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Application of Geostationary Satellite Images to the monitoring of dynamic variations

Jong-Kuk Choi, Young Je Park and Joo-Hyung Ryu

Korea Institute of Ocean Science & Technology

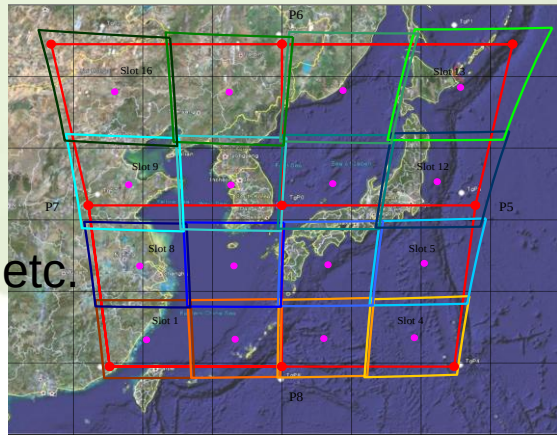
Contents

- GOCI Products (by GDPS)
- GOCI Applications (Dynamic variability)

Technical Specification of GOCI

- GOCI
  - GSD(Ground Sampling Distance) : 500m * 500m
  - Target Area : 2,500km * 2,500km (Center : 130°E 36°N)
  - Included Nations : Korea, China, Taiwan, Japan, Russia, etc.
  - Temporal Resolution : 1hour (8 times at 1 day)

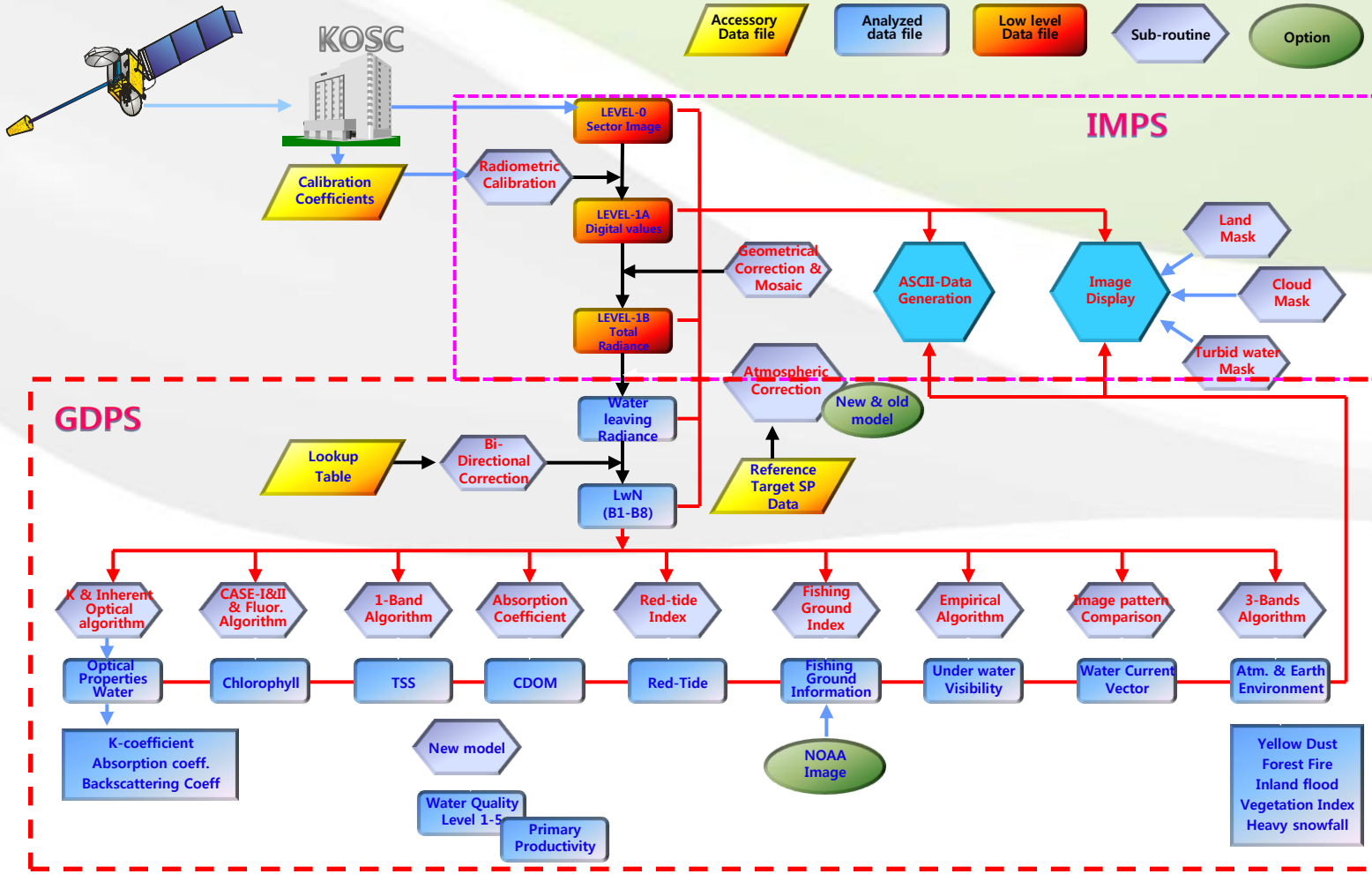
Target Area



Spectral Bands Characteristic and Requirements of GOCI

Band	*Central wavelengths*	*Band Width*	*SNR*	*Type*	*Primary Application*
B1	412 nm	20 nm	1,000	Visible	Yellow substance and turbidity
B2	443 nm	20 nm	1,090	Visible	Chlorophyll absorption maximum
B3	490 nm	20 nm	1,170	Visible	Chlorophyll and other pigments
B4	555 nm	20 nm	1,070	Visible	Turbidity, suspended sediment
B5	660 nm	20 nm	1,010	Visible	Baseline of fluorescence signal, Chlorophyll, suspended sediment
B6	680 nm	10 nm	870	Visible	Atmospheric correction and fluorescence signal
B7	745 nm	20 nm	860	NIR	Atmospheric correction and baseline of fluorescence signal
B8	865 nm	40 nm	750	NIR	Aerosol optical thickness, vegetation, water vapor reference over the ocean

GOCI Data Processing System (GDPS)



Meaning of GOCI and GDPS

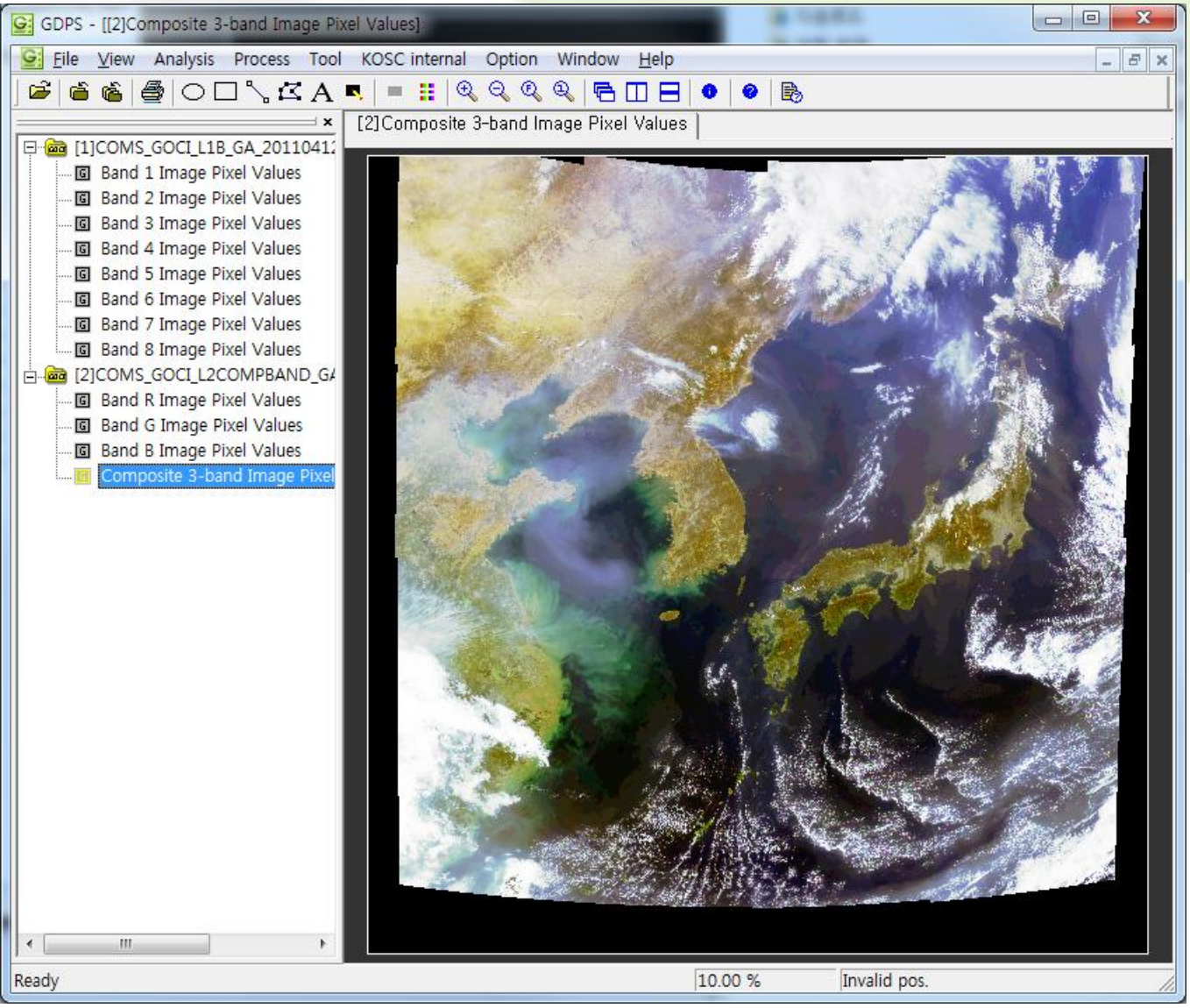
	CZCS	POLDER	OCTS	SeaWiFS	OCI	IRS-P4 (OCM)	MODIS	MERIS	GLI	COCTS	GOCI	VIIRS (NPOESS)	OLCI (SENTNEL3)	SGLI	GOCI-II
Data format	HDF4		HDF4	HDF4			HDF4	Envisat	HDF4		HDF EOS5	HDF5	NetCDF	HDF5	TBD
Data processing	-		SeaDAS	SeaDAS			SeaDAS	BEAM	NA	HYDAS	GDPS	IDPS	BEAM	TBD	TBD
OS			Unix / Linux	Unix / Windows			Unix/ Windows	All Platforms	Unix / Linux	Unix	Windows		All Platforms	Linux	Windows
Mission Development	NASA USA	CNES France	JAXA Japan	NASA USA	Taiwan	ISRO India	NASA USA	ESA EU	JAXA Japan	CAST China	KORDI Korea	NOAA NASA	ESA EU	JAXA Japan	KORDI Korea
Launch date	Oct. 1978	Aug. 1996 / Dec. 2002 / Dec. 2005	Aug. 1996	Aug. 1997	Feb 1999	May 1999	Dec. 1999	Mar. 2002	Dec. 2002	Apr. 2007	Jun. 2010	Sep. 2011	2012	2014	2018

(The world's first!) Geostationary ocean color satellite : Design for Ocean Mission
(The world's first!) Development and distribution of Exclusive S/W for GOCI
and 3rd public S/W for satellite data processing (included polar orbit satellite)

GDPS Products

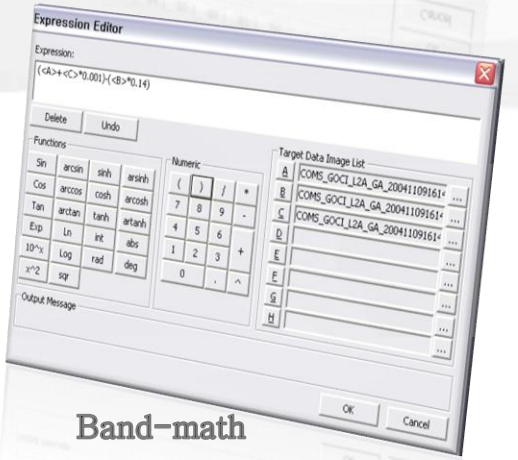
PRODUCTS	DESCRIPTION	APPLICATION
Water-leaving radiance	The radiance assumed to be measured at the very surface of the water under the atmosphere	Indispensible for water color analysis algorithms
Normalized water leaving radiance	The water leaving radiance assumed to be measured at nadir, as if there was no atmosphere with the Sun at zenith	Input data for the water analysis algorithm
Optical properties of water	K-coefficient Absorption coefficient Backscattering coefficient	Ocean optical properties analysis
Chlorophyll	Concentration of phytoplankton chlorophyll in ocean water	Ocean primary production estimation, dumping site monitoring, climate change monitoring
TSS	Total suspended sediment concentration in ocean water	Coastal ocean environmental analysis and monitoring TSS movement and transfer monitoring
CDOM	Colored dissolved organic matter concentration in ocean water	Indicator of ocean pollution Ocean salinity estimation
Red tide	Red tide index information	Ocean pollution and ecological monitoring Movement and transfer monitoring of red tide
Fishing ground information	Fishing ground probability index, fishing ground prediction	Fishing ground detection Fishing ground environmental information
Underwater visibility	Degree of clarity of the ocean observed by the naked eye	Navy tactics, ocean pollution map, sea rescue work
Sea surface current vector	Sea surface current direction/speed	Understanding of sea surface currents and estimation of pollutant movements
Atm. & earth environment	Yellow dust, Vegetation Index	Atmospheric environment and land application
Water quality level	Coastal water quality level estimation	Coastal ocean eutrophication Coastal water quality control/monitoring
Primary productivity	The production of Organic compounds from carbon dioxide, principally through the process of photosynthesis	Carbon cycle Long-term climate change monitoring

GDPS GUI



GOCI L2 Display

Setting Process Schedule

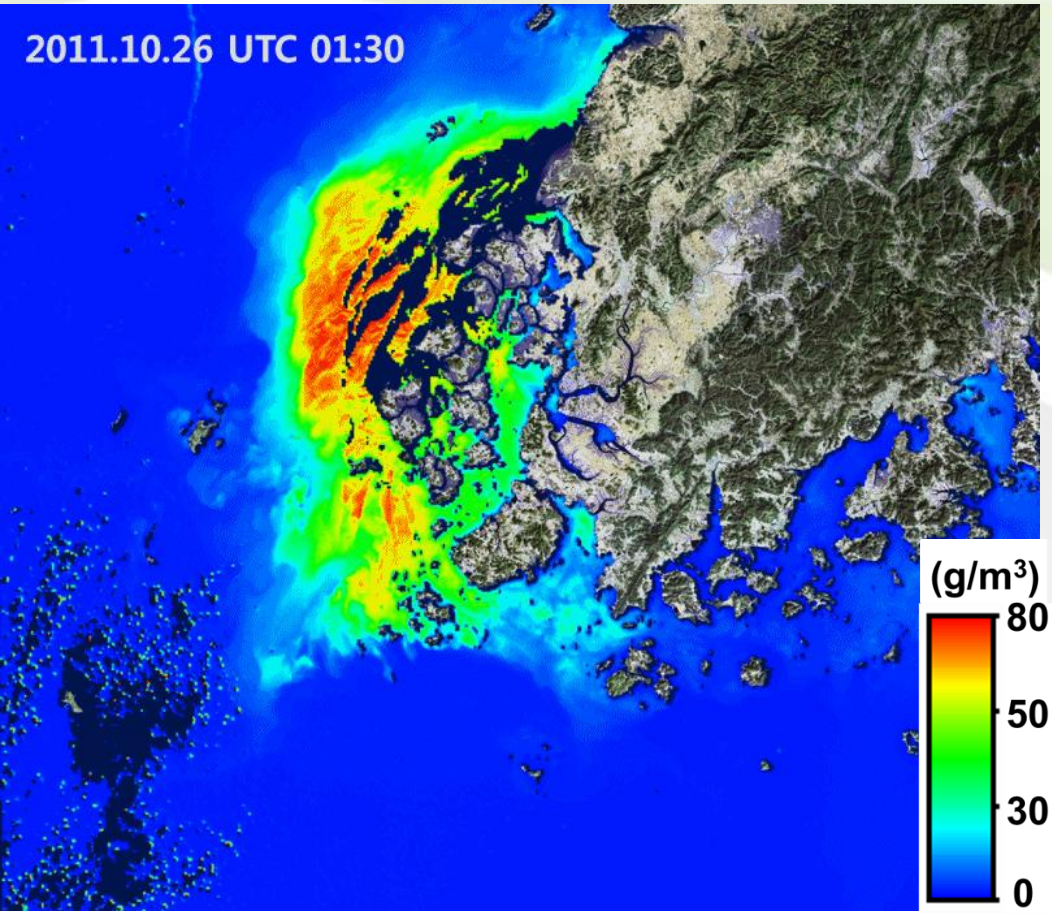


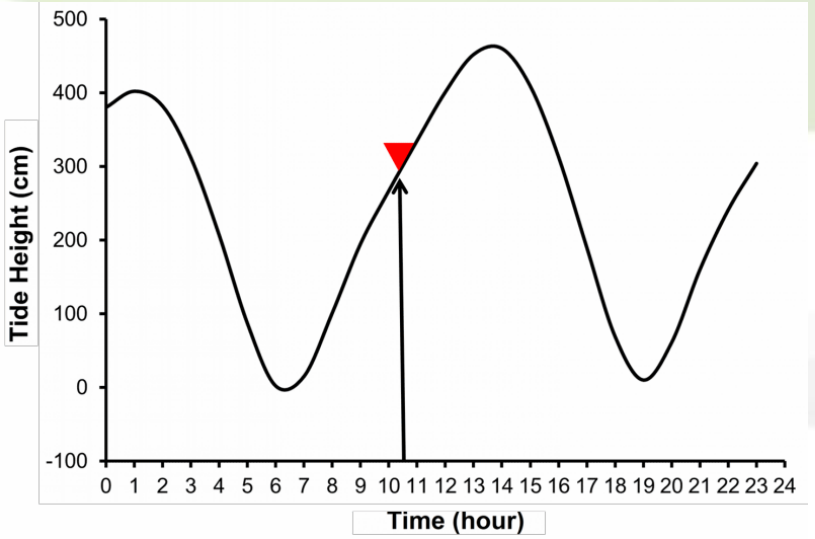
Band-math

Product (Level)

- Level 1B
  - Radiometric & geometric corrected Total Radiance
- Level 2
  - Environmental properties derived from Ocean signal(Lw)
  - For GOCI, L2 data will be generated each hour(8 times/day)
- Level 3
  - Secondary derived data from L2 like Fishery Ground information, Primary Production.
  - Cloud-free(reduced) ocean environmental data by daily composite of L2

Time-series variations in GOCI-derived turbidity





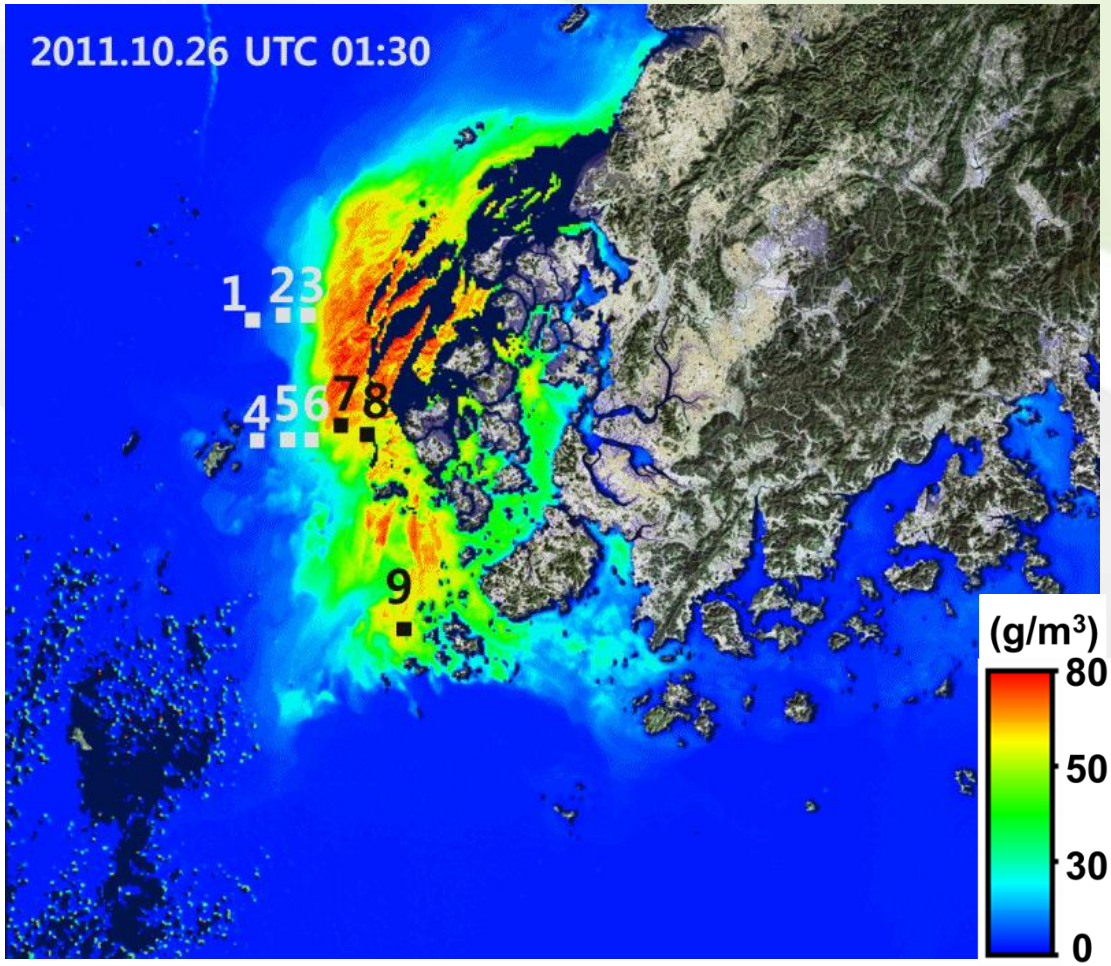
areas of relatively high turbidity (in red) gradually decreased over time

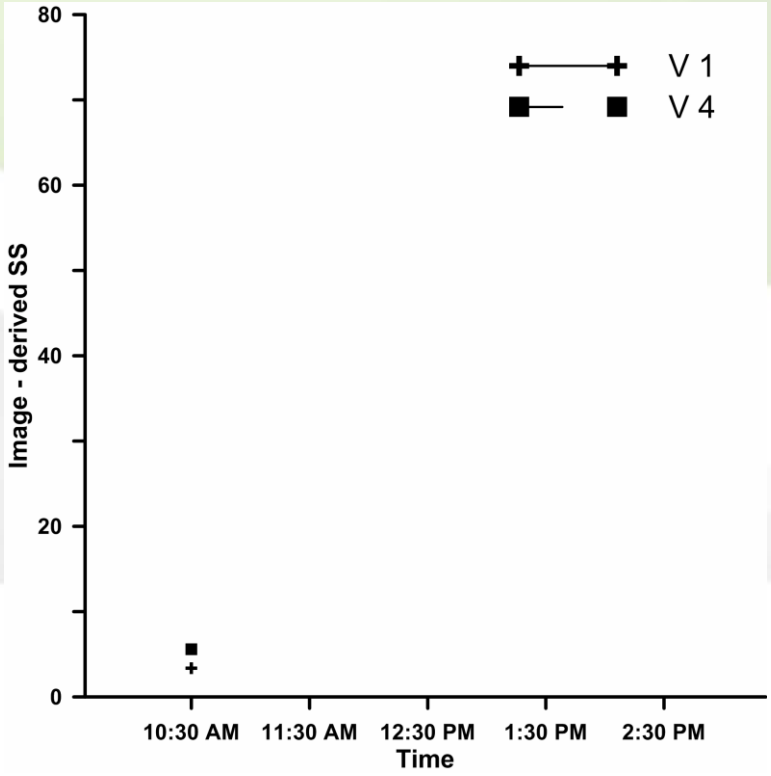
- clear water from open sea suppressed turbidity during flood tide

around the time of high tide, turbidity was remarkably lower

- settlement of suspended particulates during the transition from flood to ebb tide and resulting lull in the tidal current

Time-series variations in GOCI-derived turbidity

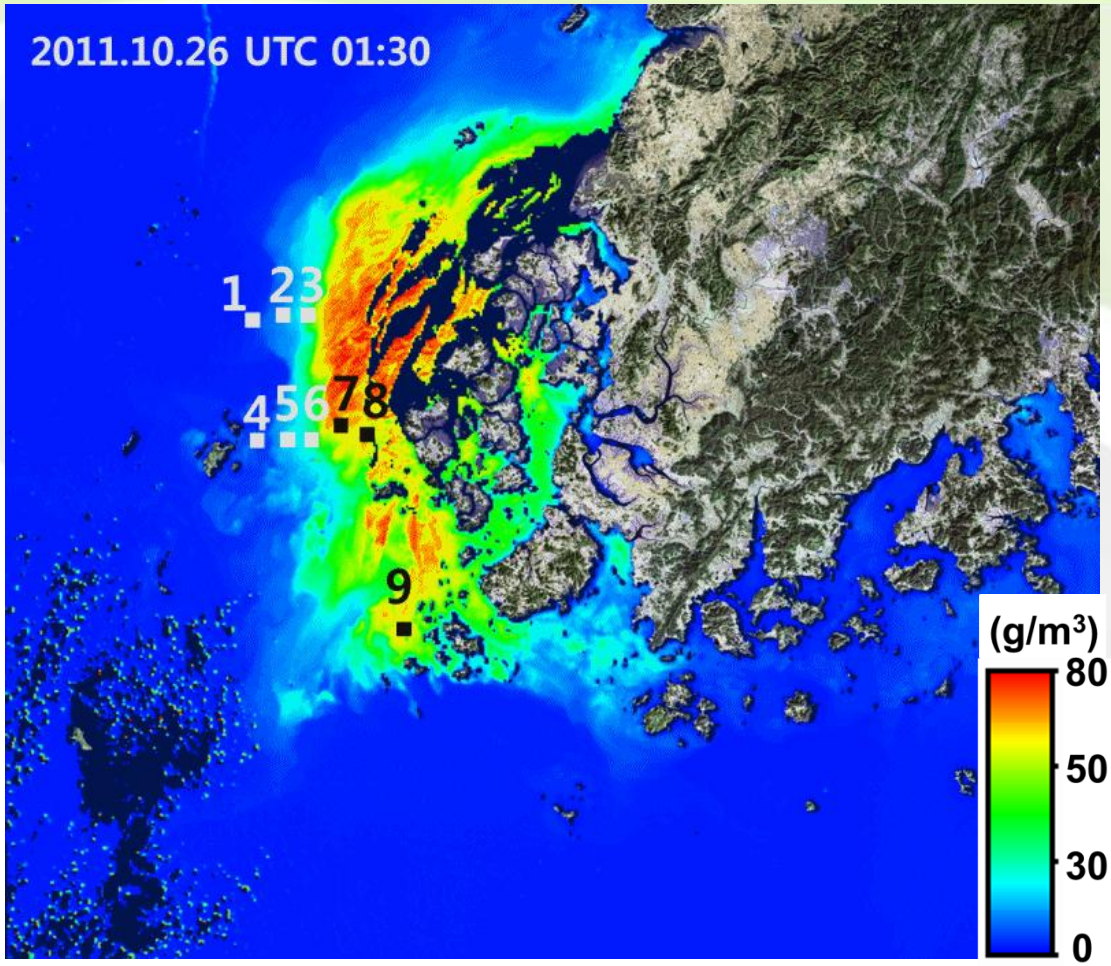


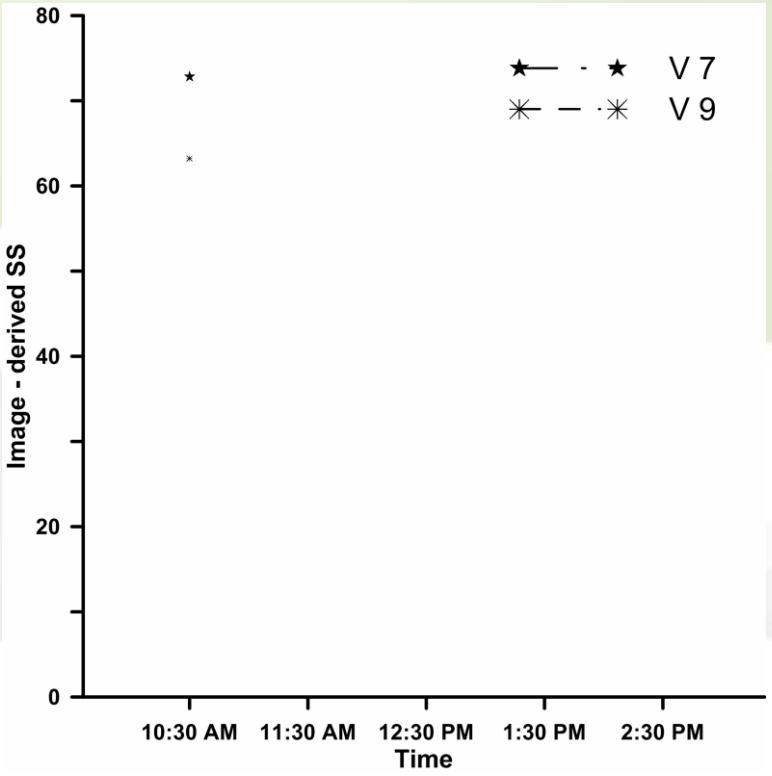


V1,4 : nearly clear water close to the open sea

- concentrations were relatively low over the entire time period from 10:30 to 14:30 and did not exhibit remarkable patterns in hourly variation in SSC

Time-series variations in GOCI-derived turbidity



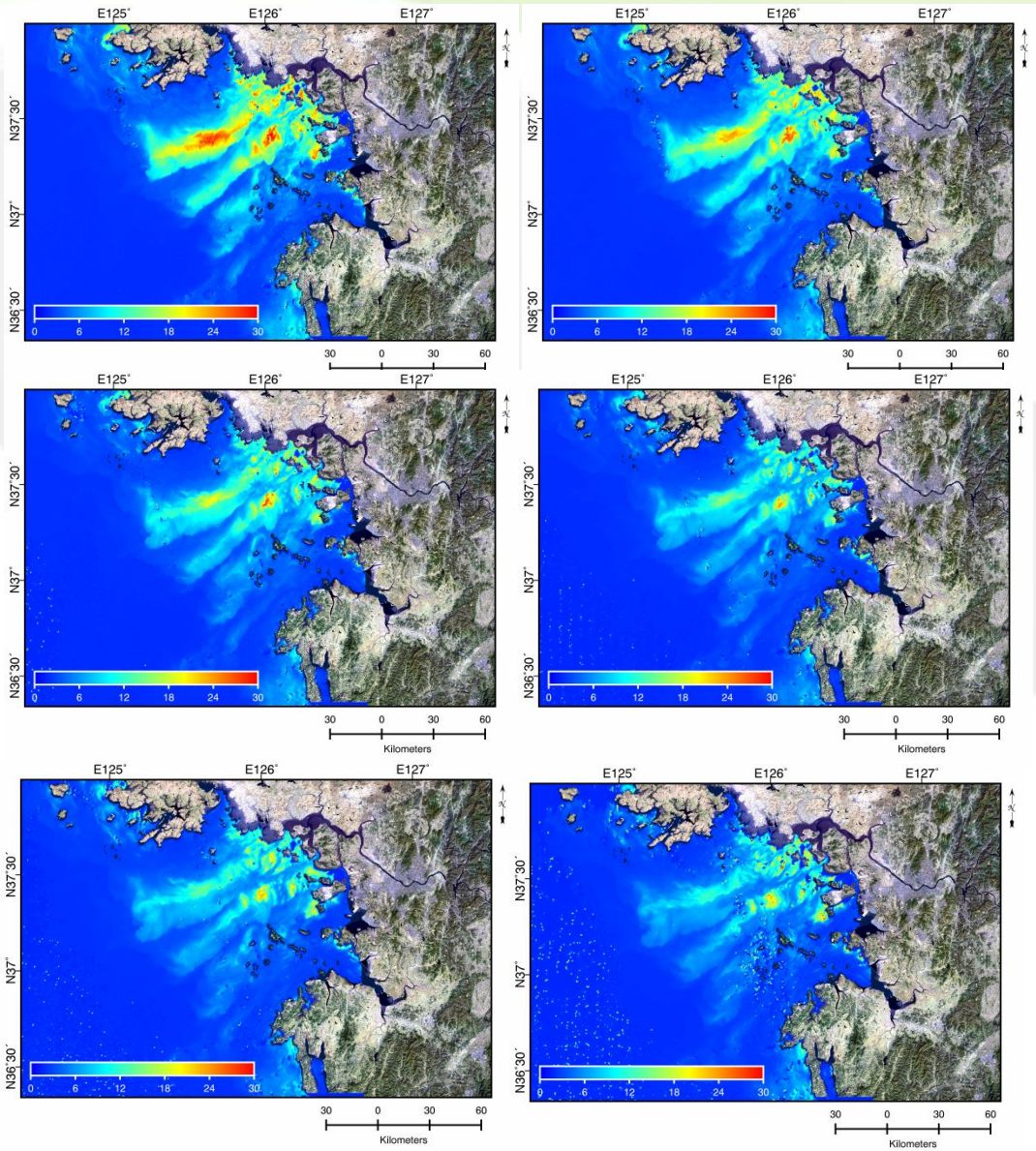


V7,8,9 : highest turbid within the coastal region

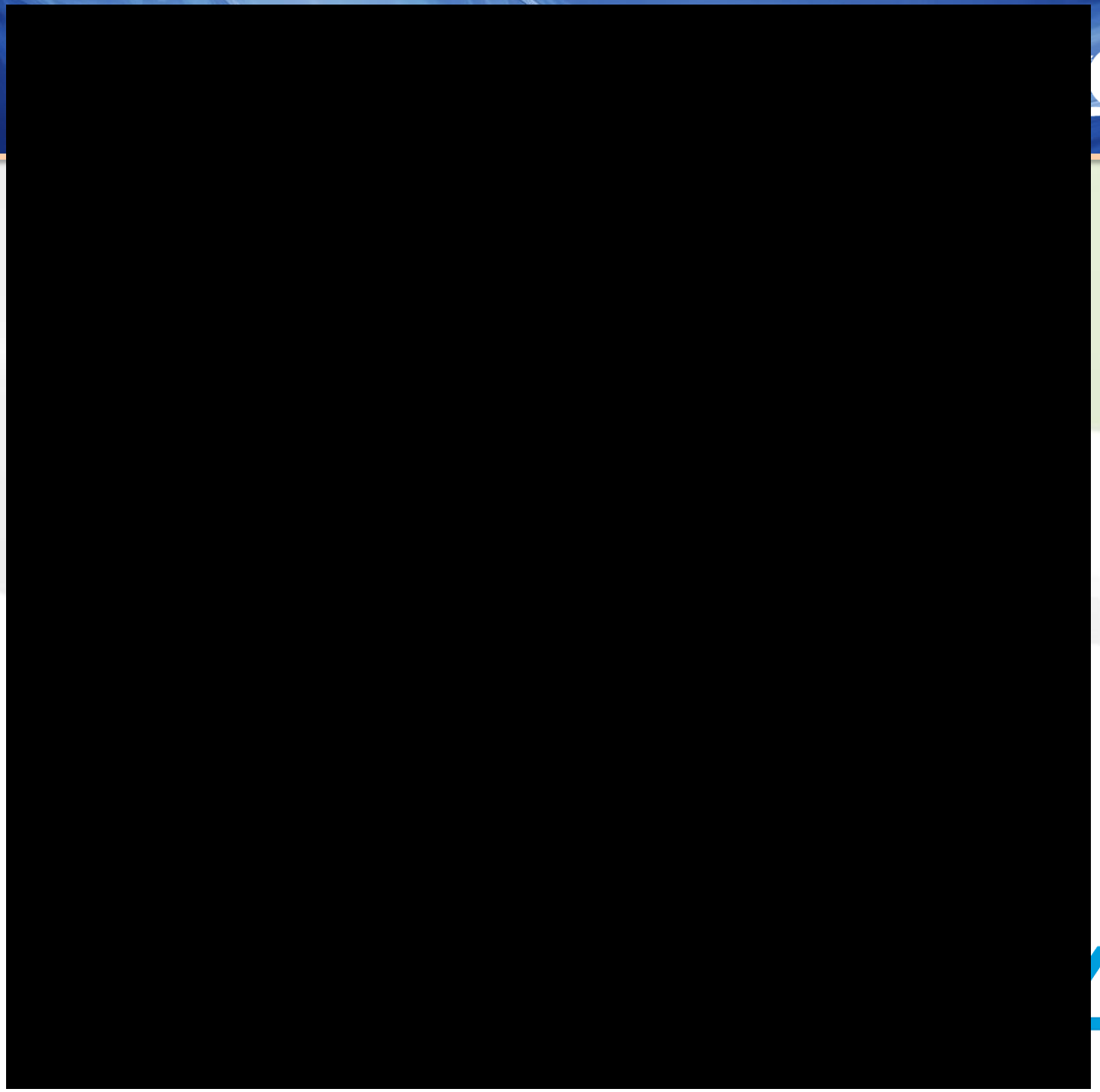
- Clear patterns of hourly decreases in turbidity

(Choi et al., 2012; JGR)

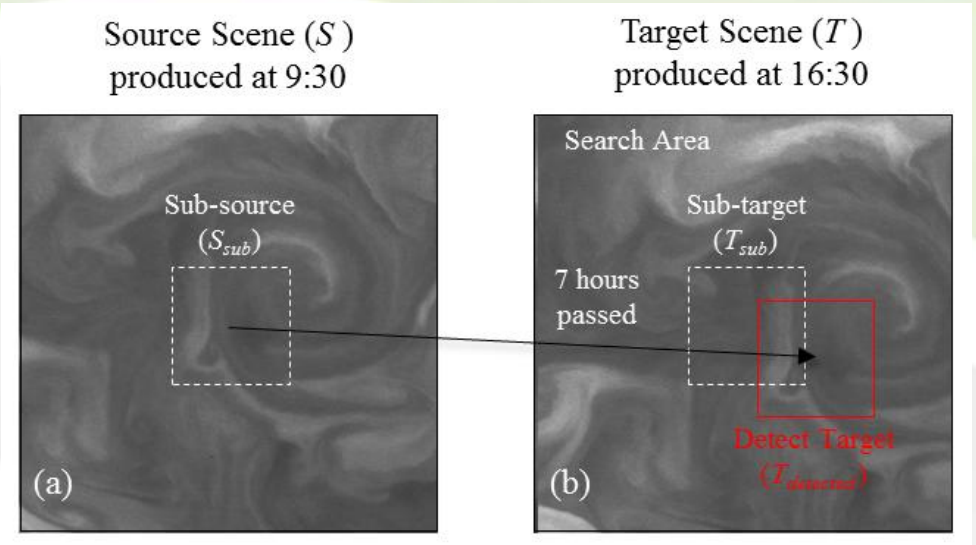
Time-series variations in GOCI-derived turbidity



- 2012. 10. 23. 00-05 UTC



Ocean surface current

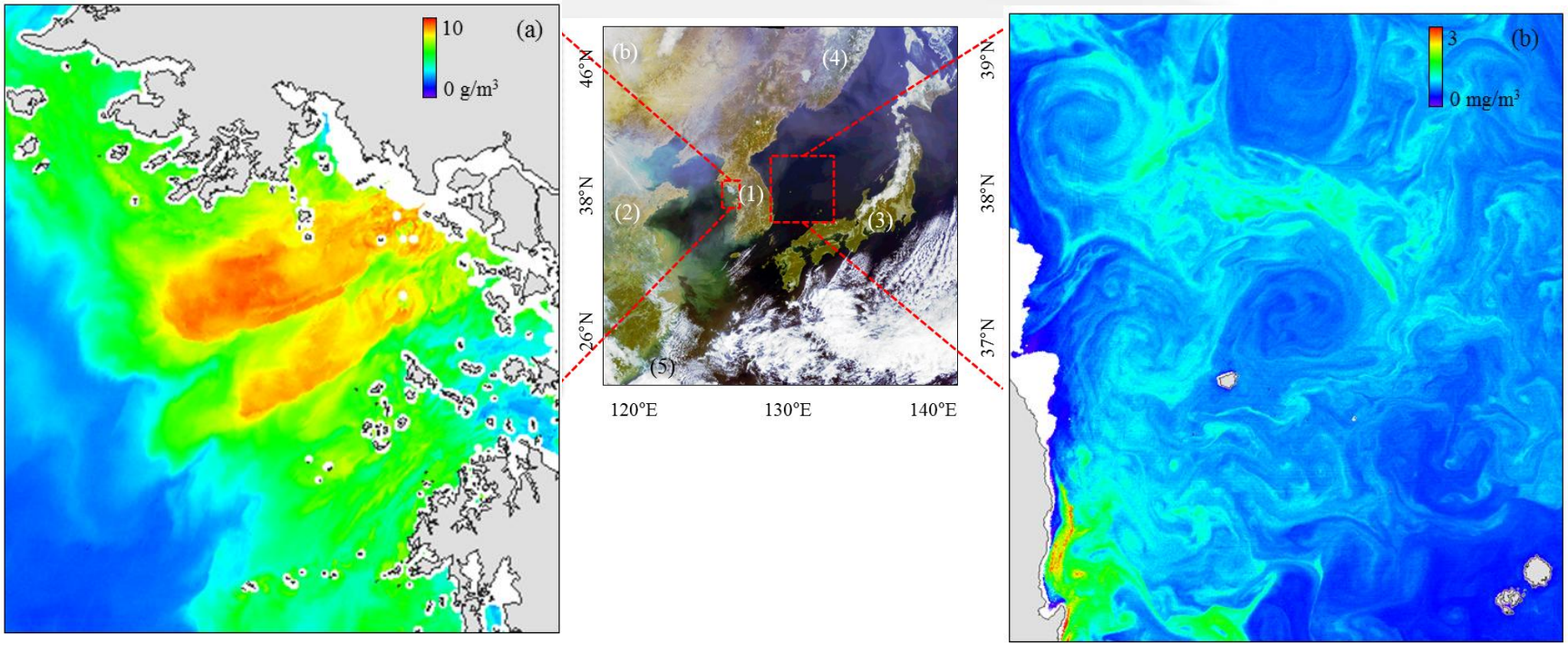


ocean surface current algorithm for GOCI

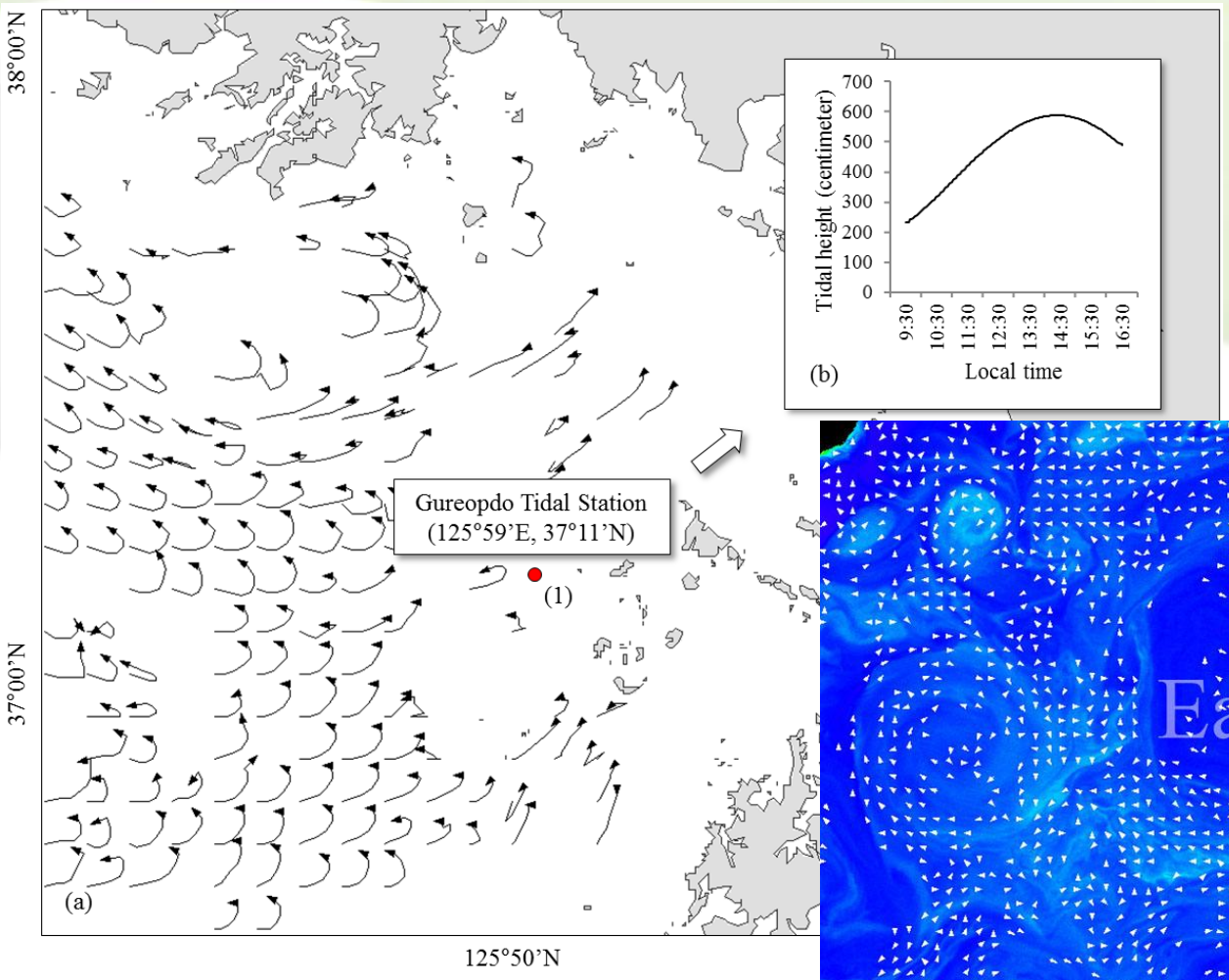
- based on MCC (maximum cross correlation) scheme

- finding equivalent geographical regions from target and source scenes

(Choi et al., 2013; JCR SI)

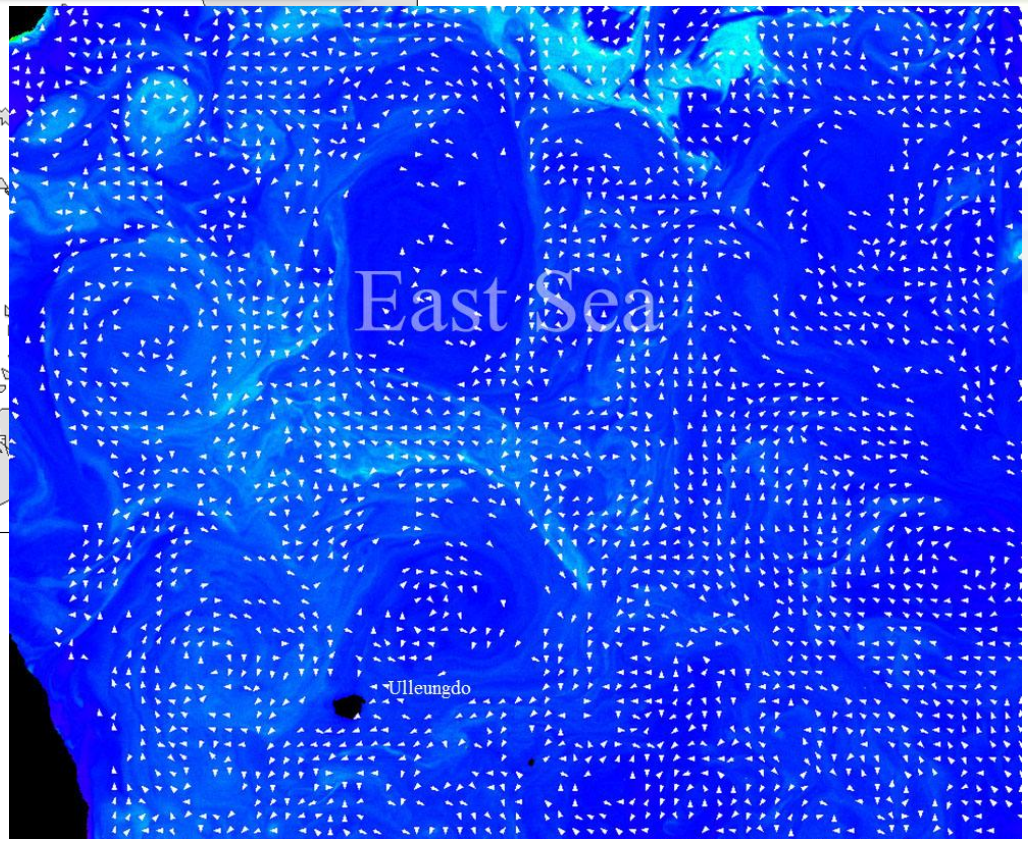


Ocean surface current

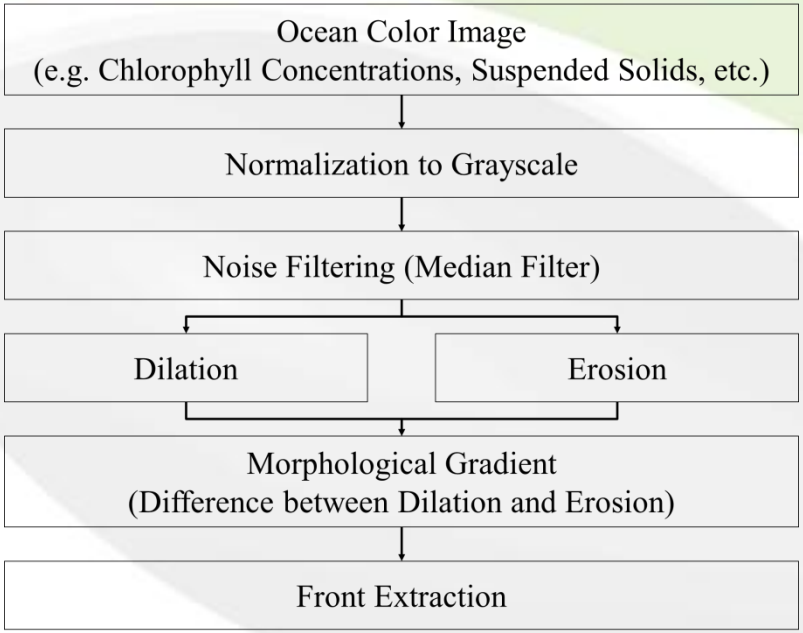


▲ Ocean surface current map in the west coast

▼ Ocean surface current map in the east coast

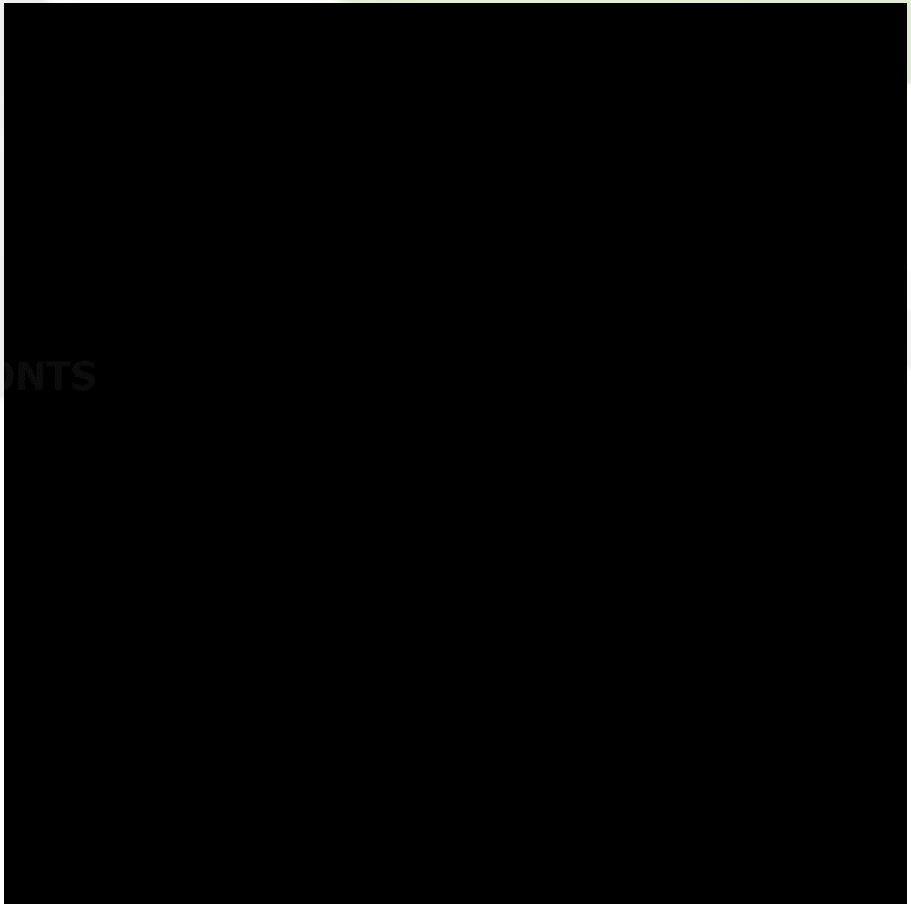


Ocean front

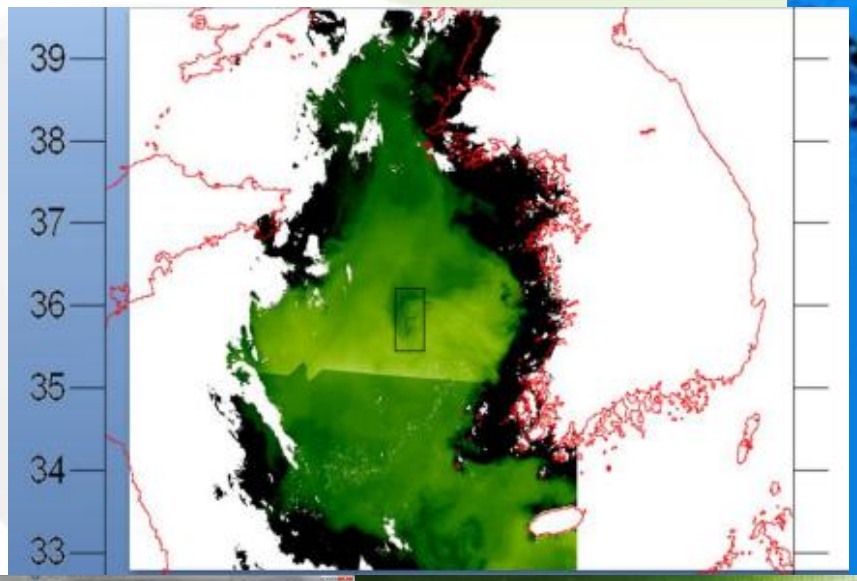


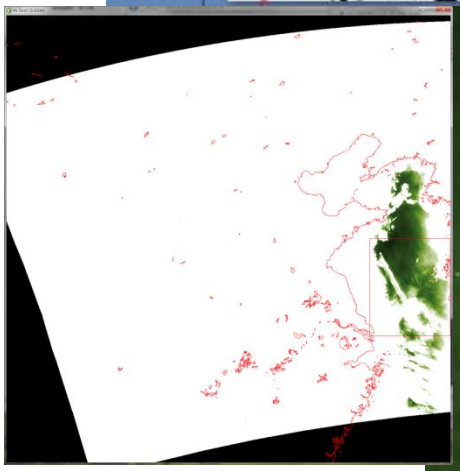
Flow diagram to extract oceanic fronts from ocean color scenes using morphological gradient method

Ocean front generated from GOCI (black lines) overlaid on SST (colored image) provided by the group for high-resolution sea surface temperature (GHRSST)

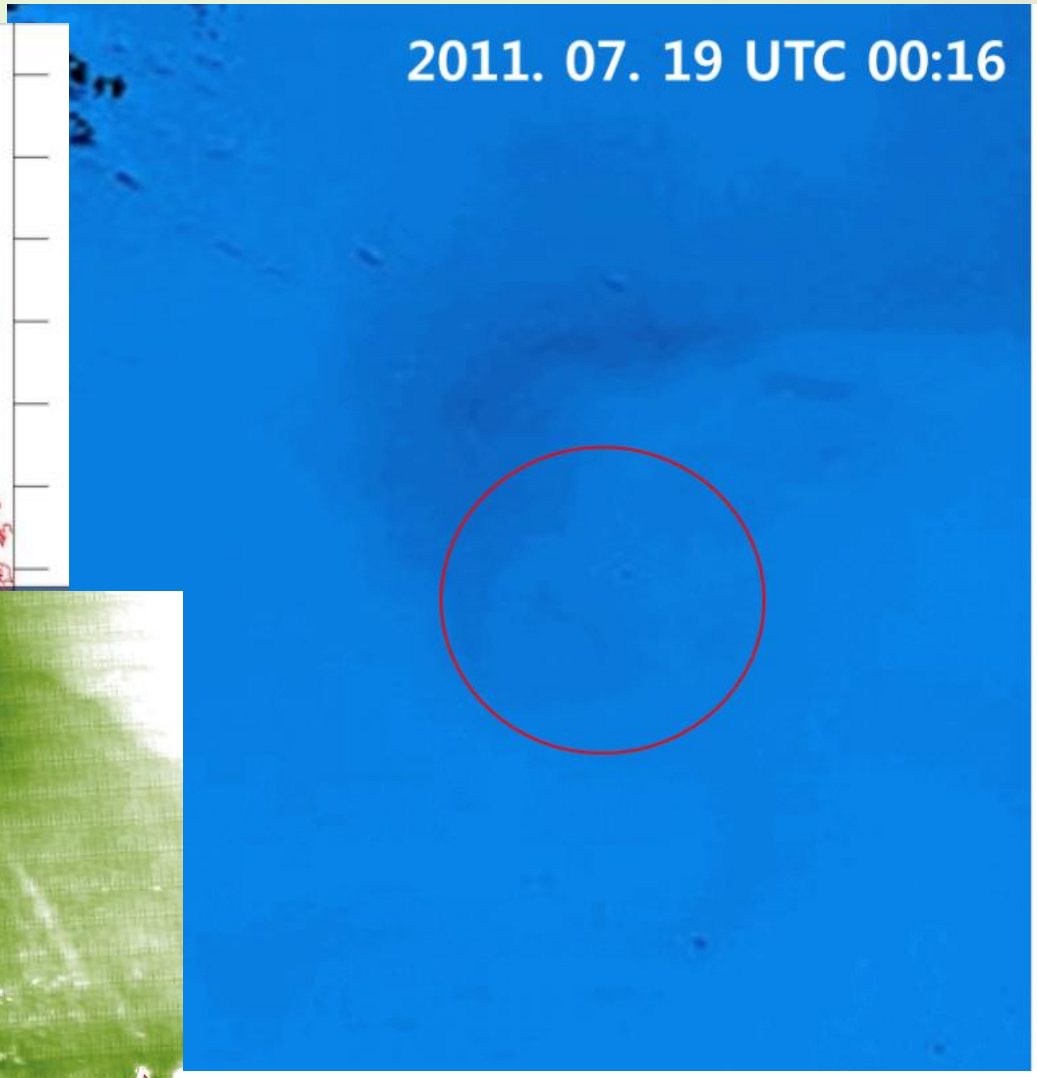


Surveillance of waste disposal activity at sea





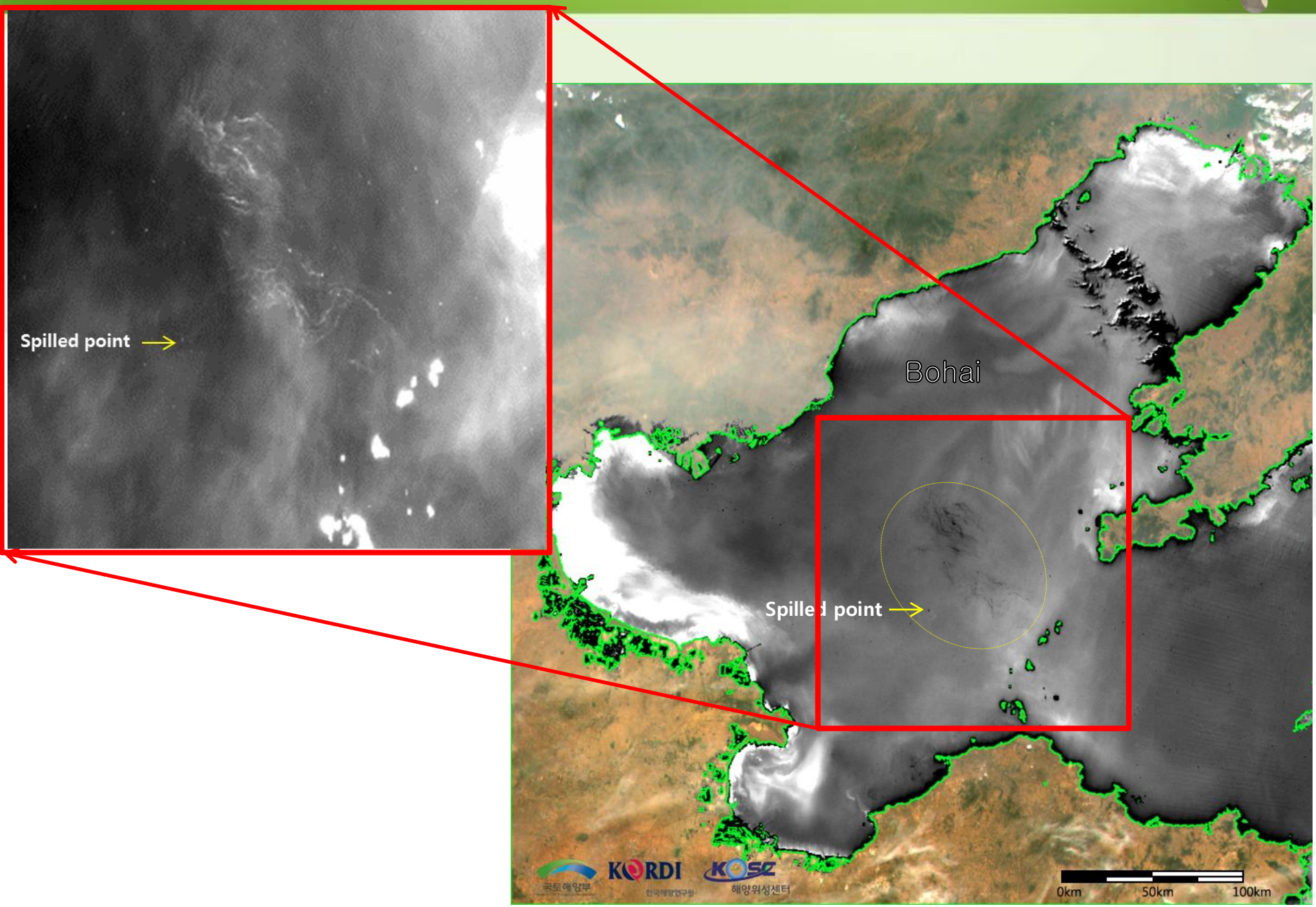
MODIS Aqua
2011.07.19. 02:00(UTC)



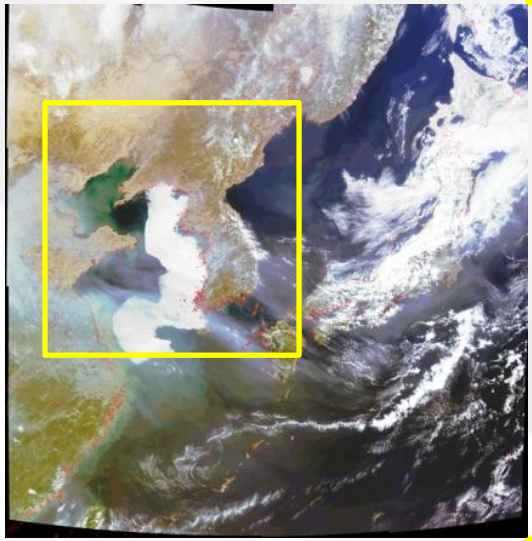
Ship velocity measurement : 8~9 knot

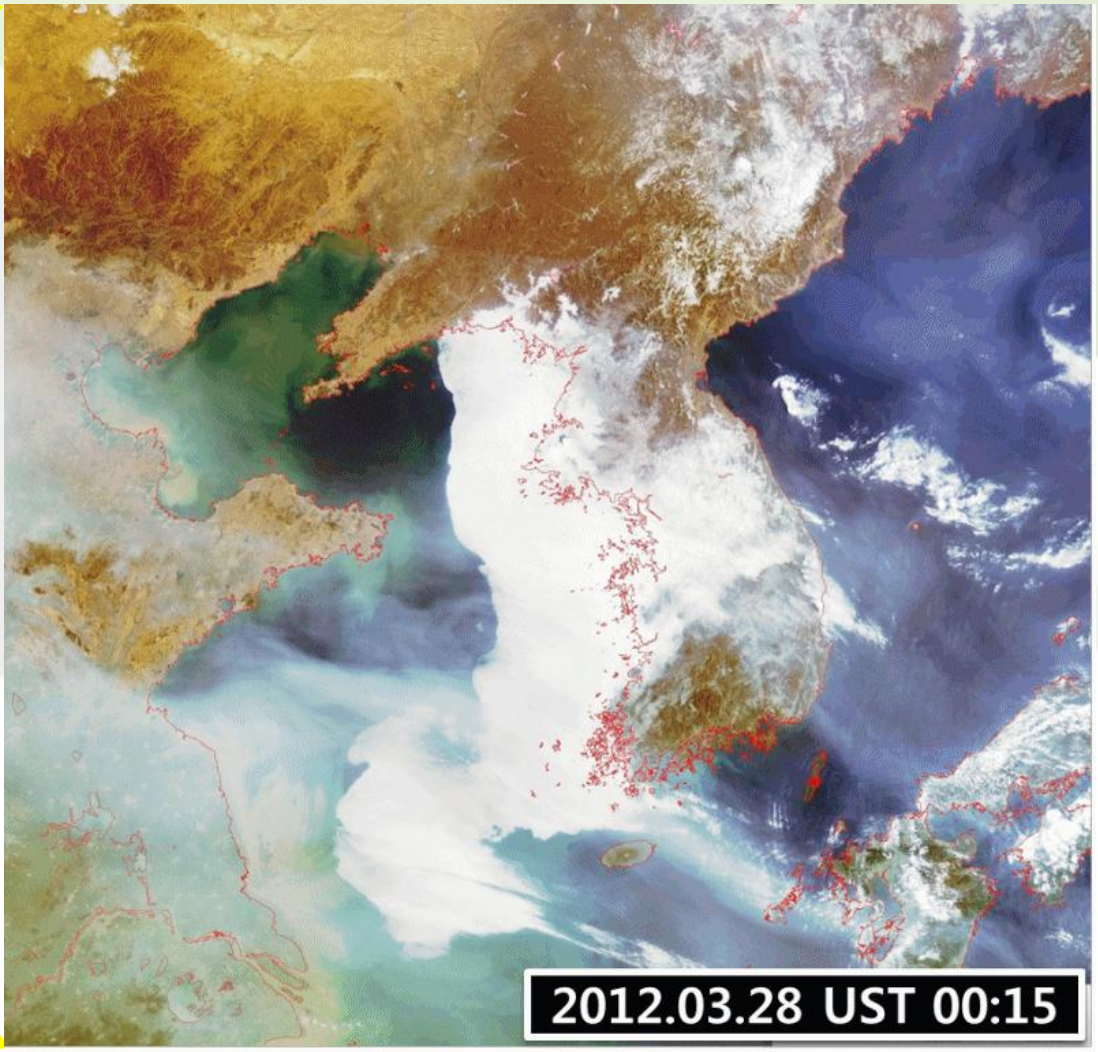
(Hong et al., 2012; OSJ SI)

Oil Spill estimation (GOCI June 13, 2011)

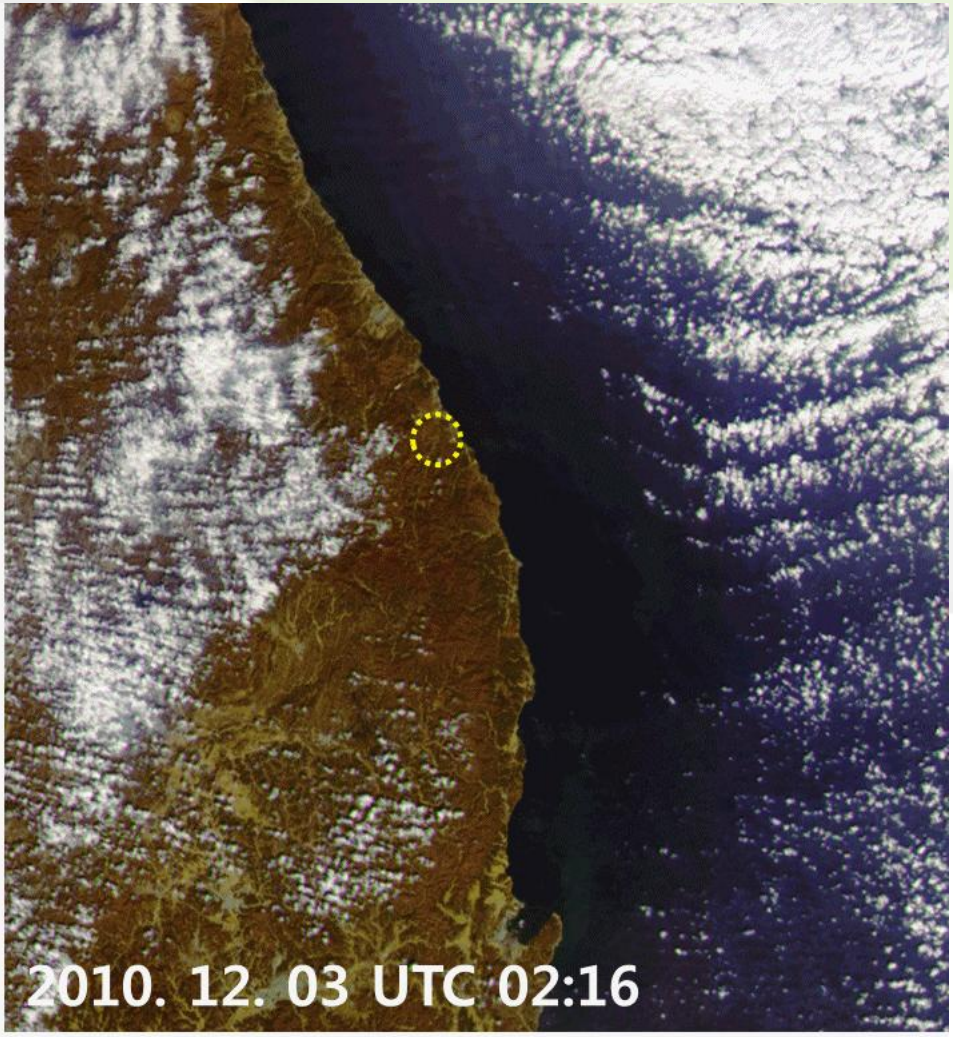


Sea Fog movement

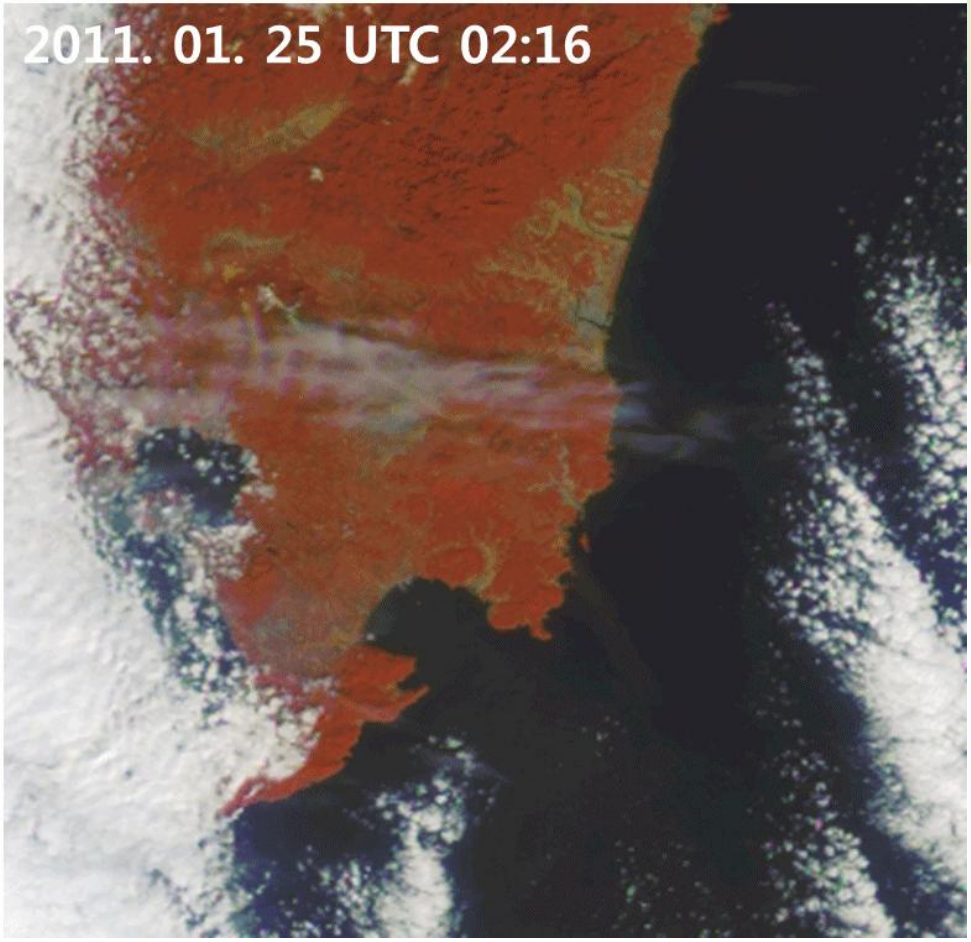




Forest Fire



Volcanic Eruption



Summary

- The dynamics of ocean properties, especially near the coastal region can be successfully estimated using geostationary satellite images with high frequency like GOCI

- To this end, algorithms for atmospheric correction, SSC, Chl and other parameters both in the open ocean and in high turbid water suited for GOCI with high accuracies are inevitable, which is still challenging

Thank you!!

jkchoi@kiost.ac