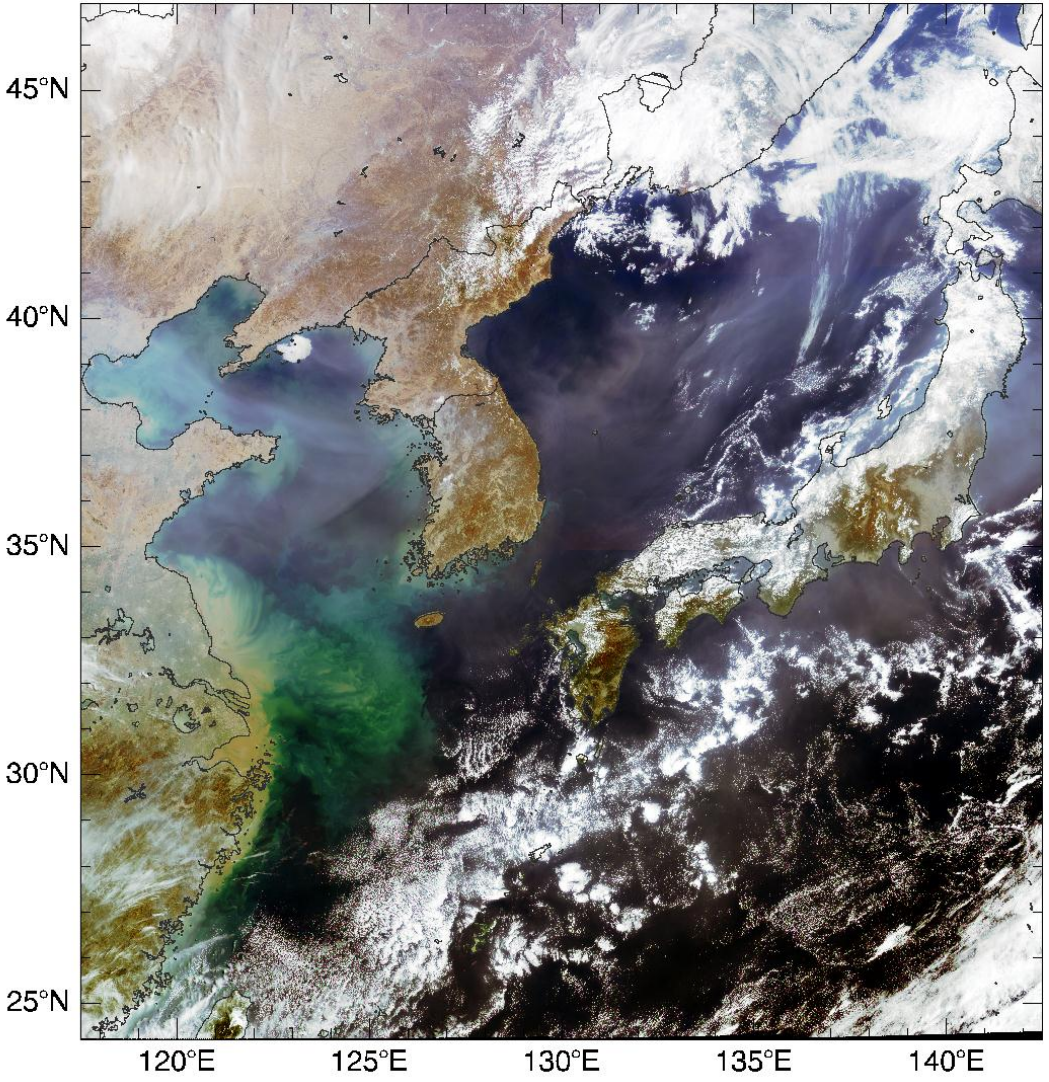

GOCI
1.2
1
0.8
0.6
0.4
0.2
0
382 402 422 442 462 482 502 522 542 562 582 602 622 642 662 682 702 722 742 762 782 802 822 842 862 882 902
B1(412) BOL
B2(443) BOL
B3(490) BOL
B4(555) BOL
B5(660) BOL
B6(680) BOL
B6(680) EOL
B6(680) BOL add
B6(680) EOL add
B7(745) BOL
B7(745) EOL
B8(865) BOL
B8(865) EOL

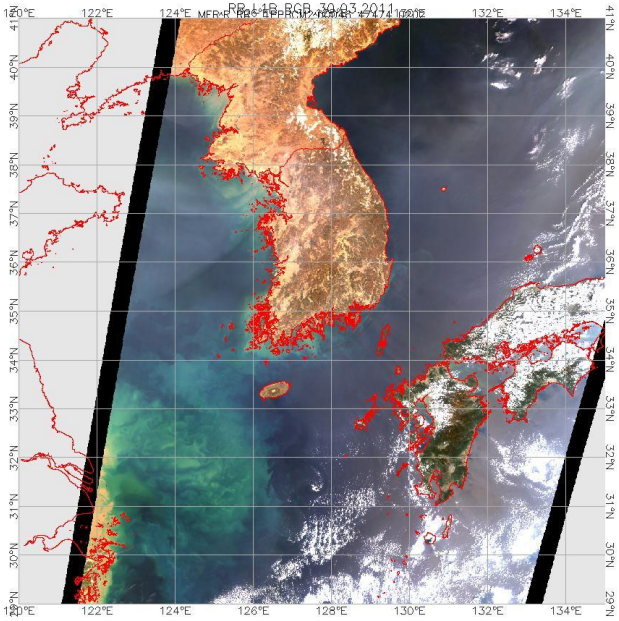

MERIS
1.2
1.0
0.8
0.6
0.4
0.2
0.0
382 402 422 442 462 482 502 522 542 562 582 602 622 642 662 682 702 722 742 762 782 802 822 842 862 882 902
band 1(412.5)
band 2(442.5)
band 3(490)
band 4(510)
band 5(560)
band 6(620)
band 7(665)
band 8(681.25)
band 9(708.75)
band 10(753.75)
band 11(760.625)
band 11 (760.625)SciHiO2)
band 12(778.75)
band 13(865)
band 14(885)
band 15(900)

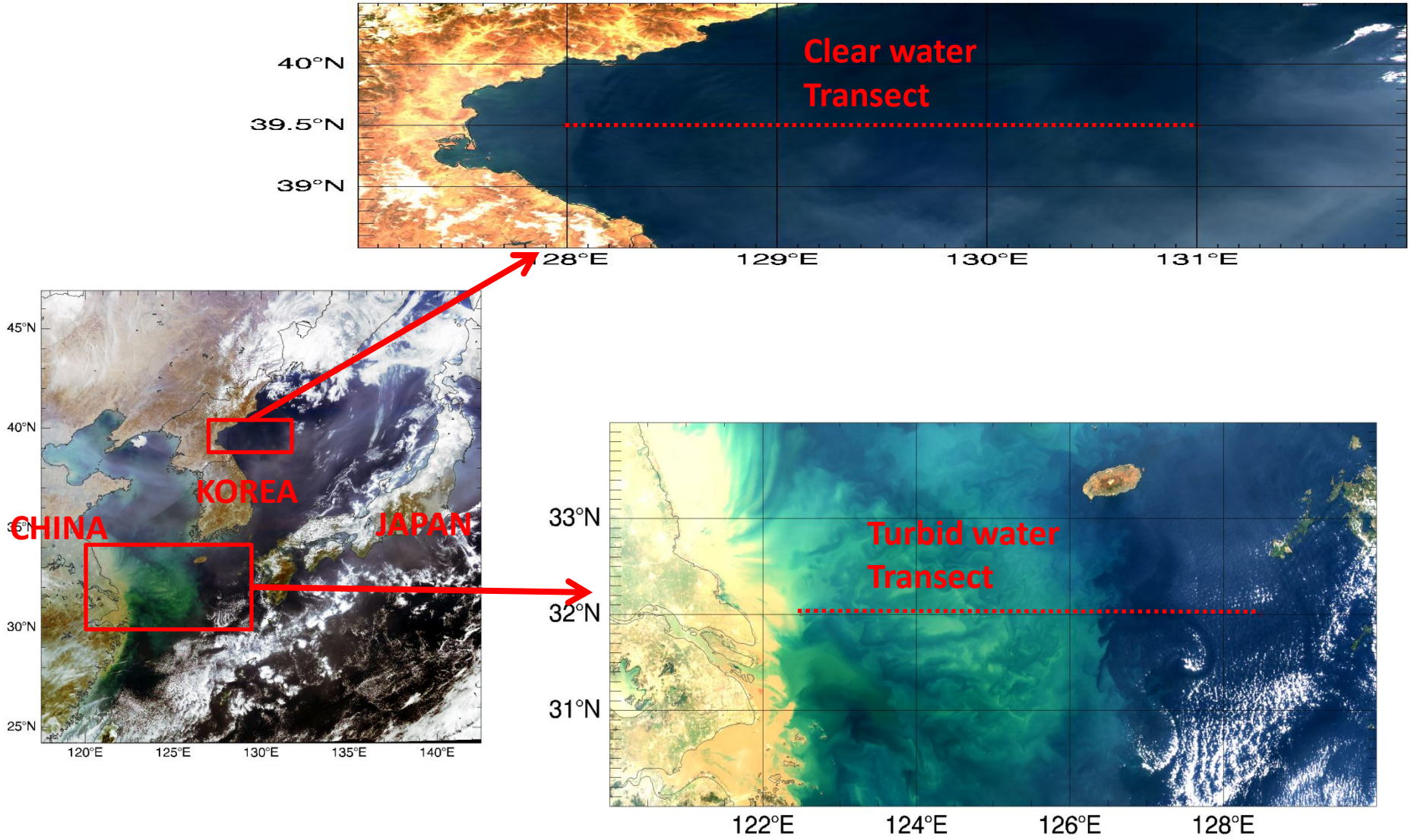
Comparison between GOCI and MERIS

- Image date: 20110330
- Radiometric data only
- MERIS data:
  - RR data downloaded from the MERCI website
  - L2 data downloaded from the MERCI website
  - L2 data processed using C2R processor in BEAM

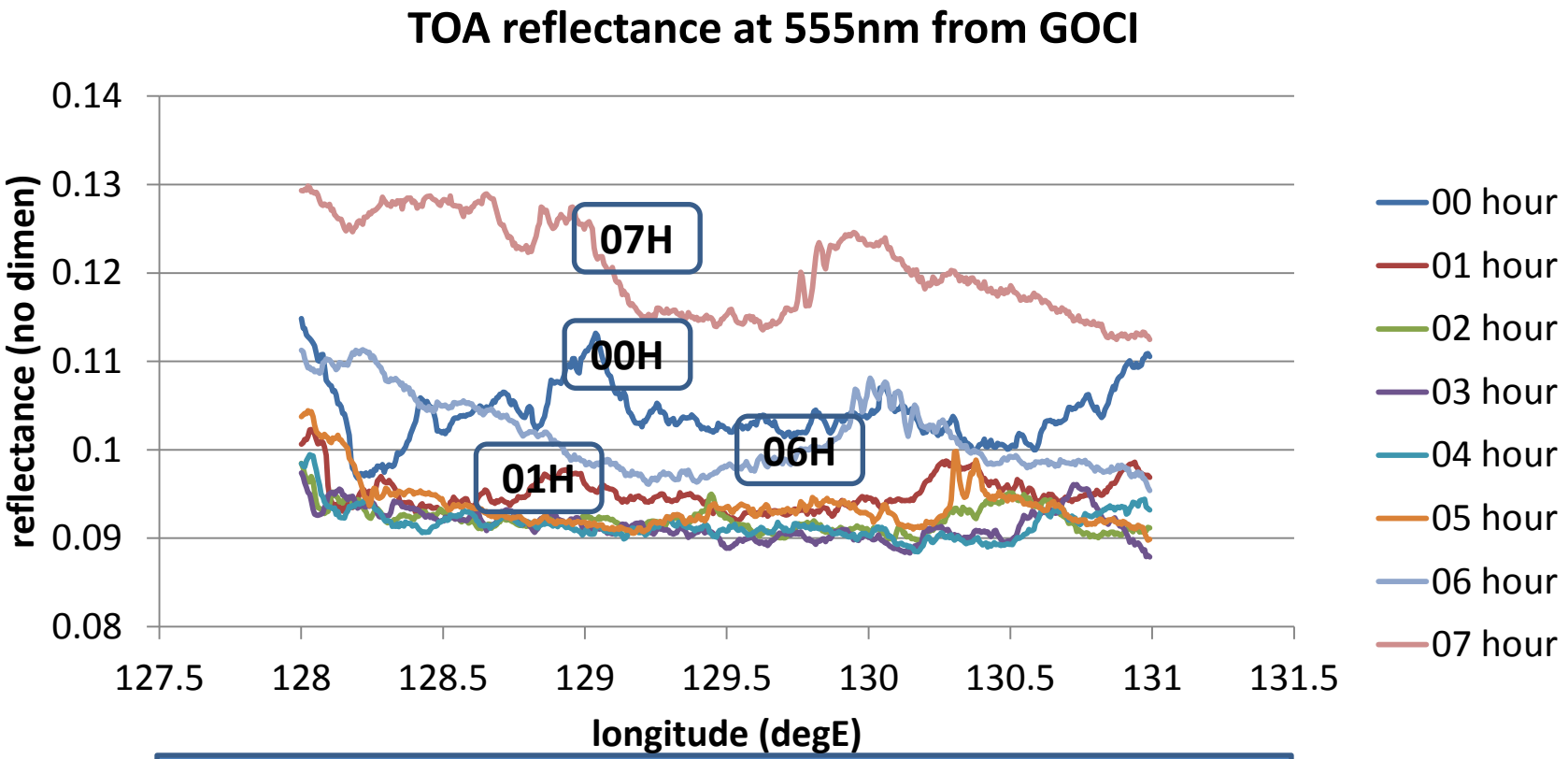
20110330 image





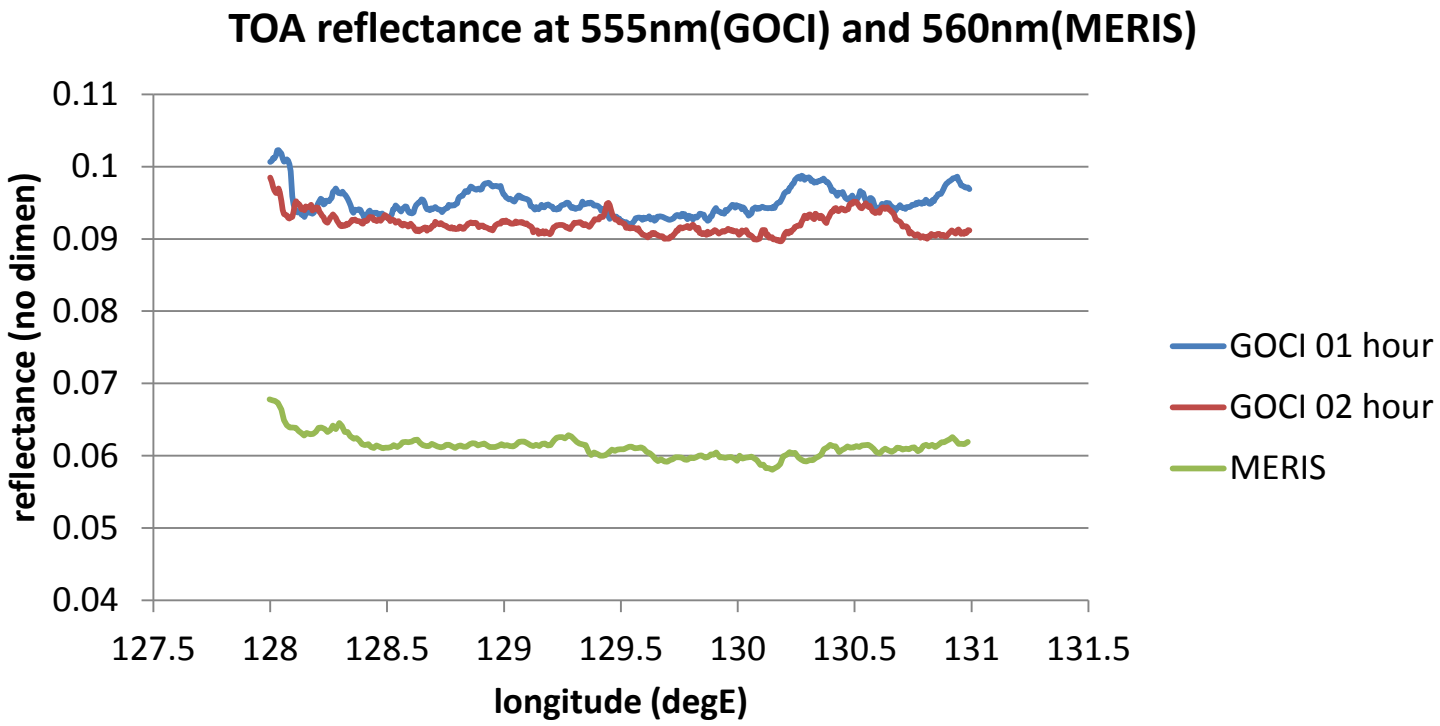

Clear water
Transect
40°N
39.5°N
39°N
128°E
129°E
130°E
131°E
KOREA
CHINA
JAPAN
45°N
40°N
30°N
25°N
120°E
125°E
130°E
135°E
140°E
Turbid water
Transect
33°N
32°N
31°N
122°E
124°E
126°E
128°E

Clear water: GOCI hourly data

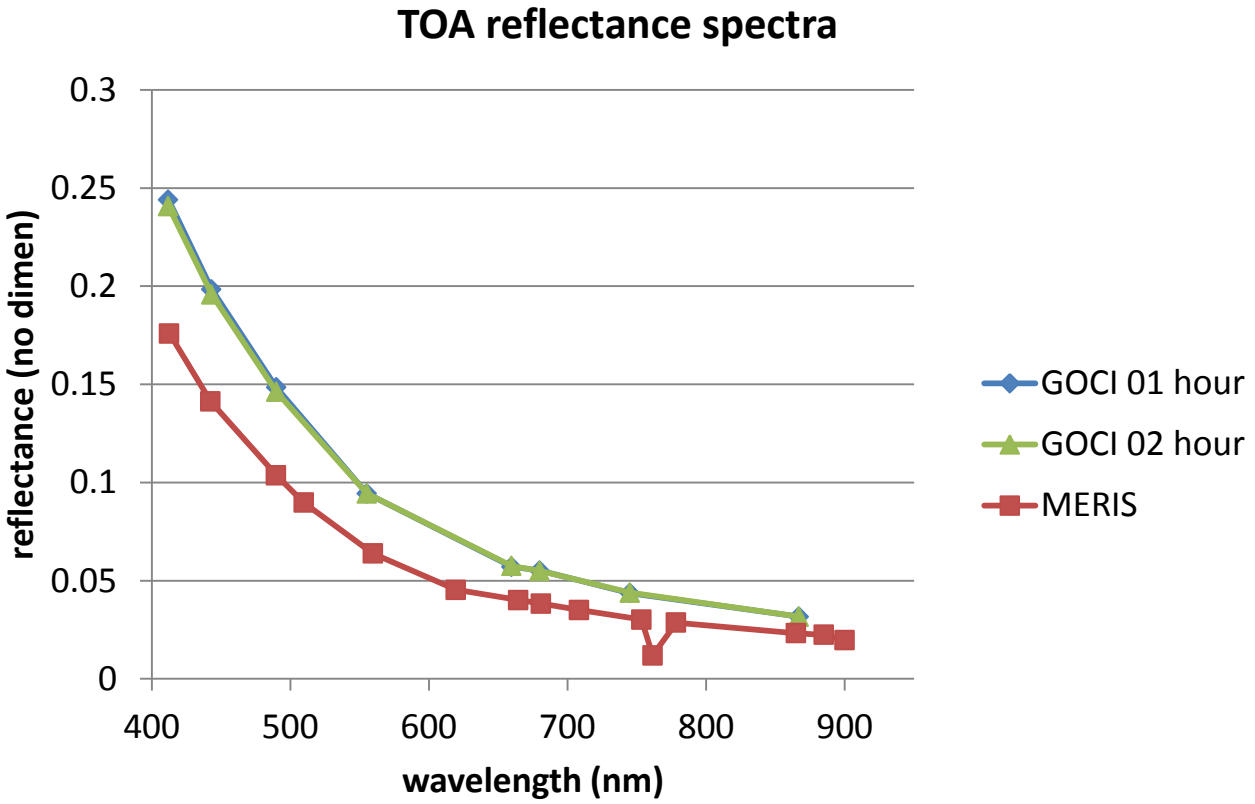


Reflectance:	07h	> 00h = 06h	> 01h	> 02h,	03h,	04h,	05h	
Solar Zenith:	64	> 55 =	54	> 45 >	39,	36,	38,	45
Rel. Azimuth:	70	62	58	47	27	2	22	42

Clear water: GOCI vs MERIS



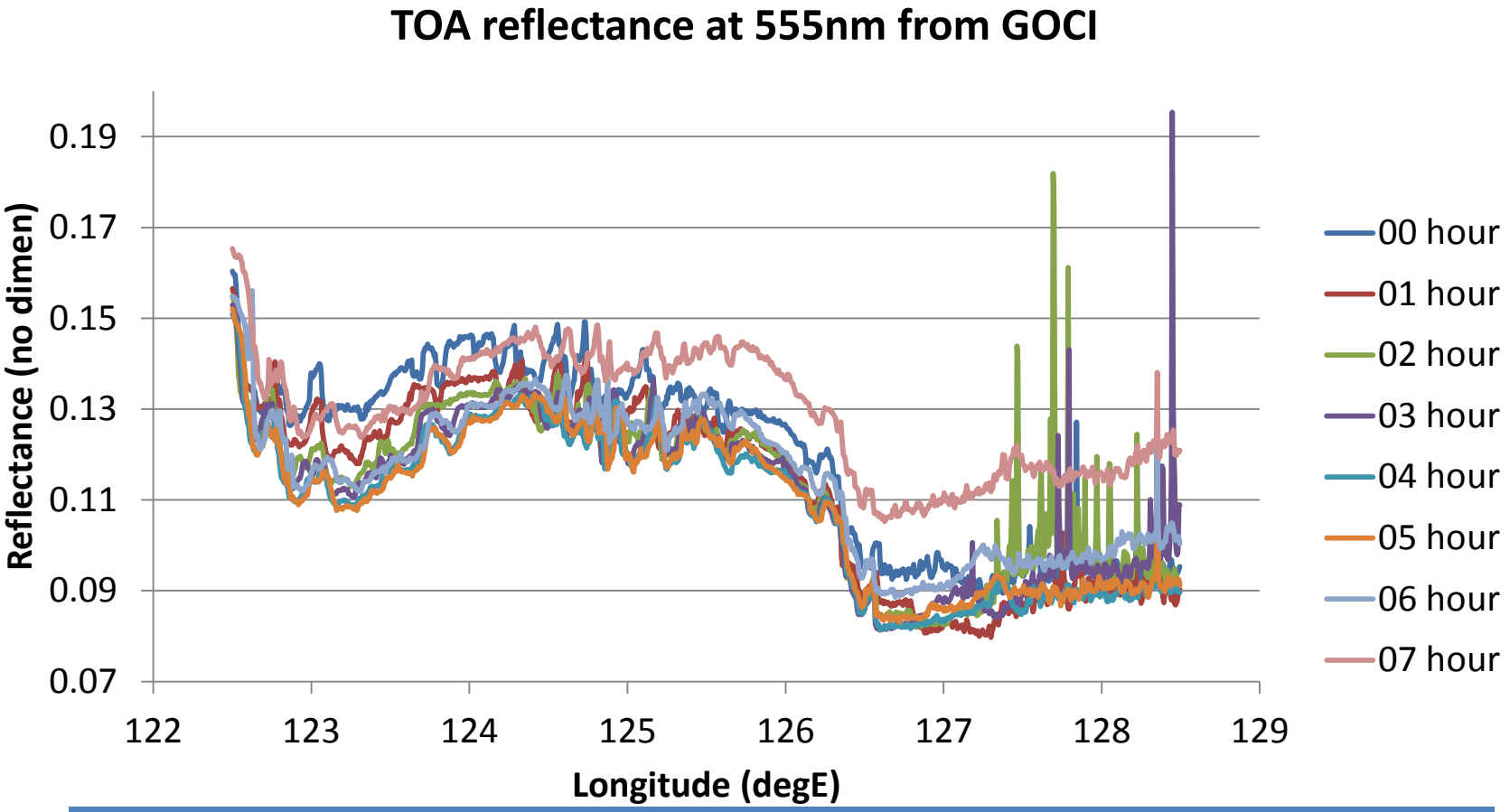
Clear water: GOCI vs MERIS



Reflectance: GOCI > MERIS

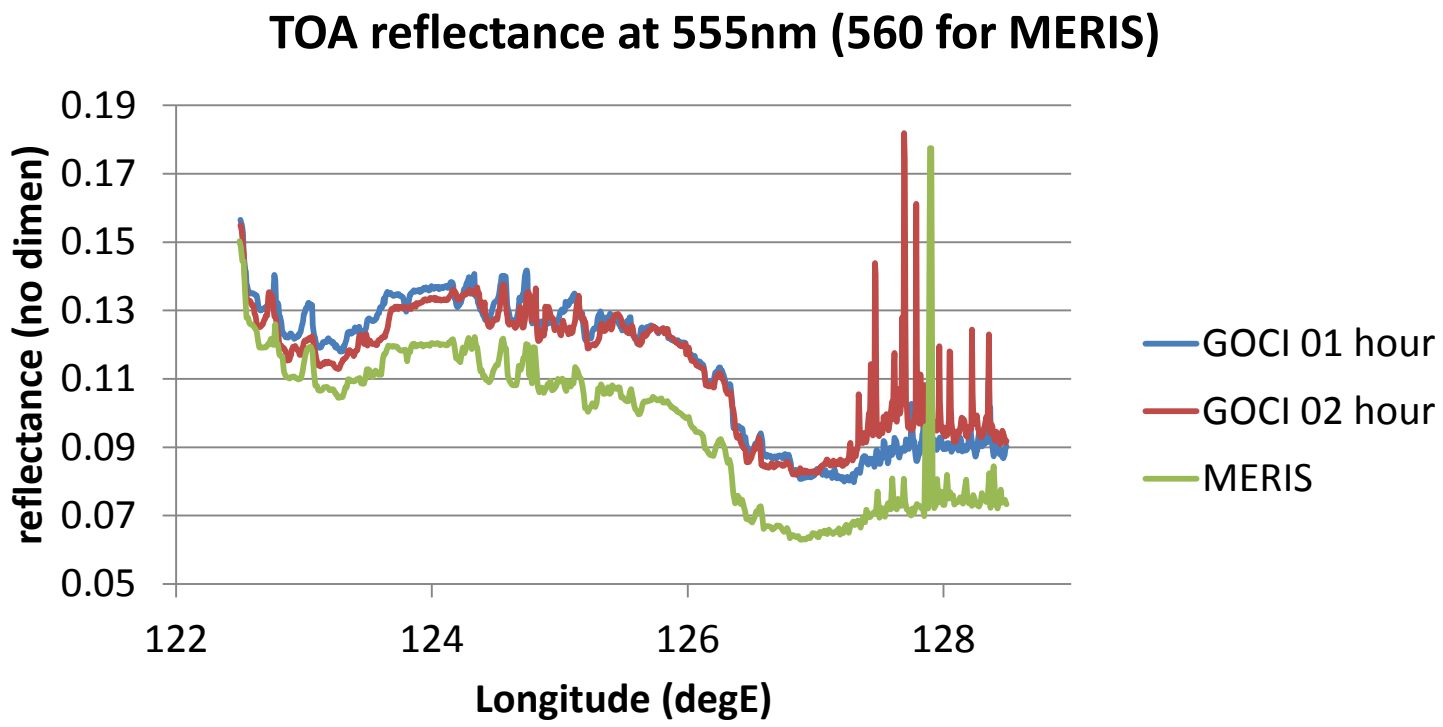
Sensor zenith: 46 5

Turbid area: GOCI hourly data



The variation in the GOCI hourly measurements
- primarily due to sun angle change
- probably due to temporal variation in suspended sediment concentration

Turbid area: GOCI vs MERIS



Difference between GOCI and MERIS is mainly due to viewing geometry (viewing zenith)

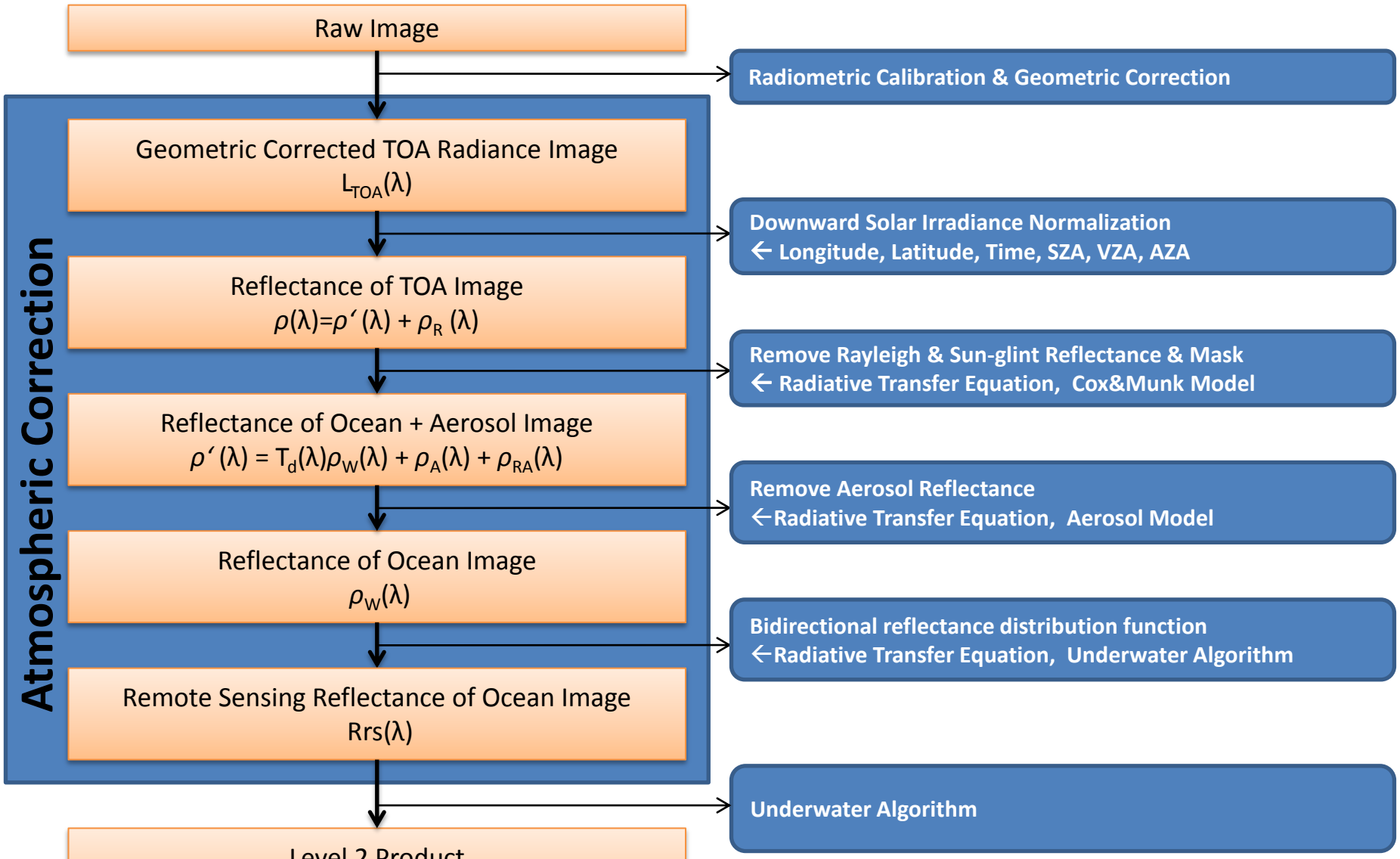
The reflectances from both seem to show very well the turbidity variation

GOCI atmospheric correction

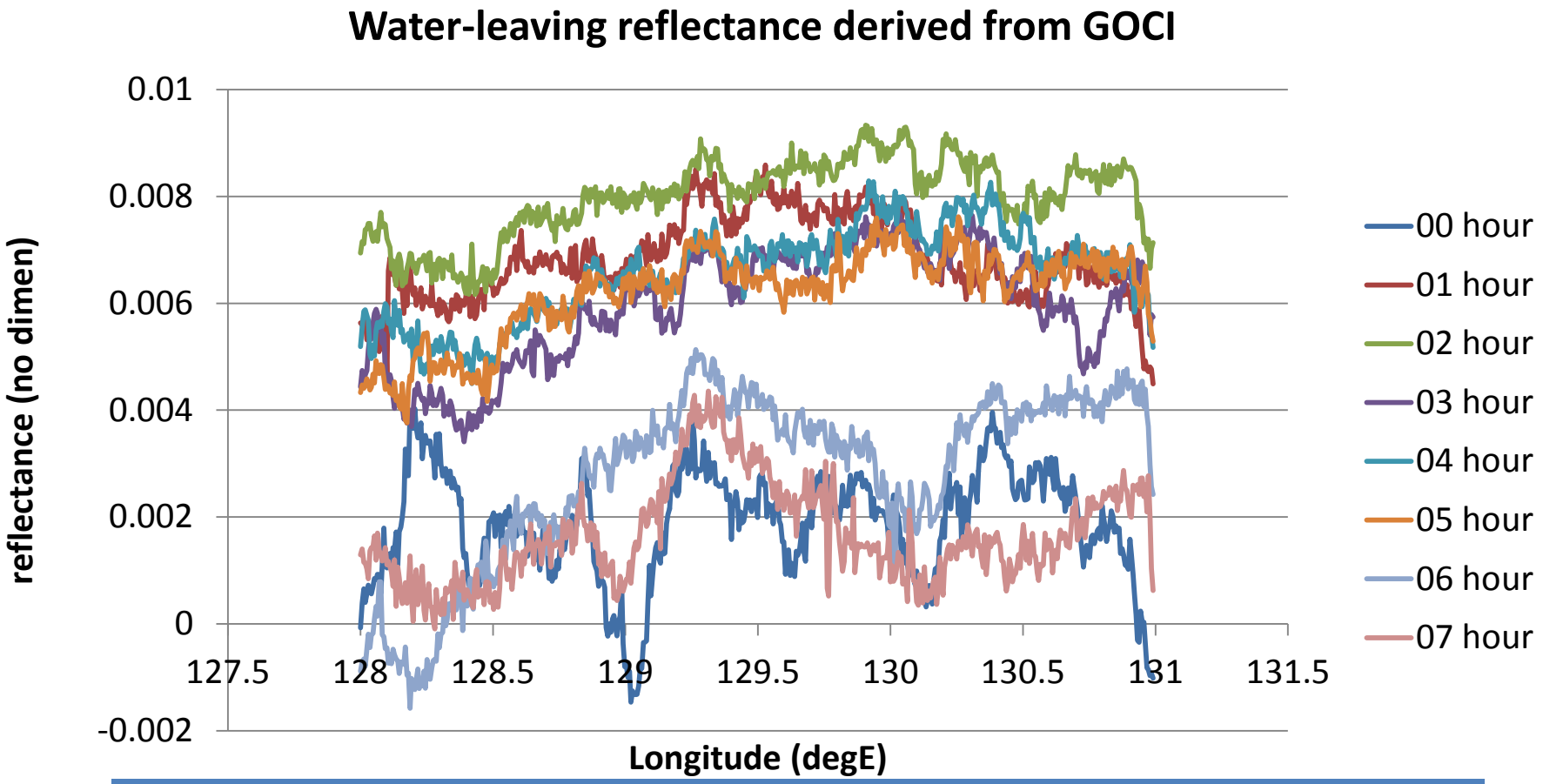
- Three options in publicly available GOCI Data processing software (GDPS)
  - Standard Atm. Corr.

    (Gordon and Wang approach)
  - SGCA (POLYMER) provided by P. Deschamp
  - Spectrum shape matching algorithm by Y-H. Ahn
- Atmospheric correction comparison is challenging. The comparison shown here is just an example and should be more systematic in the future.

GOCI Standar Atmospheric Correction

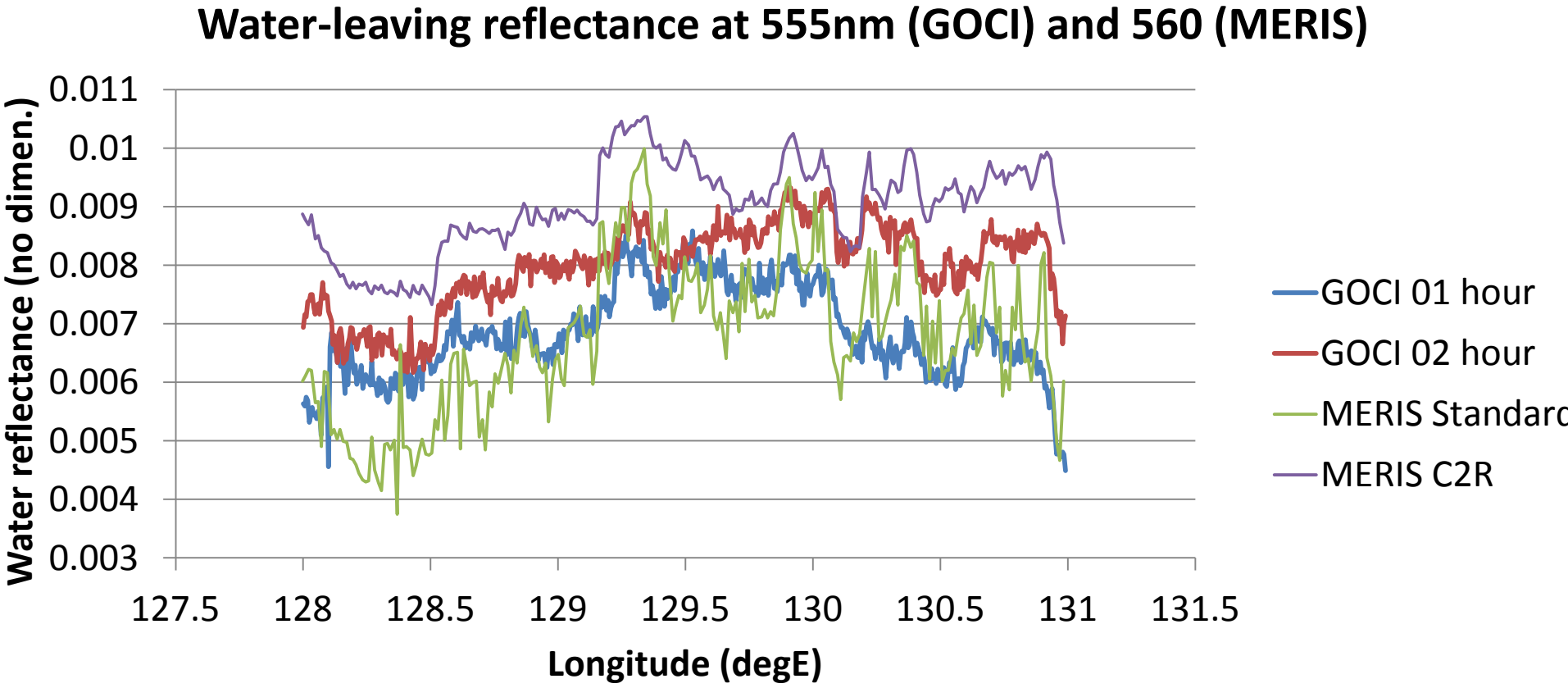


Clear water: GOCI hourly data

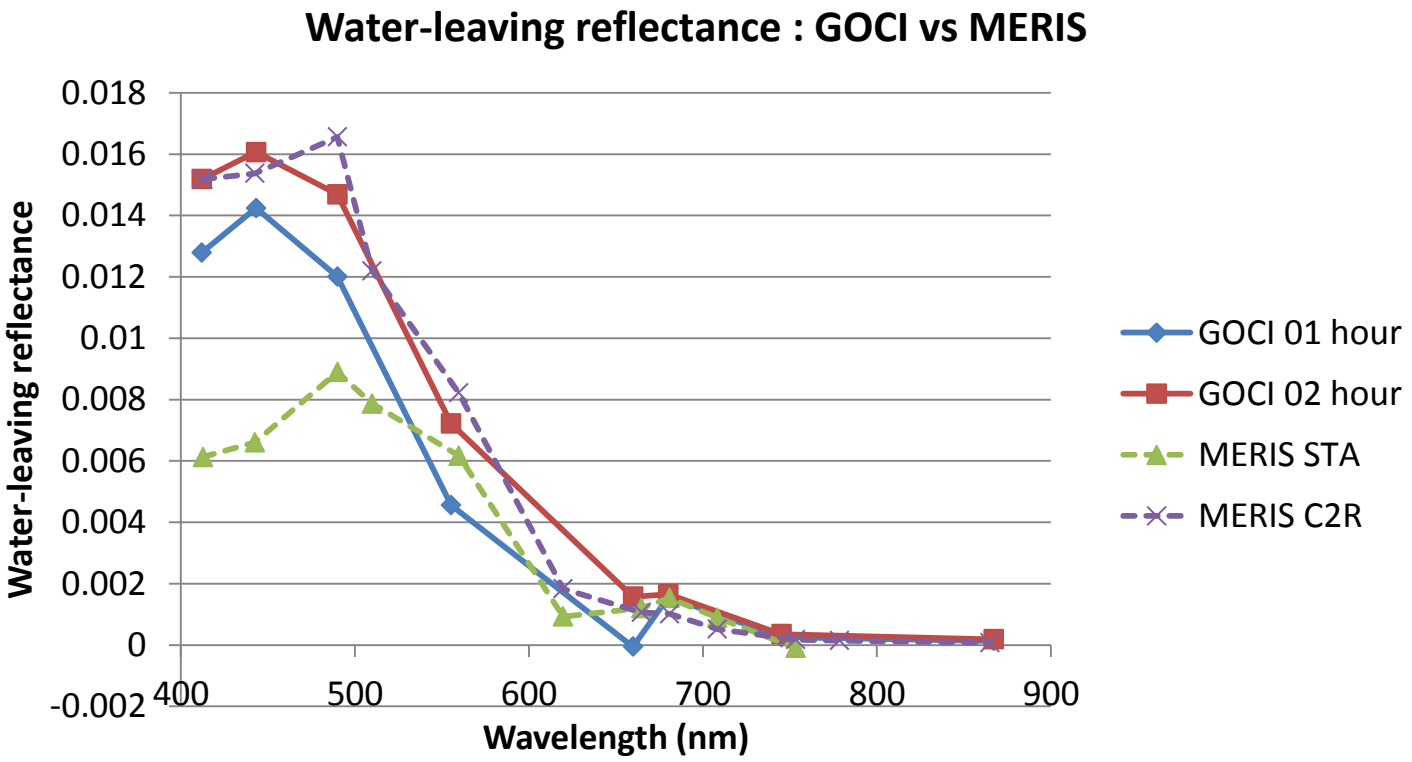


- 01 to 05 hour images shows < ~0.002 variability in water-leaving reflectance at 555
- Need to improve the atmospheric correction, especially for 00, 06, 07 hours

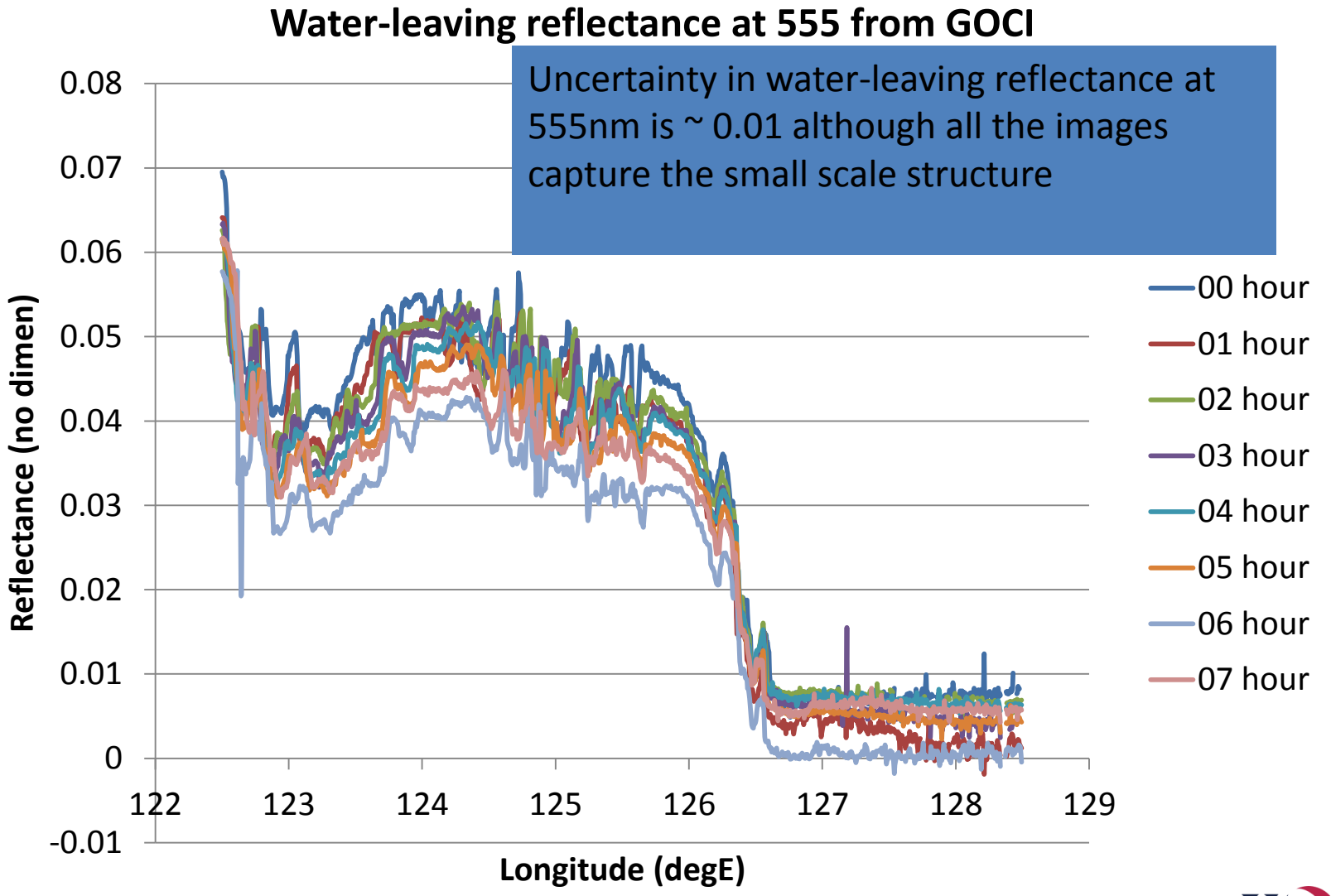
Clear water: GOCI vs MERIS



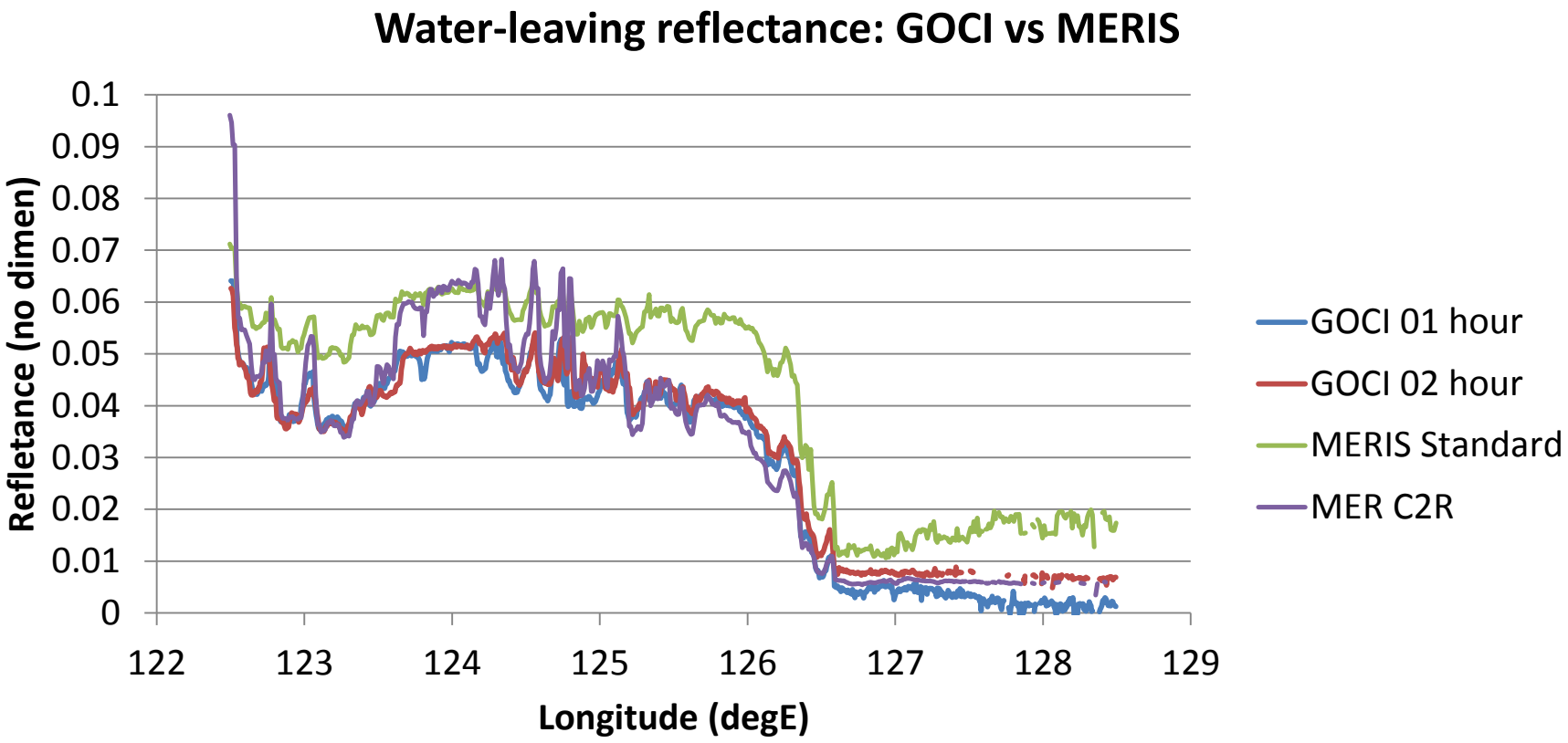
Clear water: GOCI vs MERIS



Turbid area: GOCI hourly data

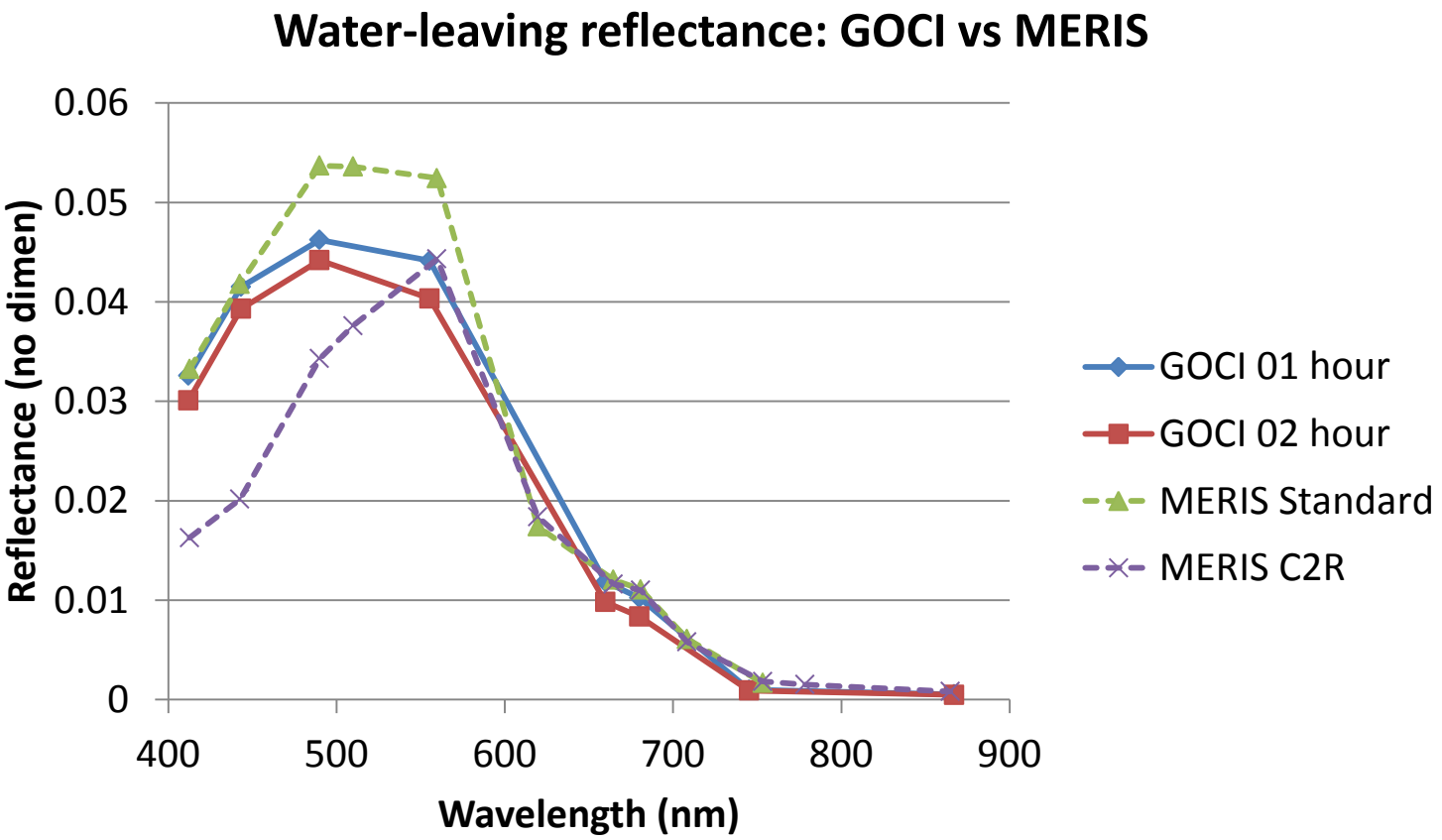


Turbid water: GOCI vs MERIS



- MERIS Standard is consistently high
- GOCI and MERIS C2R noticeably differ in a part of the transect -> need insitu data

Turbid water: GOCI vs MERIS



Thank you!

youngjepark@kordi.re.kr