S5-09

Advanced terrestrial vegetation monitoring using hyper-temporal observation by Himawari-8/9 AHI

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1: Center for Environmental Remote Sensing (CEReS), Chiba University

科研費
KAKENHI

研究拠点形成事業
Core-to-Core Program

VL

1. New-generation GEOs are powerful for land monitoring

2. Development of land surface products by GEOs

3. Exploring International collaborations

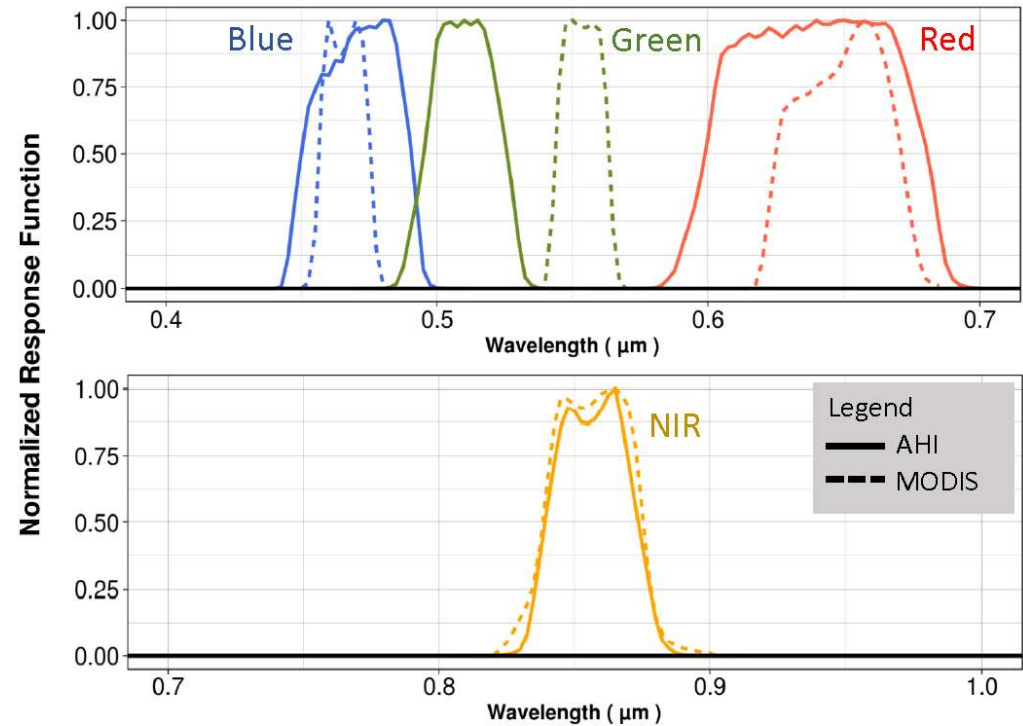# Why so effective for vegetation monitoring?

Himawari-8 AHI
(operational after July 2015)

☑ Multiple bands in VIS-NIR-SWIR
   (Similar to MODIS)

☑ Improved obs frequency, resolution
   (e.g. 10 min, 1km)

Effective Terrestrial Monitoring !
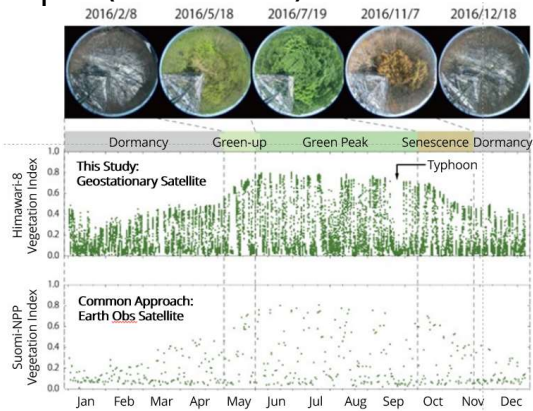

H8AHI vs Himawari-7, MODIS (Terra, Aqua)

	Himawari-8	Himawari-7	MODIS (Terra, Aqua)
Bands	16bands VIS, NIR, SWIR, MTIR, TIR	5bands VIS-NIR(1), MTIR, TIR	36bands VIS, NIR, SWIR, MTIR, TIR
Spatial Resolution (at Nadir)	0.5 – 2 km	1km, 4km	0.25km, 0.5km, 1km
Temporal Resolution (Obs Frequency)	10min	30min	1day

Potential Applications (paper review)
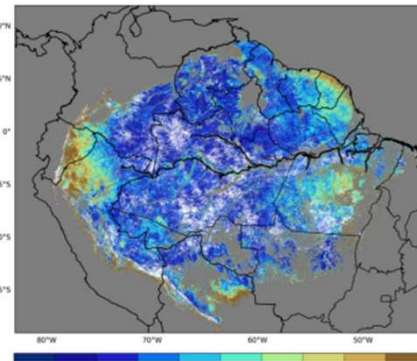
1. Shorter Composite (e.g. 8 -> 3day)
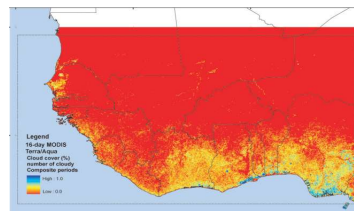
Japan (Himawari-8)

[Miura et al. 2019]

Africa (SEVIRI)
Fraction of cloud-free period

3day MSG/SEVIRI

16day Terra, Aqua/MODIS

[Fernsholt et al. 2007]

2. Phenlogy detection in heavily cloud region

Amazon (GOES-R)

[Hashimoto et al. 2021]

[Zhang et al. 2022]

3. Diurnal Variation

30-min photosynthesis (by GK-2A)
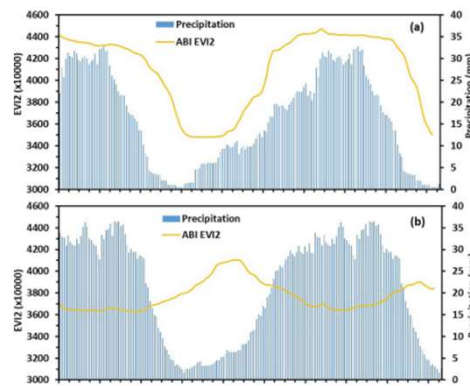
[Jeong et al. 2023]
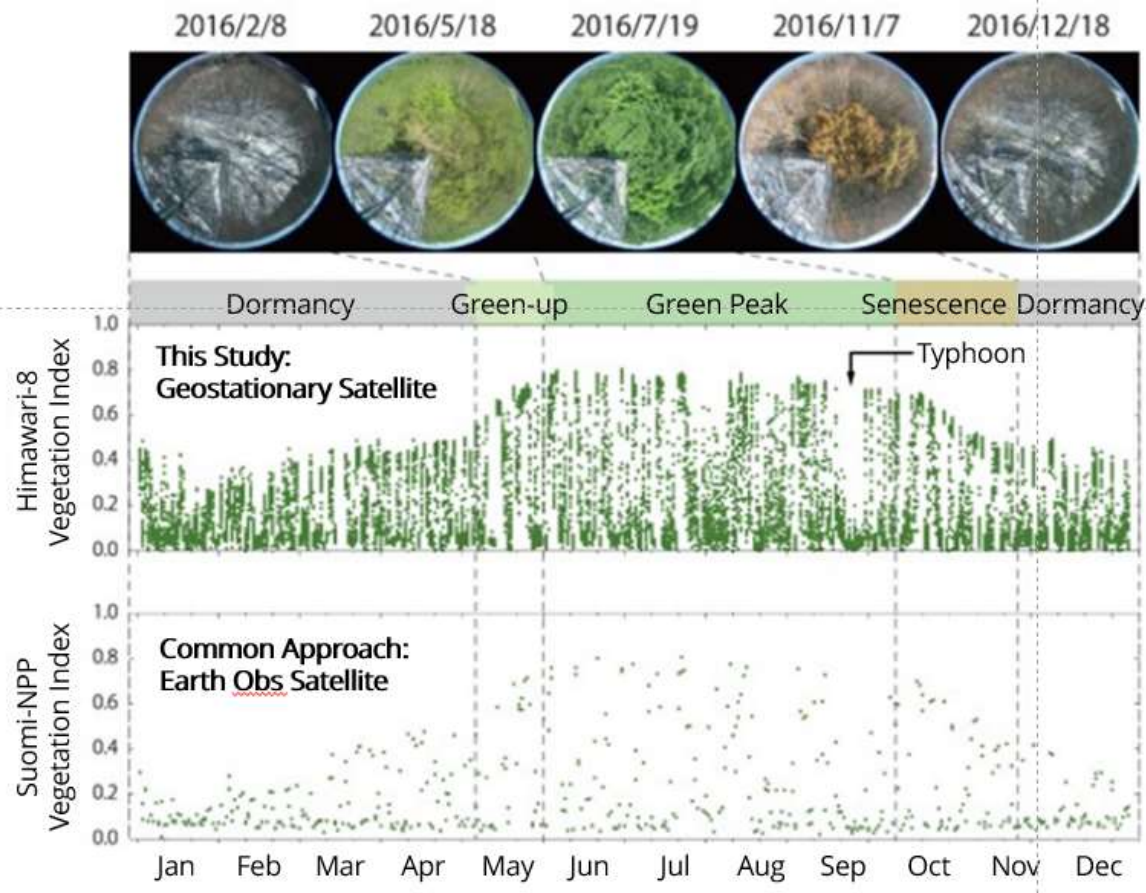
Application of diurnal patters
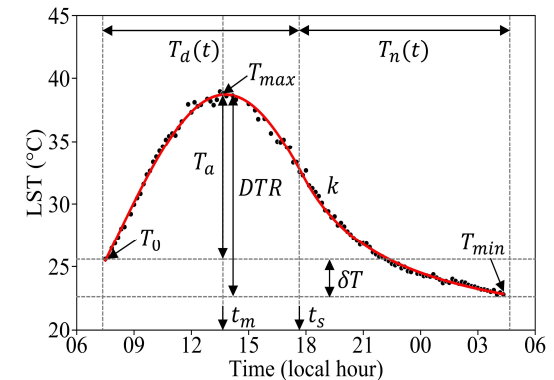
[Yamamoto et al. 2023]

Seasonal Variation in NDVI

[Takayama, Japan]

[Phenological Eyes Network (PEN)]

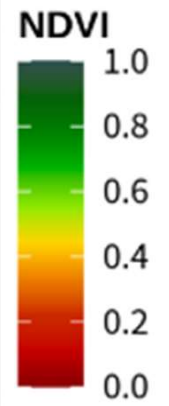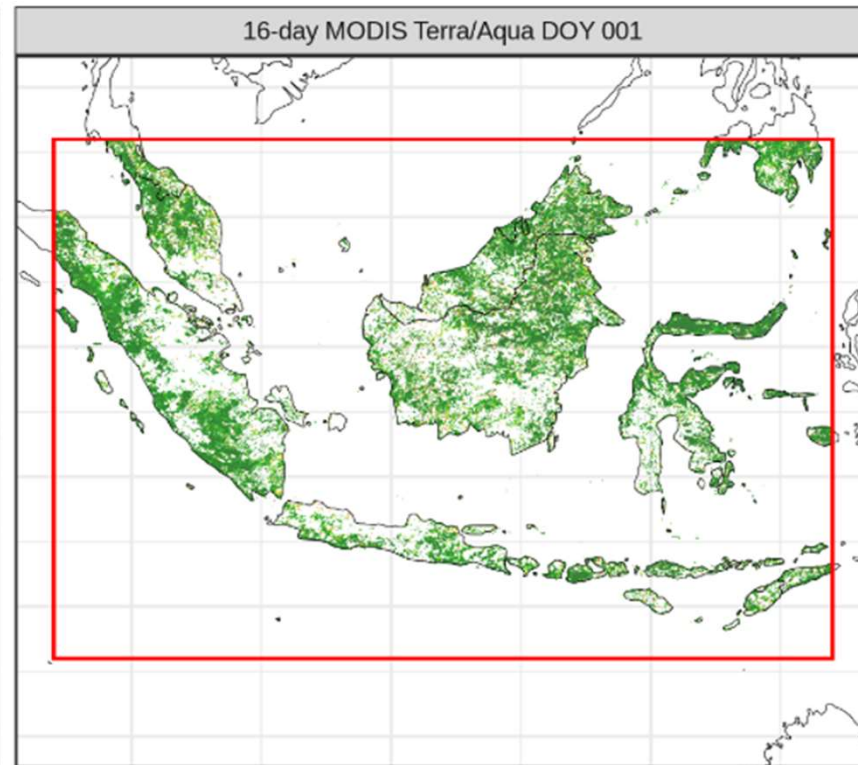| 2016/2/8 | 2016/5/18 | 2016/7/19 | 2016/11/7 | 2016/12/18 |

✓ Typical RS (VIIRS)

✓ Geostationary
(Himawari-8)

✓ Himawari :
Increased in observation (> 25 times)

✓ Shorter interval
(phenology)
(12 days → 4 days)

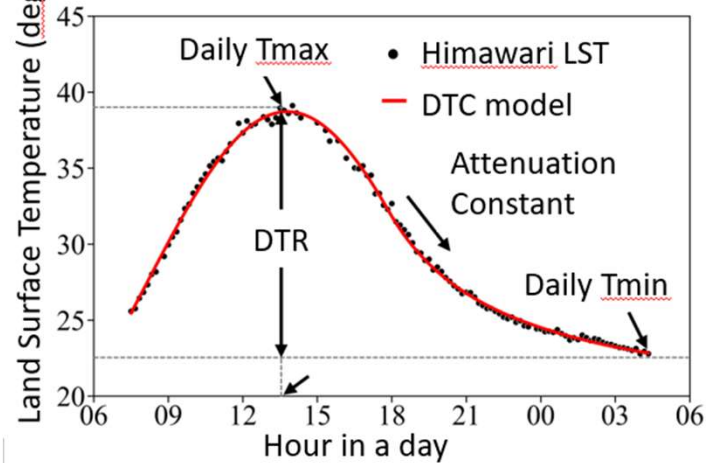[Miura et al. Sci Rep, 2019]

Himawari-8 AHI
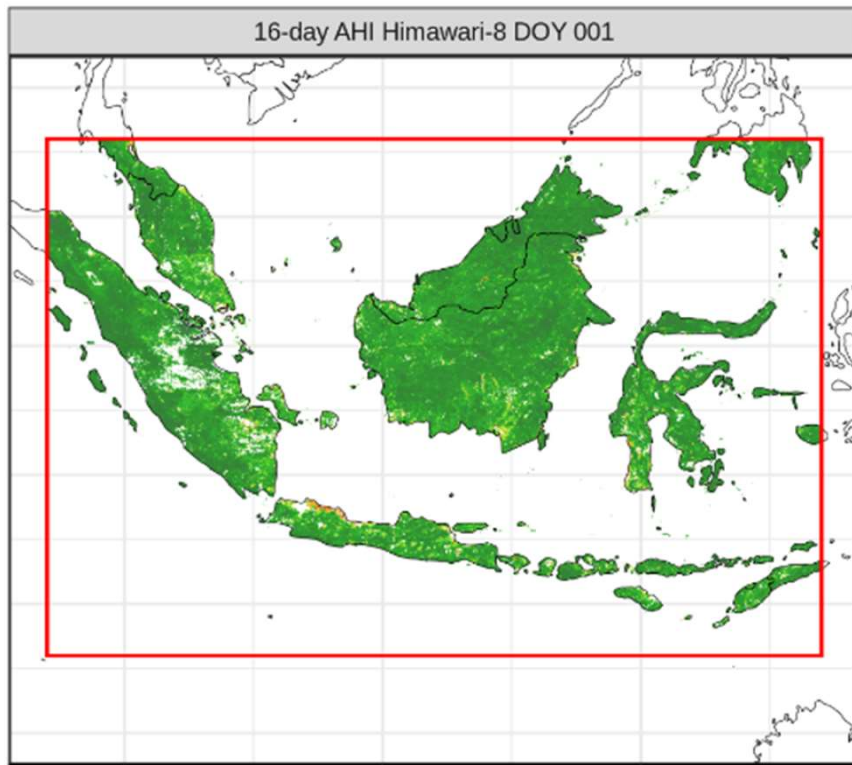
Terra+Aqua MODIS

White: No cloud-free data in the 16-day period
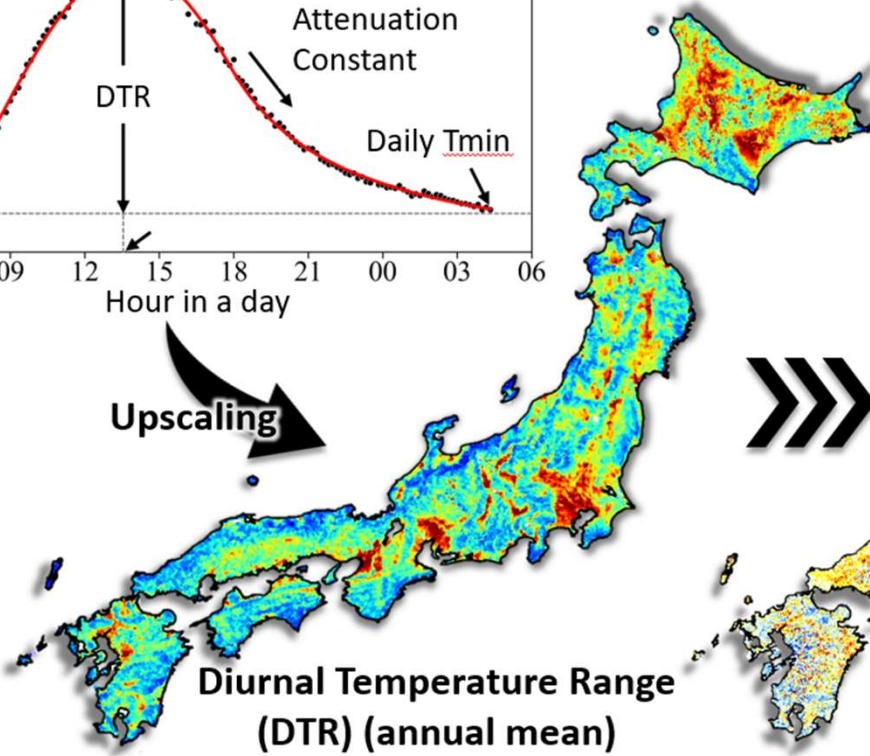
Diurnal Temperature Range (DTR) vs drought stress

Extract daily waveform parameters

Detect Veg Dryness Status

Diurnal Temperature Range (DTR) (annual mean)

DTR anomalies in heatwave days

[Yamamoto et al. 2023; RSE]
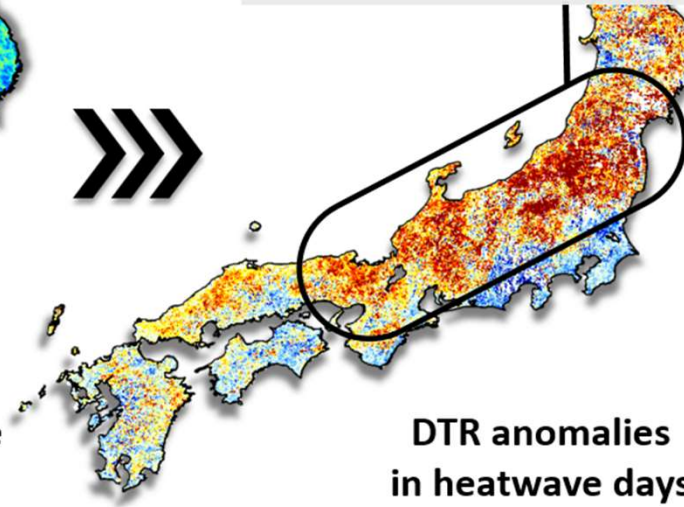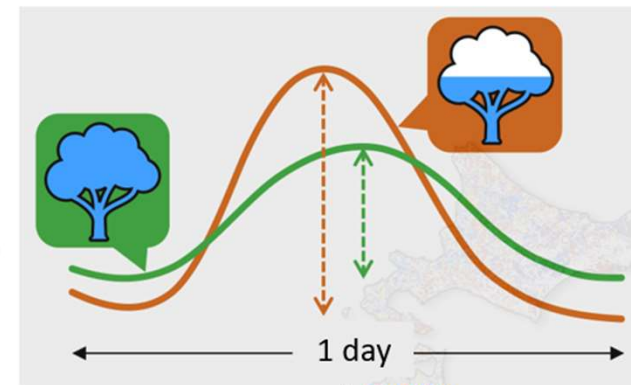
Geostationary Satellite : **Top-of-Atmosphere** Reflectance

Atmospheric
Correction
+
Evaluation

Our Target : Surface Reflectance
Higher Level Products

Incoming Surface Shortwave Radiation
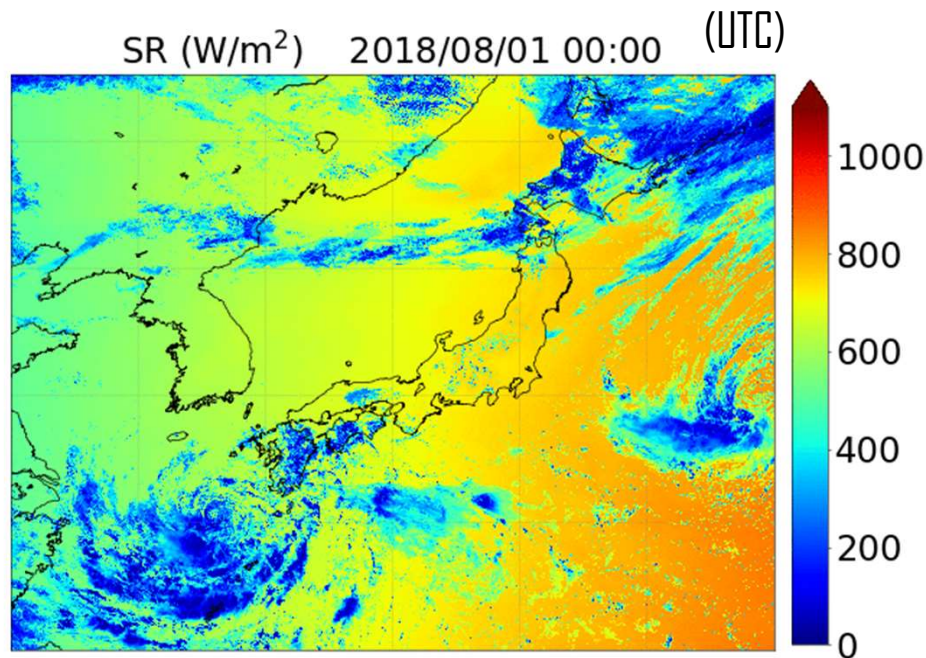
Land Surface Temperature (+cloud flag)

SR (W/m^2) 2018/08/01 00:00 (UTC)

LST (°C) 2018/08/01 00:00 (UTC)

Takenaka et al. (2011) JGR-A
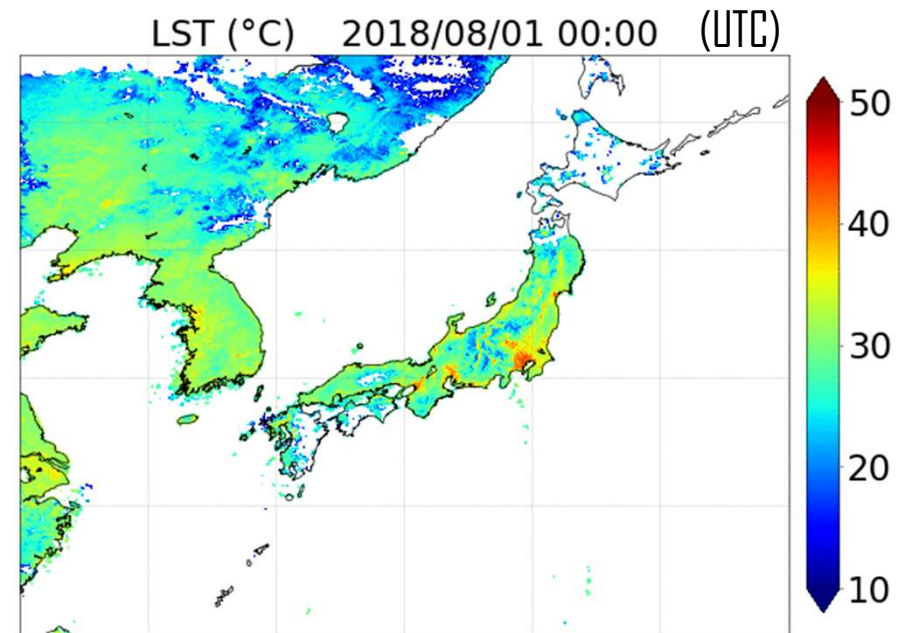
Yamamoto et al. (2018 JMSJ, 2022 ISPRS)

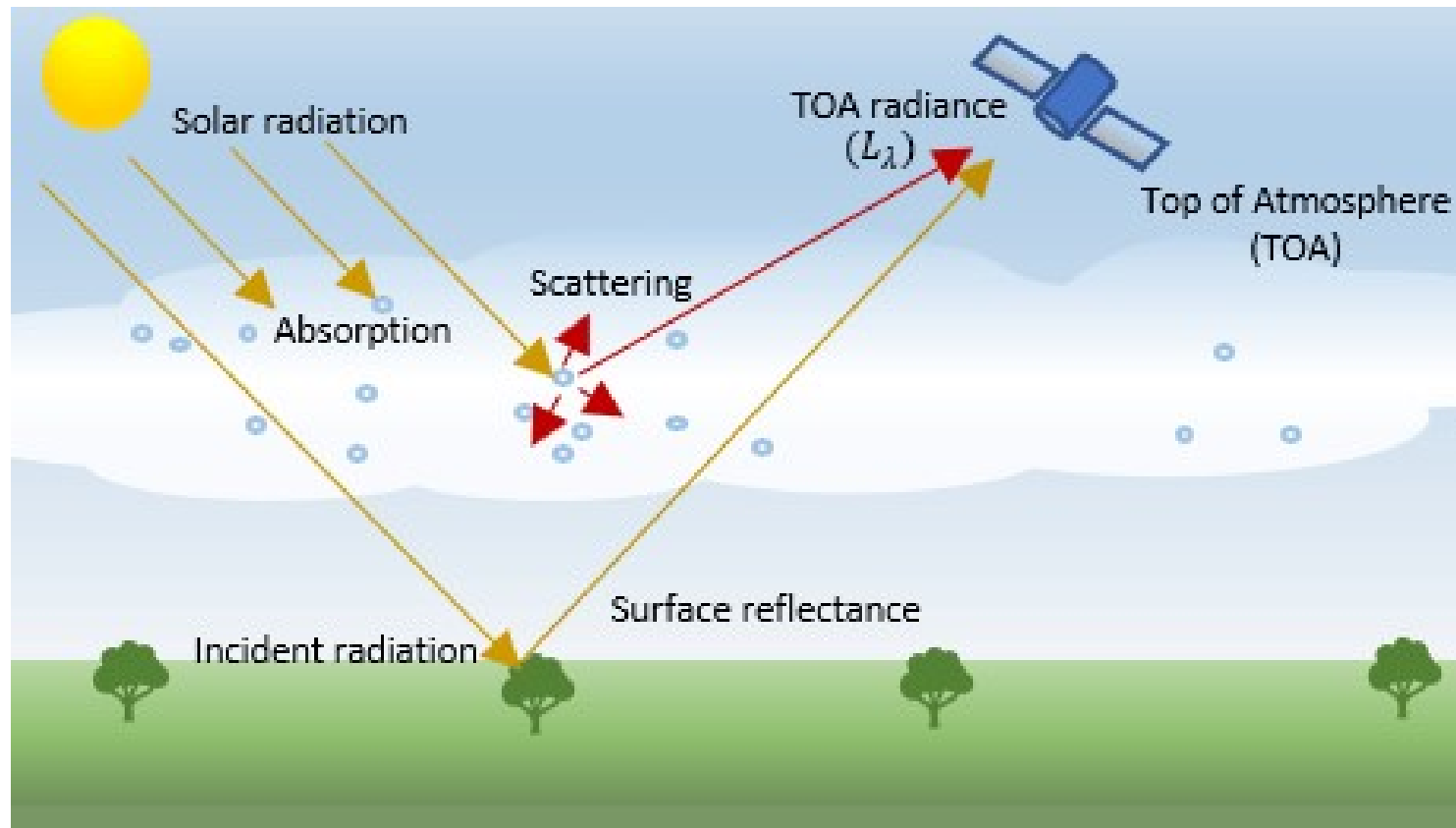# Status of product development (CEReS, Chiba Univ)

JMA to CEReS/ChibaUniv

Himawari–8 (vis.01) 20160512 0300UTC

Org Data (Full-disk)   **Calibration Info (JMA)**

Geometric Correction

JMA, (NICT) (Full-disk)

Implement
Higuchi
Takenaka

[Takenaka et al. 2020]
[Yamamoto et al. 2020]

CEReS Geo-Corr Reprojection

Evaluate
Yamamoto

CEReS (lon-lat)

TOA Reflectance
TOA Brightness Temp

ftp://hmwr829gr.cr.chiba-u.ac.jp/
gridded/FD/V20190123/

CEReS/CU data -> Products

L-1   **CEReS (lon-lat)**   TOA Reflectance
TOA Brightness Temp

Atmospheric Correction   Cloud Detection   Temp-Emissivity Retrieval

L-2   **Surface Reflectance**   **Cloud Mask**   **LST**

[Li et al. in prep]
[Zhang et al. in prep]   [Yamamoto et al. 2018]   [Yamamoto et al. 2018, 22]

BRDF Correction

Surface Reflectance (Standardized)

LST available at:
ftp://modis.cr.chiba-u.ac.jp/yyamamoto/
AHILST/v0/

Further Processing

L-3   **VI**   **Solar Rad.**   **GPP, ET**   **FPAR LAI**   **Fire?**

JSPS Core-to-core Program
(a. Advanced Resaerch Network)

(YR2022-2026)

静止気象衛星による国際陸域観測ネットワーク
GEOLAND-NET

グローバルな環境変動の現状把握と予測を 高い時間解像度で実現

CHIBA UNIVERSITY

1. データ検証（地上観測）　2. プロダクト構築　3. プロダクト応用

https://ceres.chiba-u.jp/geoland/

研究拠点形成事業
Core-to-Core Program

The **1st** **Expert Workshop**
on Advancing International Constellation
of Geostationary Satellites for Terrestrial Monitoring
by GEOLAND-NET and CISESS

Click or read QR below to apply

Location
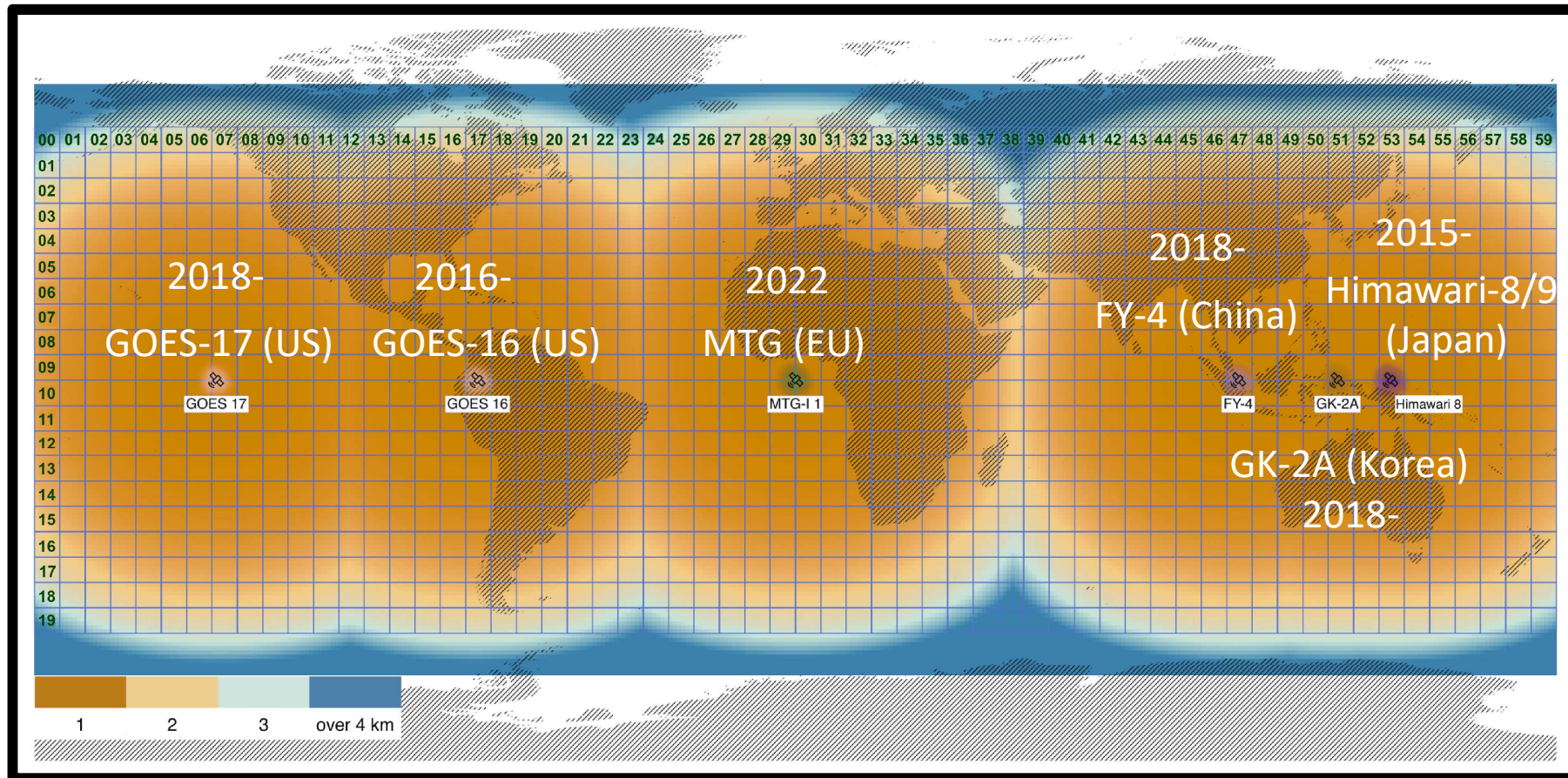University of Hawaii at Manoa, HI, US

2023/08

1st WS
(Hawaii)

Global Hyper-Temporal Observation Data (e.g. 10-min)

[Wang et al. 2020; Remote Sens]

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2. Development of land surface products by GEOs

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