ALOS Kyoto & Carbon Initiative

6 th Advisory Panel / Science Team meeting

ADEOS-II GLI-250m
--- Data and product availability ---

February 28 (Mon), 2005

H. Yamamoto, EORC/JAXA

Introduction

ADEOS-II satellite has been successfully launched on Dec. 14, 2002.

Objective of ADEOS-II mission

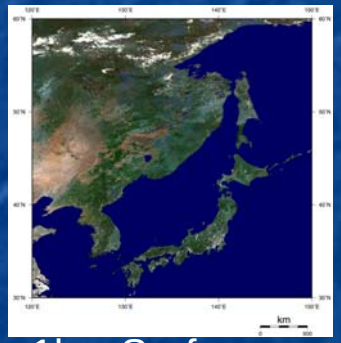
1. **To research in water/energy cycle and carbon cycle**
2. **To estimate quantatively plant biomass and primary product which is concerned with carbon cycle**
3. **To understand and forecast global climate change such as global warming**

ADEOS-II operational anomaly happened on the end of Oct.

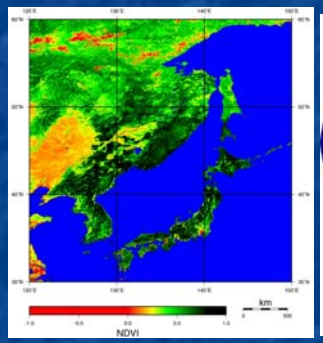
ADEOS-II GLI has been able to obtain the data from spring to fall of 2003.

- It has capability of research for vegetation dynamics in northern hemisphere.
- It is very useful to analyze and research by using acquired GLI sensor data, which has unique channels.

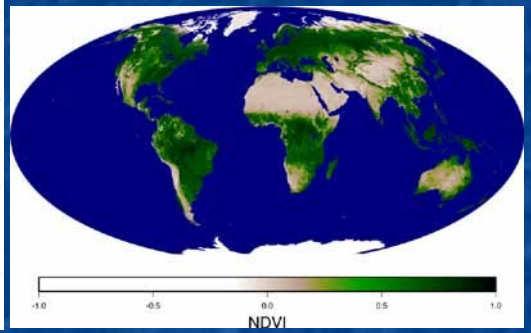
ADEOS-II/GLI data has capability of good **Vegetation Quality Assessment.**



1km Surface Reflectance



1km VIs



1km Global VIs

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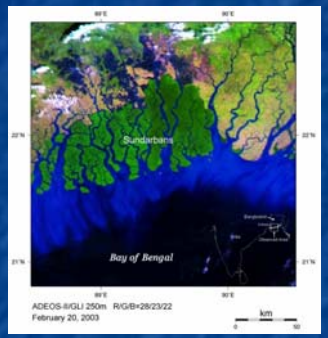


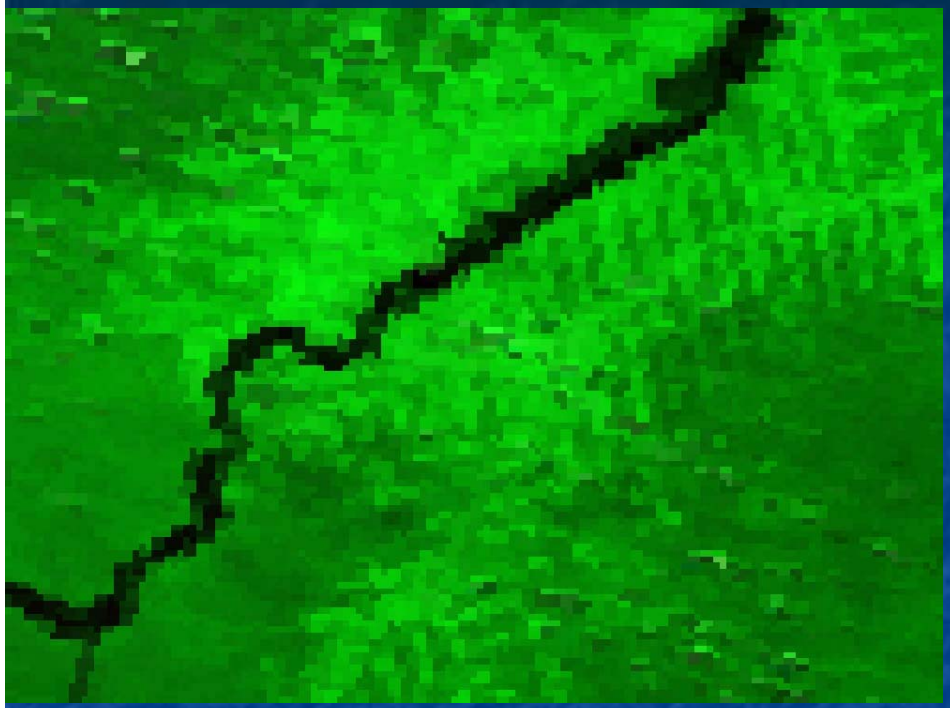
250m products
Research Products

Standard Products -> You can get these products via EOC.

Objective

- To evaluate GLI 250m land higher level products (Reflectance, NDVI/EVI)

Why is needed 250m resolution



A2GL103051934l4OD1_PV1B0000000.00
ADEOS-II/GLI **1km** R/G/B=ch.13/ch.19/ch.8

A2GL203051934l4OD1_P01B0000000.00
ADEOS-II/GLI **250m** R/G/B=ch.22/ch.23/ch.21

Trans-Amazonian Highway running from east to west in Para, Brazil

→ **+ Cloud is mixed in 1km pixel. This causes misclassification.**
+ 1km data cannot discriminate detailed "fishbone"

Detection of deforested area associated with the human impacts is very important issue on Global Carbon Cycle.

Specification for GLI Land channels (VNIR, SWIR, MTIR)

ch	Wave length [nm]	Dynamic range [W/m2/str/m m]	SNR (input L)	ch	Wave length [nm]	Dynamic range [W/m2/str/m m]	SNR (input L)	ch	Wave length [nm]	Dynamic range [W/m2/str/m m]	SNR (input L)
VNIR (1km) (#p: *piecewise linear band*)				15	710.1	233 (369)	300 (10)	250 m bands			
1	380.7	683	467 (59)	16	749	11 (17)	991 (7)	20	462.4	691	241 (36)
2	399.6	162	1286 (70)	17	762	246 (473)	293 (6)	21	542.1	585	141 (25)
3	412.3	130	1402 (65)	18	866.1	8 (13)	1309 (5)	22	661.3	115 (156)	255 (14)
4p	442.5	110 /680	893 (54)	19	865.7	211 (339)	386 (5)	23	824.1	210 (287)	218 (21)
5p	459.3	124 /769	880 (54)	SWIR (1 km)				28	1644.9	76	298 (5)
6	489.5	64	1212 (43)	24	1048.6	227	381 (8)	29	2193.8	32	160 (1.3)
7p	519.2	92 /569	627 (31)	25	1136.6	184	412 (8)	MTIR (Kelvin, NEΔT at 300K)			
8p	544	96 /596	611 (28)	26	1241	208	303 (5.4)	30	3721.1	345 K	0.07 K
9	564.8	39	1301 (23)	27	1380.6	153	192 (1.5)	31	6737.5	307 K	0.03 @285K
10	624.7	28*1 (39*2)	1370 (17)	•Dynamic range and SNR are cited from "Tanaka, K., GLI Mission Data Evaluation Test results, NASDA ADEOS-II Project, ADEOS-II/GLI Workshop, November 14-16, 2001, Tokyo, Japan".				32	7332.6	322 K	0.03 K
11	666.7	22 (31)	1342 (13)	•Center wavelength is derived from GLI spectral response.				33	7511.4	324 K	0.02 K
12	679.9	23 (33)	1293 (12)	•S/N tests are in ambient (VN+SW) and high temp (MT) condition.				34	8626.3	350 K	0.05 K
13	678.6	342 (522)	235 (12)	•*1 Maximum radiance for **linear response (VN2)**				35	10768	354 K	0.05 K
14	710.5	16 (24)	1404 (10)	•*2 Predicted maximum radiance for **DN=4095 (12bit) or saturation.**				36	12001.3	358 K	0.06 K

NASDA GLI CAL Group, May 1, 2002

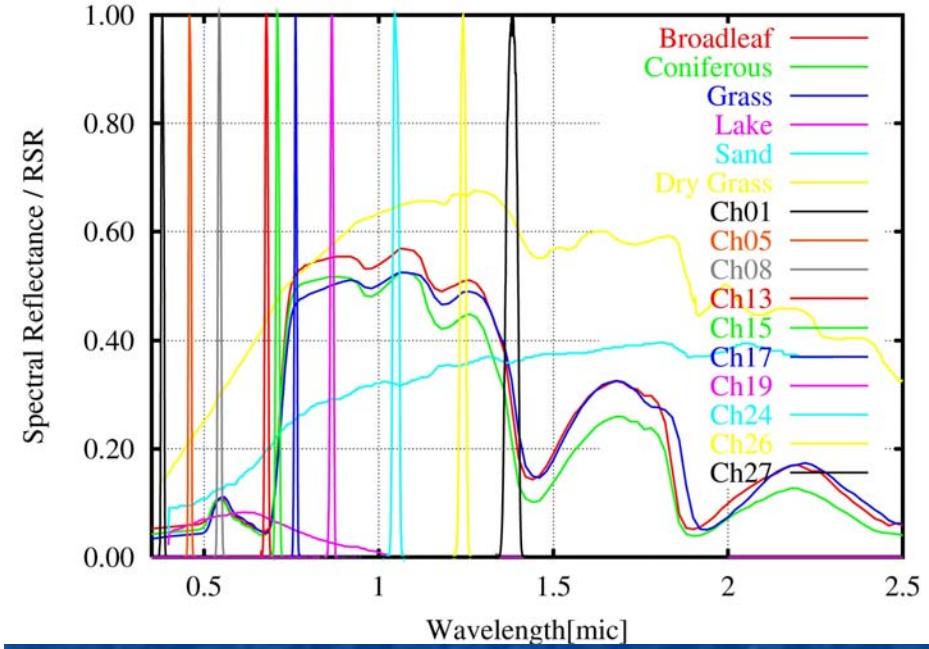
:1km Land Channel

:250m Land Channel

→ Difficult to see the characteristics...

Comparison of RSR of GLI land channels

VNIR SWIR

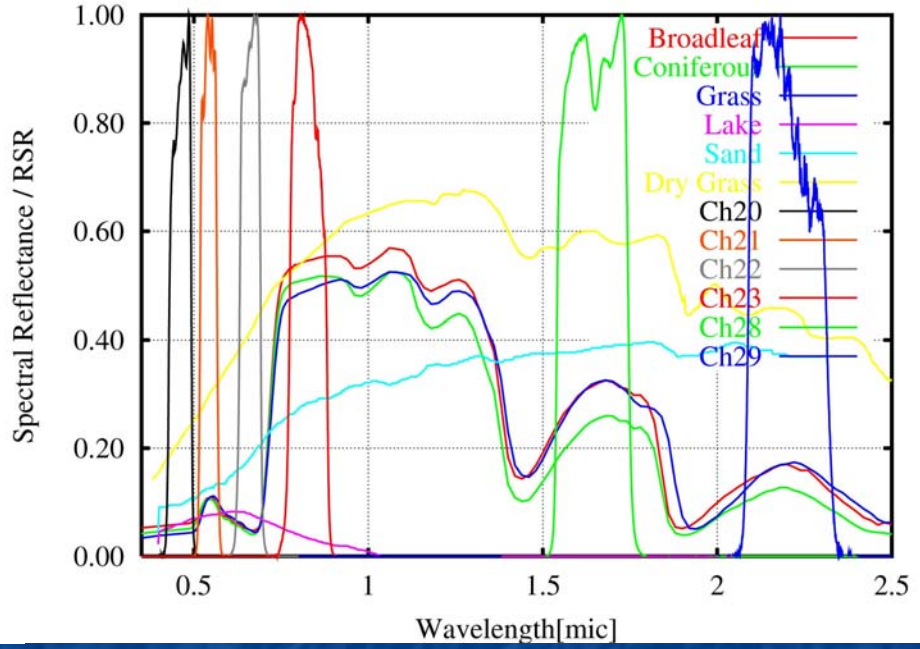


RSR of 1km land channels
With typical spectral reflectance

7 VNIR land channels
3 SWIR land channels
5 MTIR land channels

➔ **Narrow-band**

VNIR SWIR



RSR of 250m land channels
With typical spectral reflectance

4 VNIR land channels
2 SWIR land channels

similar to Landsat/TM, ETM+

➔ **Broad-band**

GLI data Level definition

Level 0 (GLI 1km,250m):

'Raw' data

Level 1A(GLI 1km,250m):

Reformatted L0

- Bit string(13bits) of L0 is transformed into byte unit(16bits).
- Radiometric and Geometric correction coefficients are attached.

Level 1B(GLI 1km,250m):

Radiometric corrections and Geometric corrections are applied.

- Band registrations are done.
- Projection coefficients attached.
- Ocean/Land flags attached.
- Image data are grouped to 3, VNIR, SWIR, MTIR

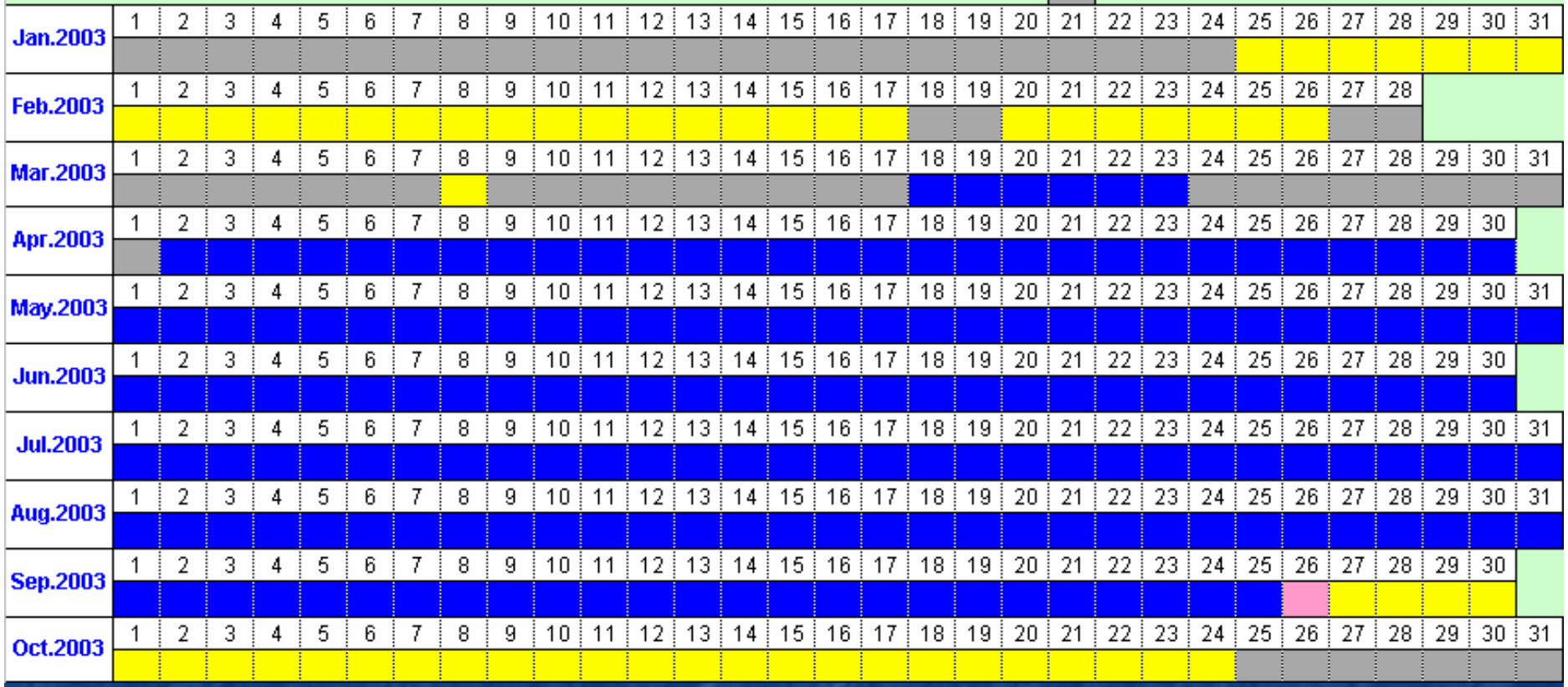
GLI 250m land higher level products

1. **Precise Geometrically Corrected Radiance**
2. **16-day composite Reflectance**
3. **Atmospherically Corrected Reflectance**
4. **Vegetation Index (NDVI,EVI)**

→ Research Products

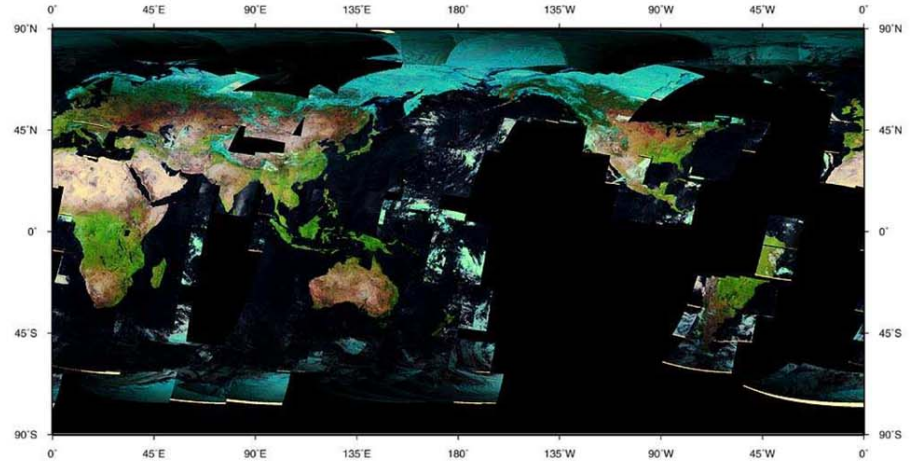
[Processed list of GLI](Level-1A,Level-1B)

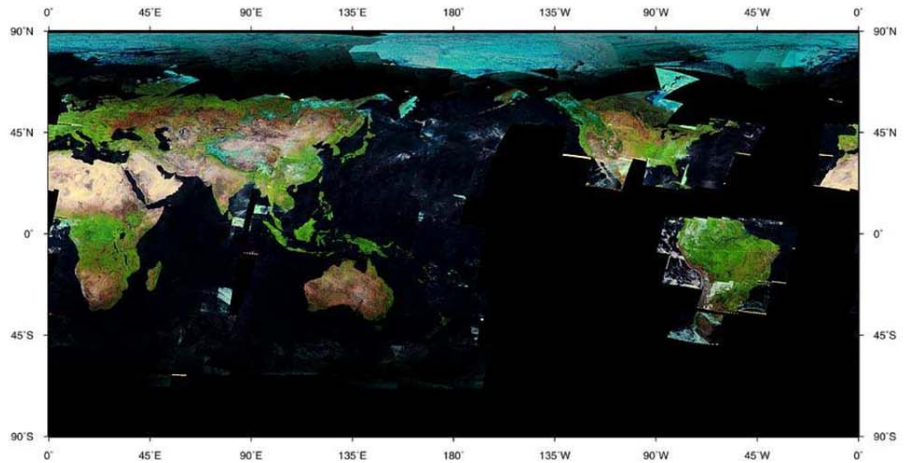
As of Feb. 22 2005

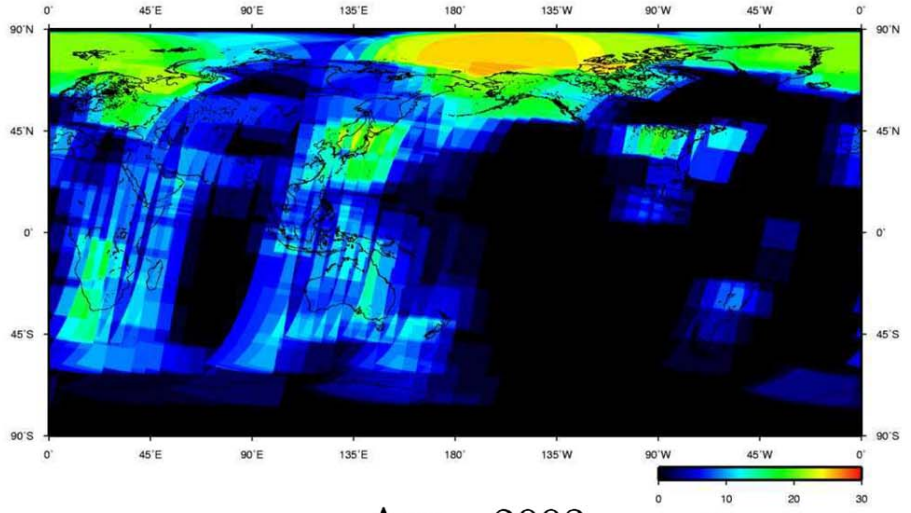


GLI data is re-processing L1 and higher level products in EOC.
GLI 250m L1 data is being re-processed until Sep. 25.
GLI 250m higher level products will be generated in EORC.

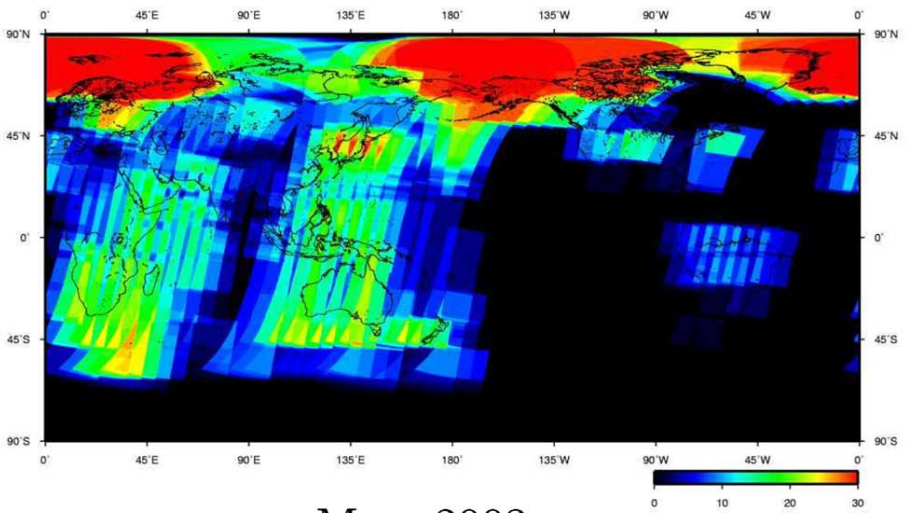
250m coverage map (Apr. & May, 2003)





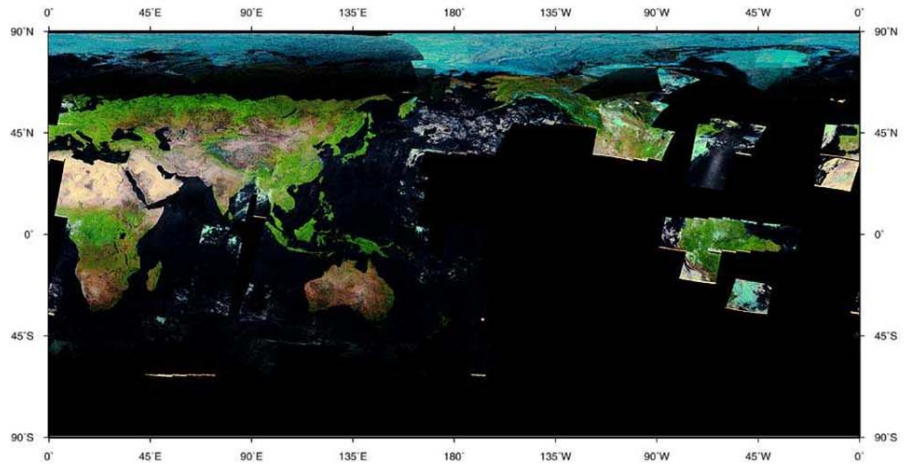


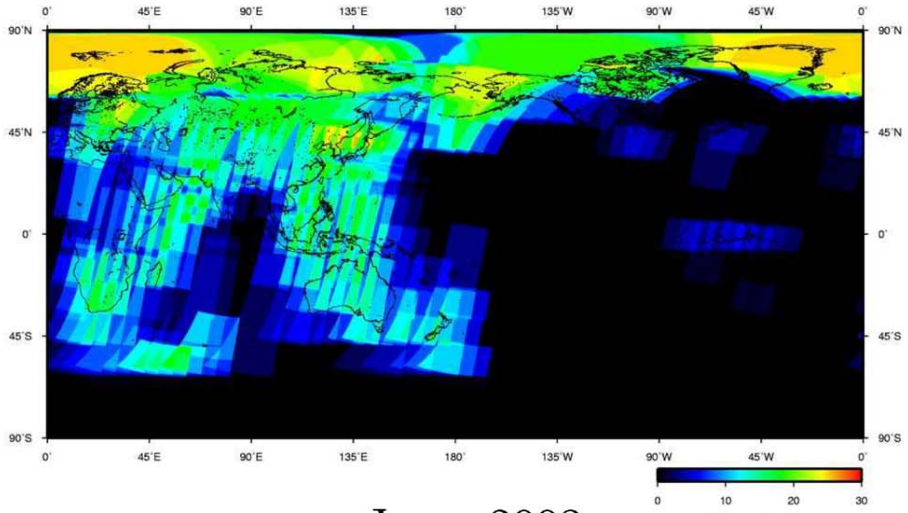
Apr. ,2003



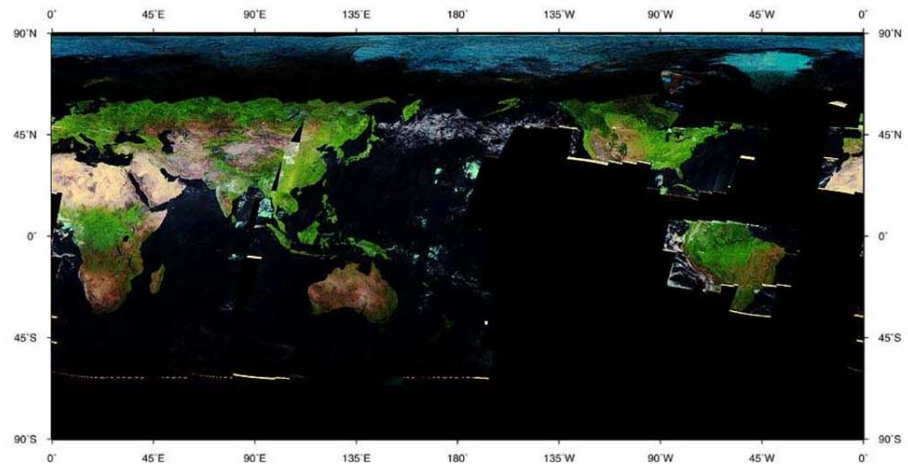
May ,2003

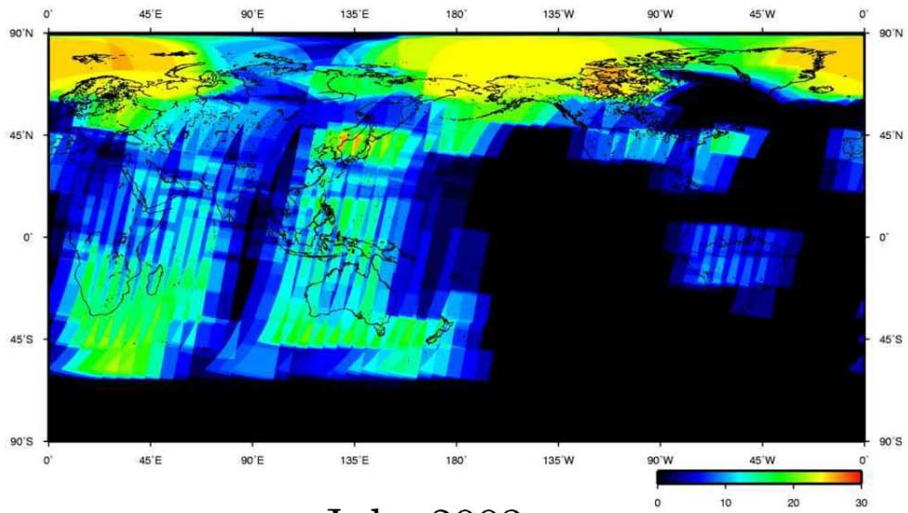
250m coverage map (Jun. & Jul., 2003)





Jun. ,2003

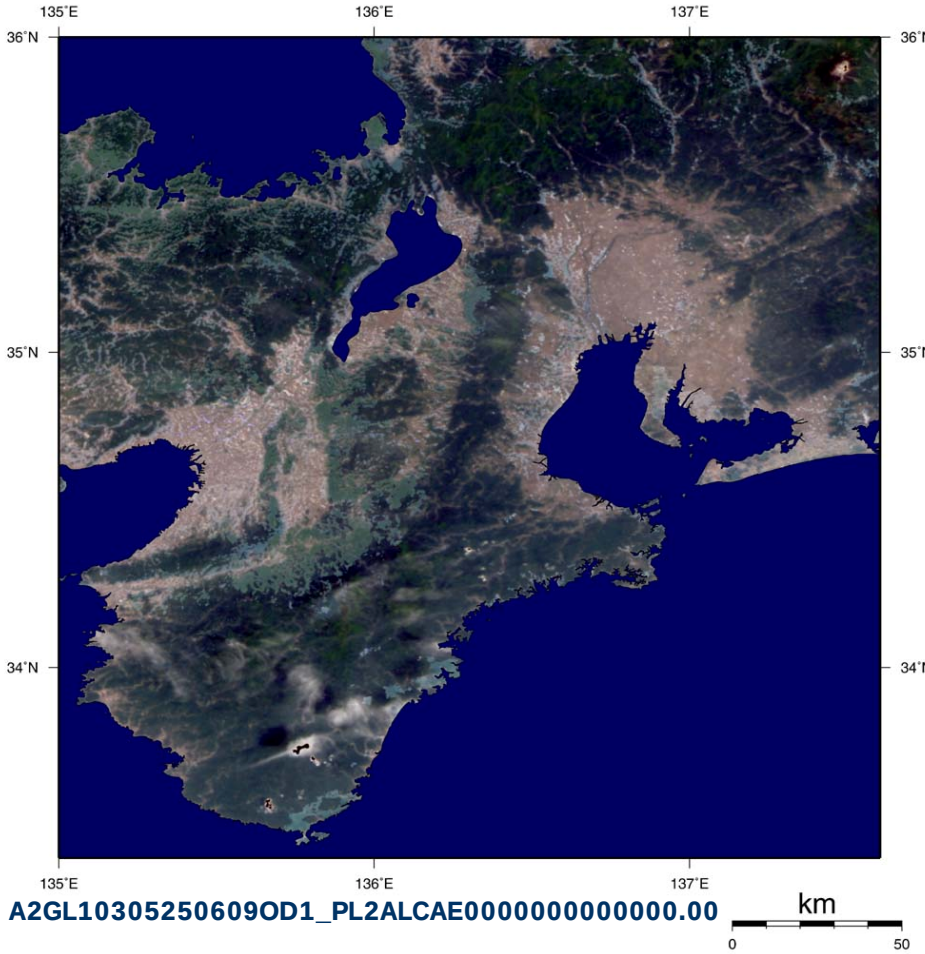


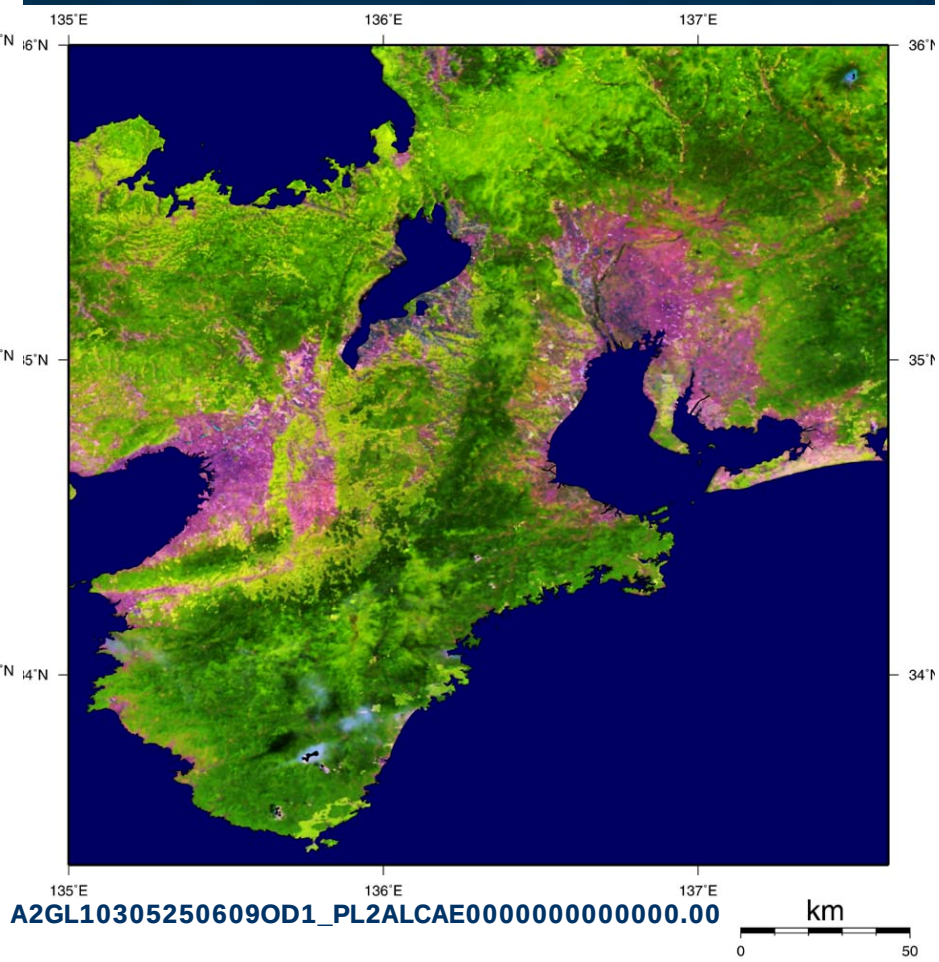


Jul. ,2003

We are trying to research GLI 250m acquisition rate over land for removal of clouds.

GLI 250m 16-day Composite (Reflectance)





May 25, 2003~June 9, 2003
(R/G/B=Ch.22/Ch.21/Ch.20)

May 25, 2003~June 9, 2003
(R/G/B=Ch.28/Ch.23/Ch.22)

The accuracy of 250m precise geometric correction is less than 1pixel

GLI 250mdata allow us to more detailed vegetation distribution and changes.

GLI 250m Atmospherically corrected Reflectance

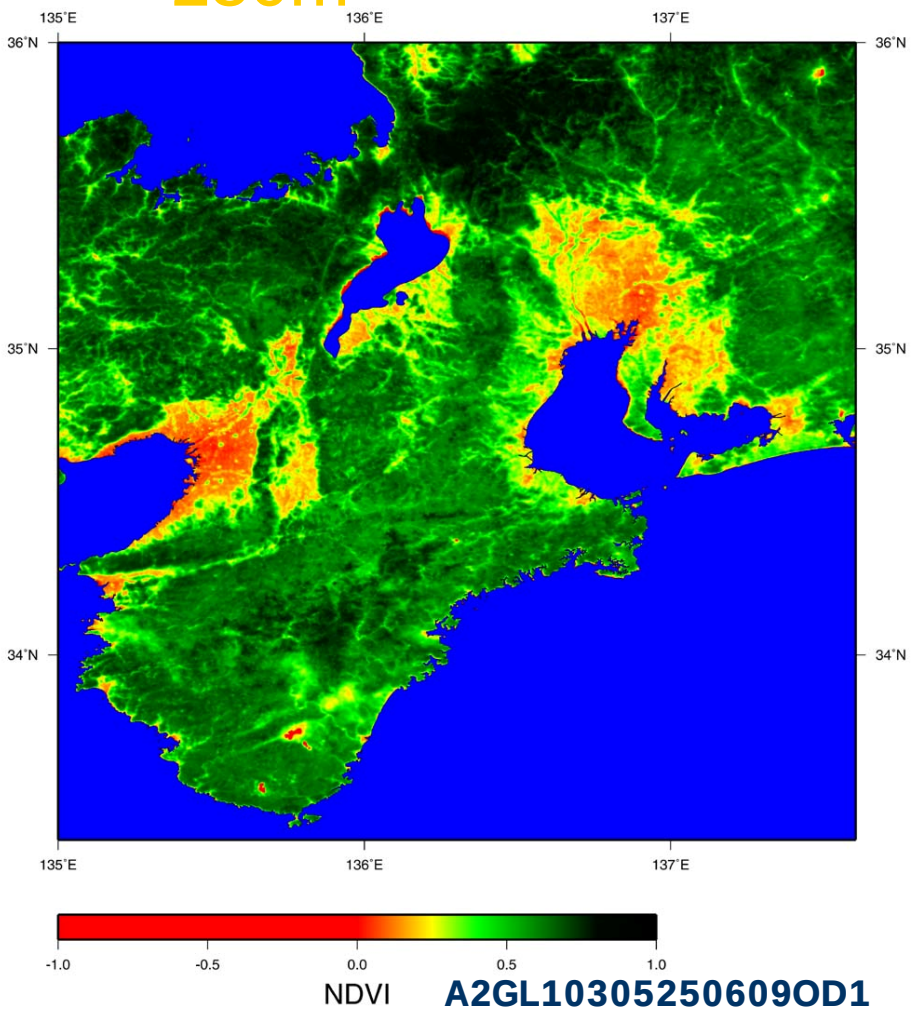
Uncorrected （RGB= (Ch.22,21,20) ）

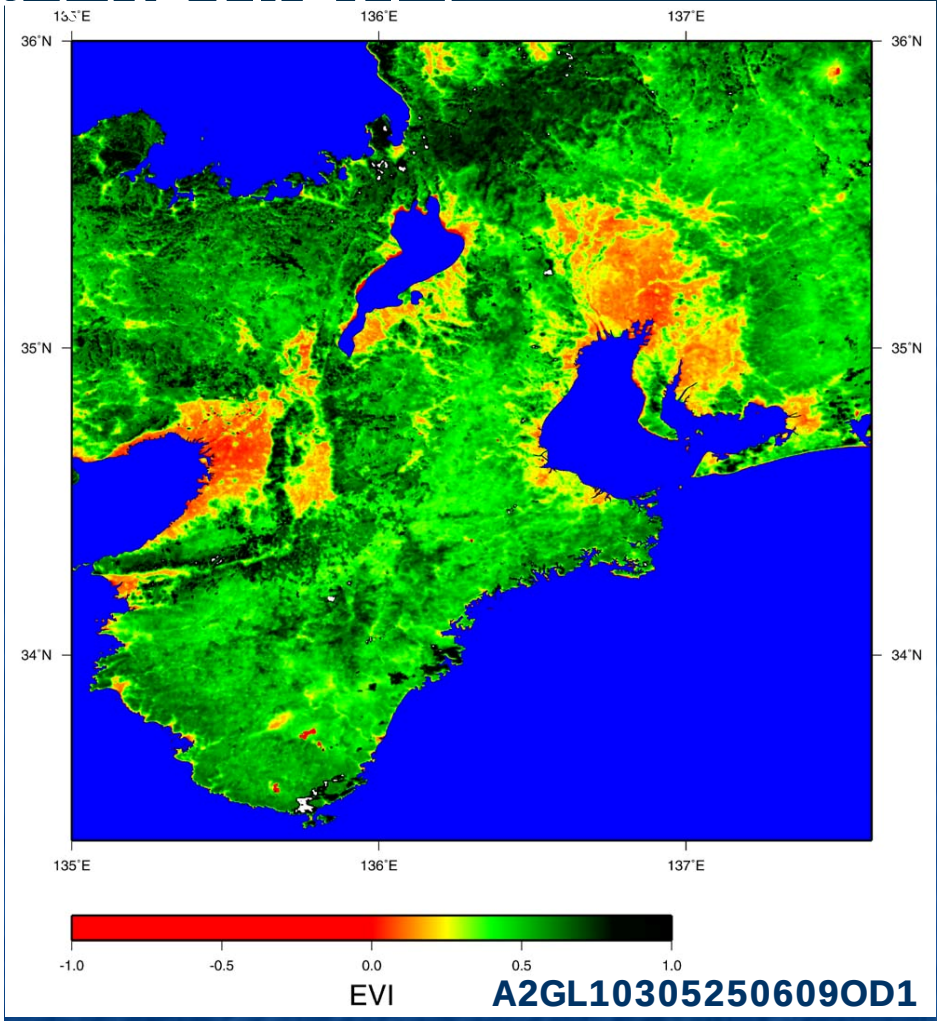
Corrected （RGB= (Ch.22,21,20)）

Example of applying **1km ozone & Rayleigh correction algorithm to 250m data**

This algorithm has **completed to be installed now** !
Products are **under verification** !

GLI 250m 16-day Composite (NDVI/EVI)





GLI 250m NDVI image

May 25, 2003~June 9, 2003

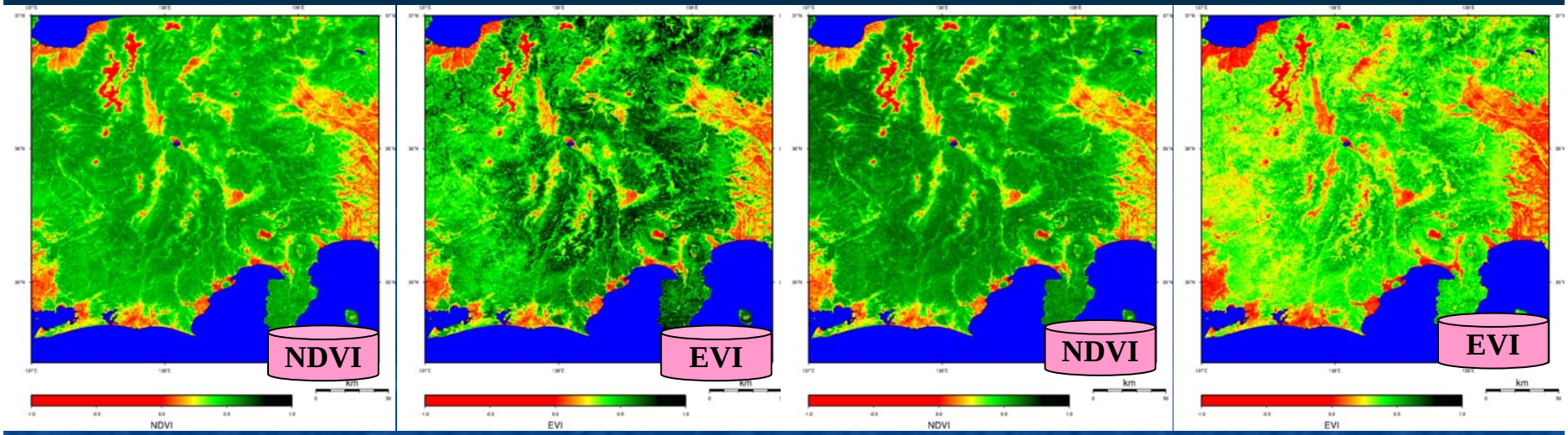
GLI 250m EVI image

May 25, 2003~June 9, 2003

→ Especially, EVI is easy to be affected to aerosol over land, because this index use blue channel.

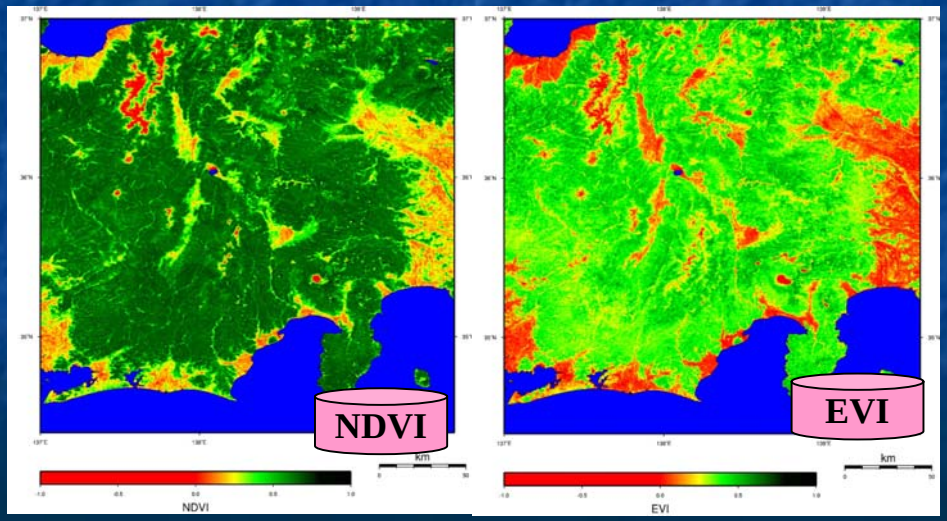
→ It is also **needed to evaluate** by using other satellite data and validation data.

Inter-comparison of ADEOS-II/GLI and Terra/MODIS 250m VI



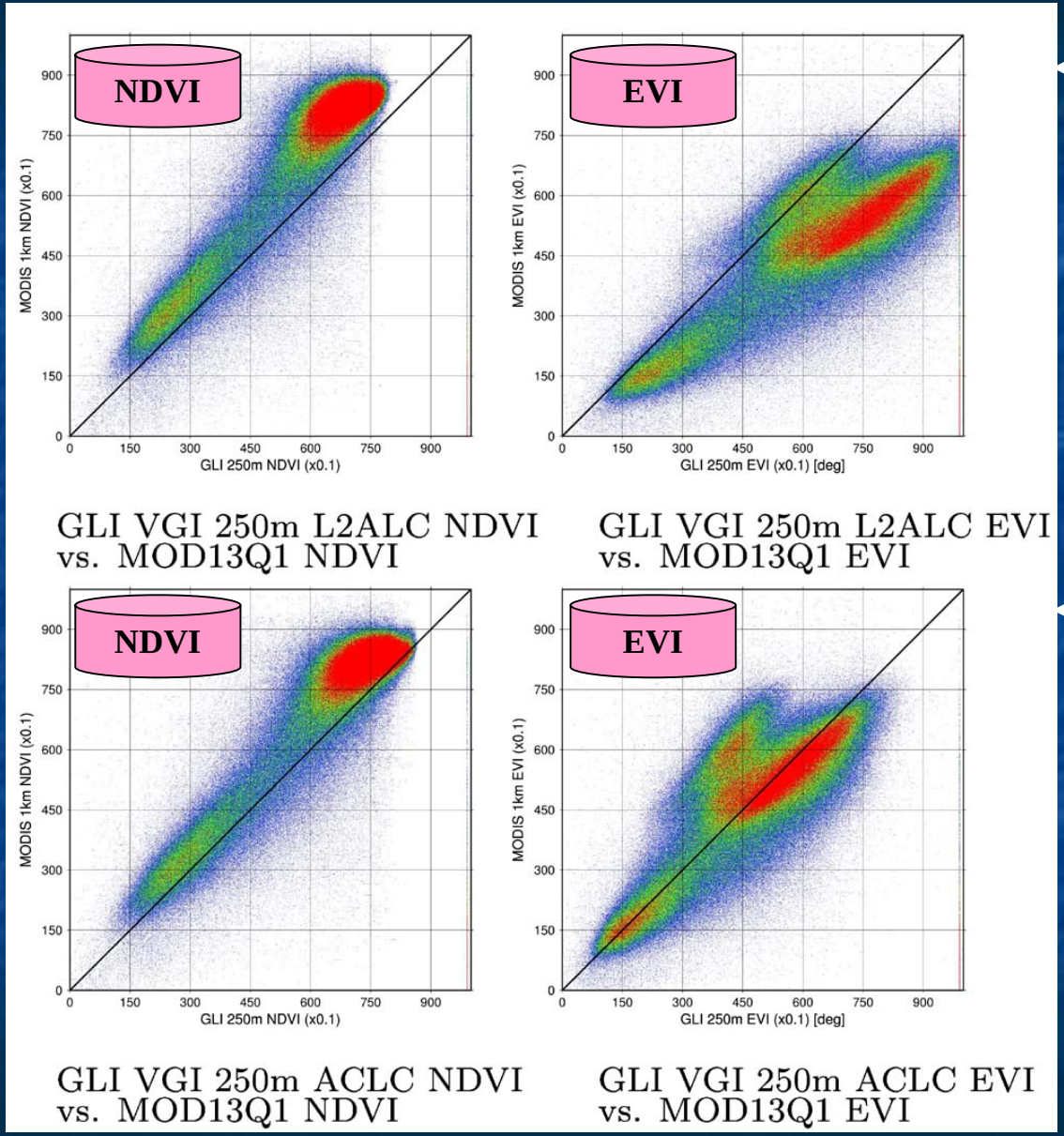
Rayleigh/Ozone Uncorrected **Rayleigh/Ozone Corrected**

GLI 250m 16-day NDVI/EVI Composite (May.25~Jun.9, 2003.)



MODIS 250m 16-day NDVI/EVI Composite (MOD13Q1) (May.25~Jun.9, 2003.)

Inter-comparison of ADEOS-II/GLI and Terra/MODIS 250m VI



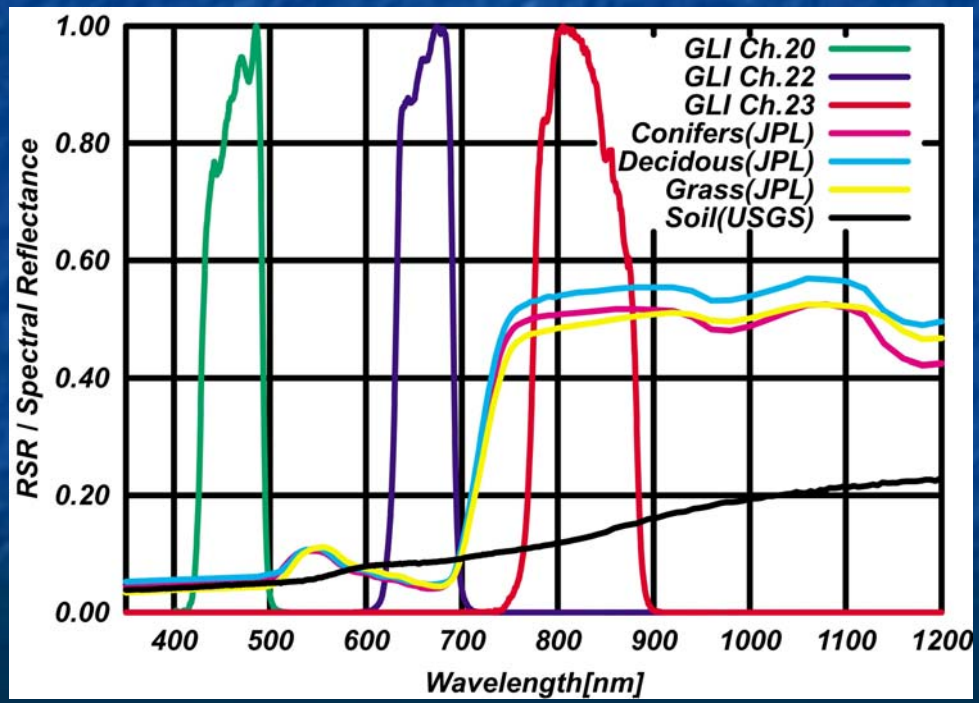
Rayleigh/Ozone Uncorrected

Rayleigh/Ozone Corrected

***GLI 250m NDVI/EVI also has similar trend of MODIS NDVI/EVI.**
***GLI 250m NDVI is lower than MODIS 250m NDVI.**
***GLI 250m EVI is higher than MODIS 250m EVI.**

Estimation of relative error of GLI NDVI affected by Water Vapor and Aerosol

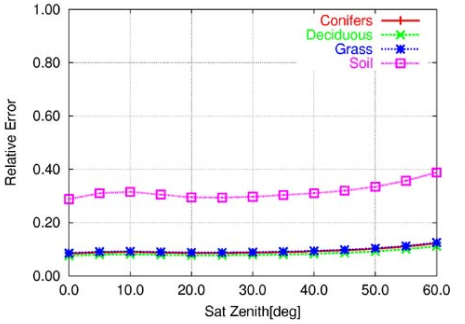
Radiative Transfer Code :6S
Spectral Reflectance :USGS Digital Spectral Library splib05a, JPL ASTER spectral library
Solar Elevation:N30[deg](Jun. 21)10:30, N60[deg](Jun. 21)10:30
Satellite Zenith Angle :0[deg]~60[deg], interval=5[deg]
Relative Azimuth Angle :0[deg]
Spectral Irradiance :Thuillier2002(Thuillier,2003)
Ground Surface :Lambertian
Elevation :0m



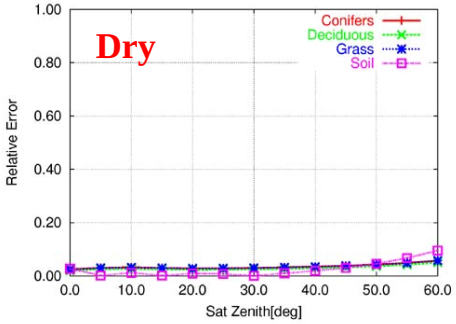
Spectral Reflectance with GLI 250m RSR

Estimation of the aerosol and water vapor effect (simulation)

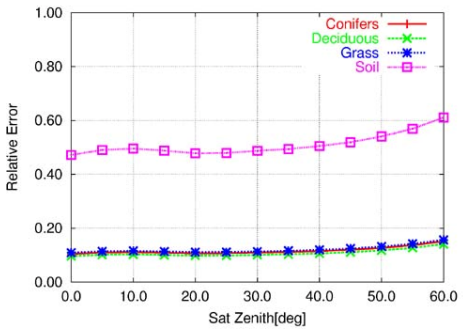
$$\varepsilon = \frac{|\ (\text{simulated L2A\_LC or ACLC}) - (\text{surface NDVI})\ |}{(\text{surface NDVI})}$$



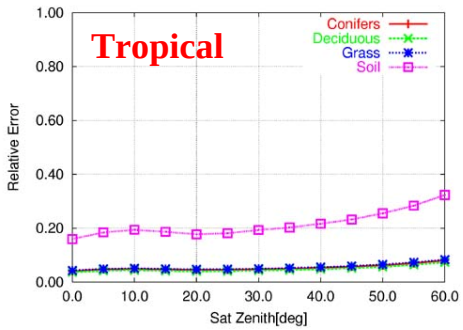
Atmospherically Uncorrected 250m NDVI



Atmospherically Corrected 250m NDVI

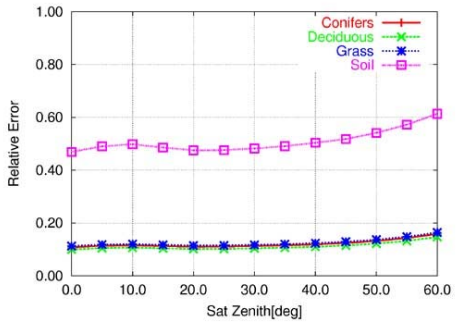


Atmospherically Uncorrected 250m NDVI

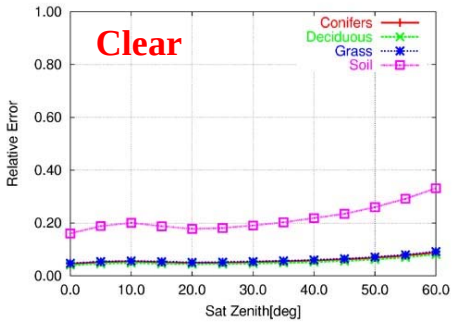


Atmospherically Corrected 250m NDVI

Relative error of GLI **250m** NDVI
N30[deg], Jun.21(**Water:0.0g/cm2**)

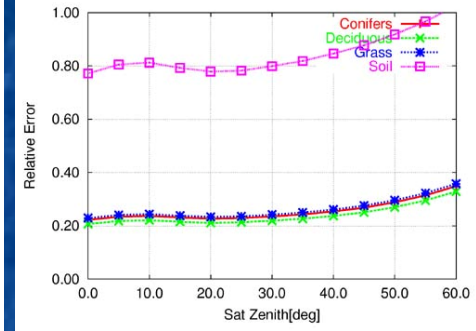


Atmospherically Uncorrected 250m NDVI

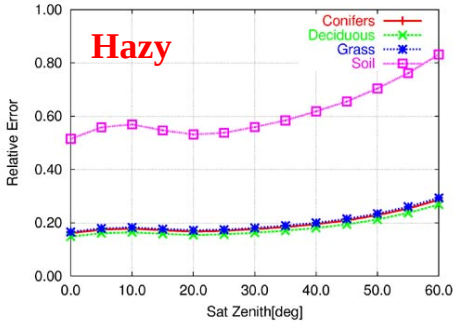


Atmospherically Corrected 250m NDVI

Relative error of GLI **250m** NDVI
N30[deg], Jun.21(**Water:4.0g/cm2**)



Atmospherically Uncorrected 250m NDVI



Atmospherically Corrected 250m NDVI

Relative error of GLI **250m** NDVI
N30[deg], Jun.21(Continental, **visibility:23km**)

Relative error of GLI **250m** NDVI
N30[deg], Jun.21(Continental, **visibility:5km**)

Atmospheric Model :Midlatitude Summer uO3=0.319cm-atm)

Aerosol Type :Continental (Dust-like=70%, Water-Soluble=29%, Oceanic=0%, Soot=1%), VIS=23km

GLI 250m NDVI is affected by water vapour and aerosol.

Conclusions :

1. GLI 250m L1 data is being re-processed until Sep. 25, 2003 (Feb. 22, 2005) . GLI 250m higher level products will be generated in EORC.
2. The accuracy of 250m precise geometric correction is less than 1pixel.
3. Composite and atmospheric correction algorithm seems to work well.
4. Atmospheric correction algorithm has completed to be developed now. Products are under verification .
5. GLI 250m NDVI/EVI has similar trend of MODIS NDVI/EVI. GLI 250m NDVI is lower than MODIS 250m NDVI. GLI 250m EVI is higher than MODIS 250m EVI. The coefficients of EVI can be optimized for GLI.
6. GLI 250m NDVI/EVI is affected by water vapour and aerosol over land.
7. Inter-comparison of GLI, other satellite sensors, and field-based measurements data are ongoing studies.
8. GLI 250m higher level algorithm will be completed.
9. We are trying to research the GLI 250m acquisition rate over land (enough to remove clouds?).

If you have interests of ADEOS-II/GLI, please contact to
kath@eorc.jaxa.jp .