

Research on development of ET-Index Map as a GCOM Land Product

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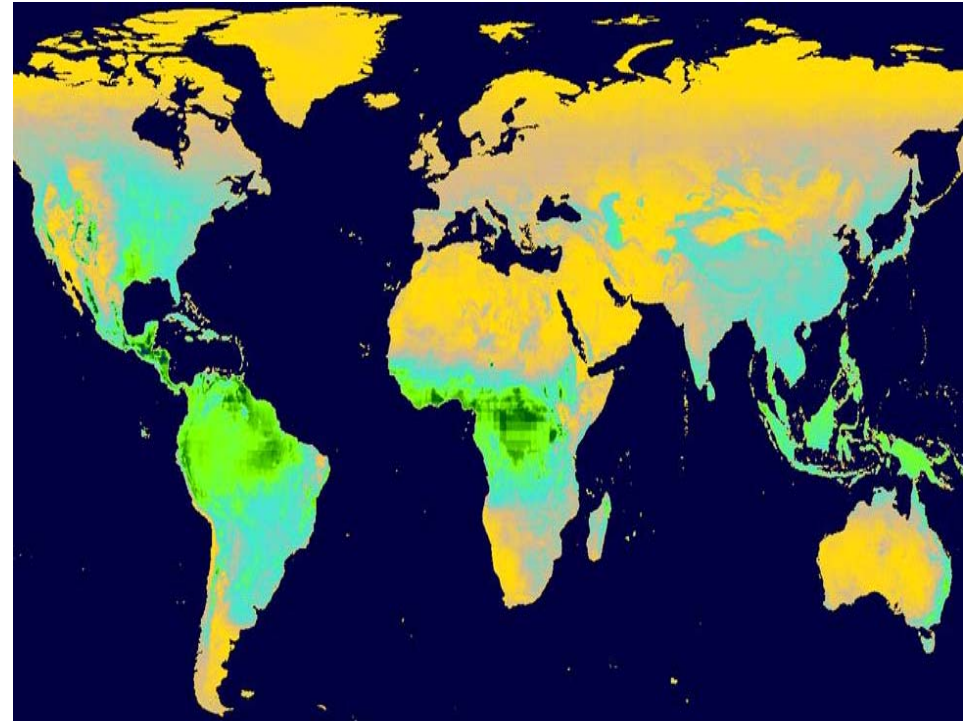
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Dr. Masao Moriyama, Nagasaki U.

Dr. Kazuo Mabuchi, Chiba Univ.

Ms. Kiyomi Hirakawa, U. Miyazaki

Dr. Richard G. Allen, Univ. Idaho

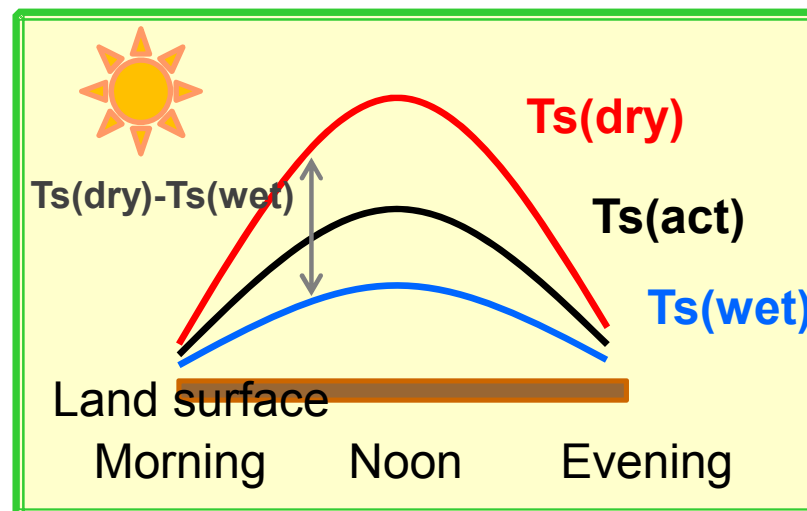


*Joint PI Workshop of Global Environmental
Observation Mission @ TKP Takebashi
Conference Center, Tokyo, Jan.14-17, 2014.*

GCOM-C1 ET Index Model

Satisfies:

- Global applicability
- Robustness
- Long-term stability
- Applicable to other datasets
- Fast-processing

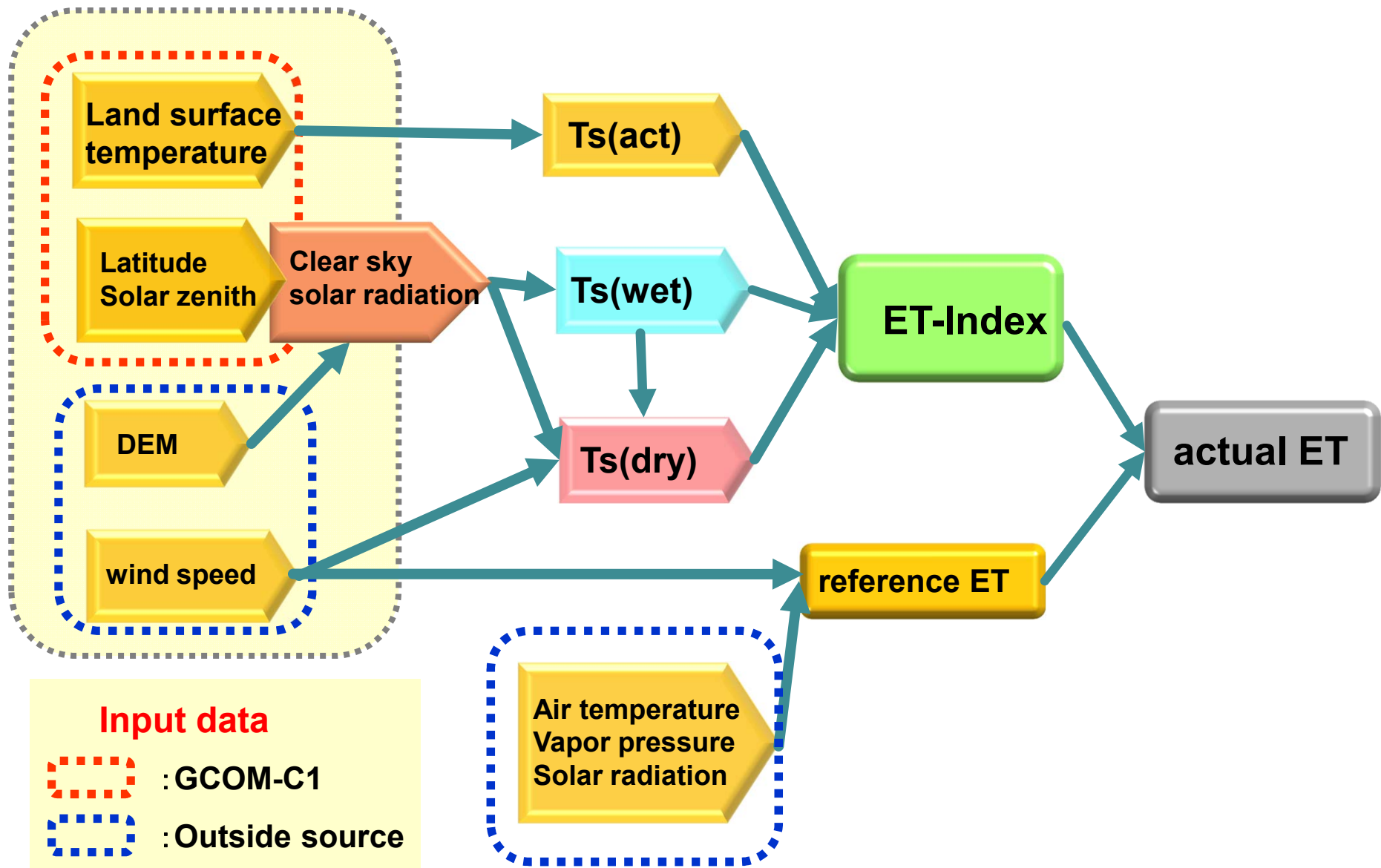


$$ET_INDEX = 1.23 \frac{T_s(dry) - T_s}{T_s(dry) - T_s(wet)}$$

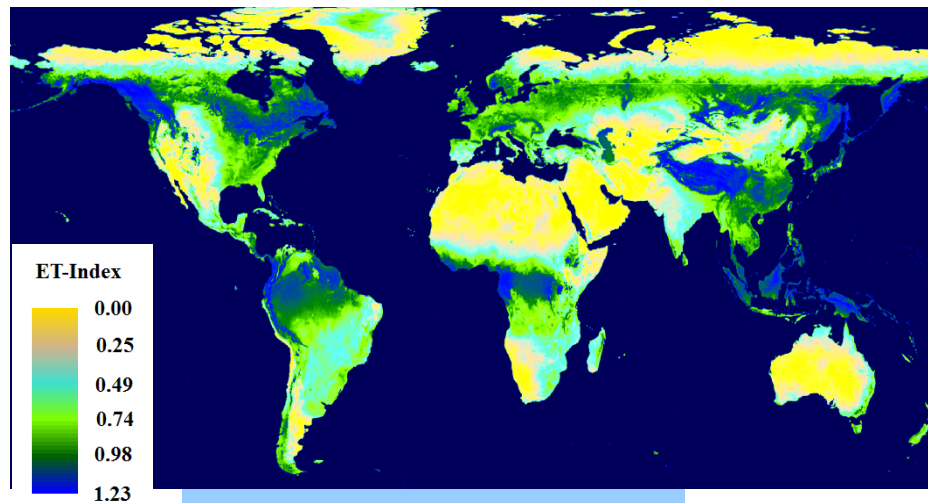
$$T_s(wet) = 0.06R_s - 30.34 - \sin\left(\frac{DoY + S_{day}}{365} \times 2\pi\right) \times f(Lat)$$

$$T_s(dry) = T_s(wet) + (-0.0023u + 0.0301)R_s$$

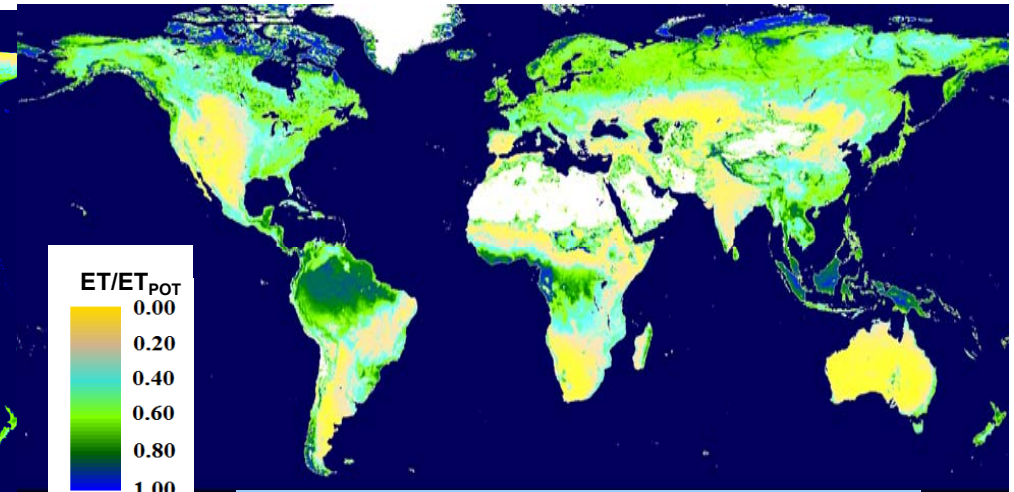
GCOM-C1 Global ET-Index



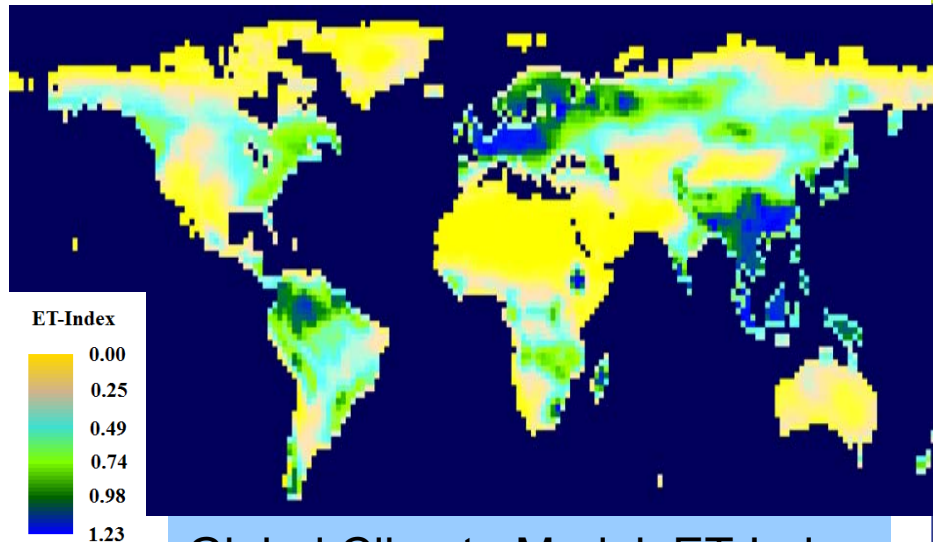
ET Index comparisons



GCOM-C1, ET-Index

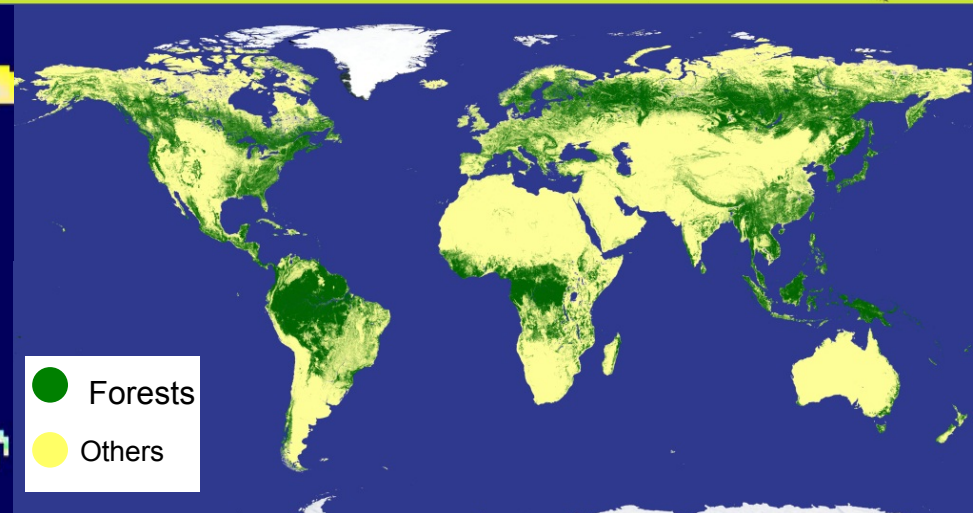


MODIS ET Product, ET/ET_{pot}



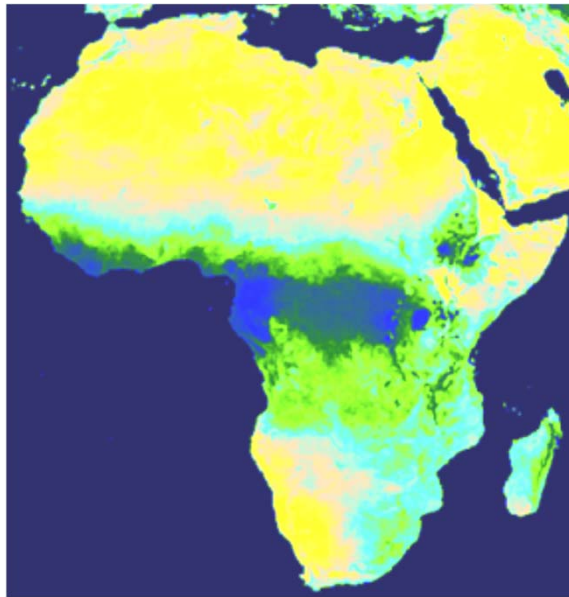
Global Climate Model, ET-Index

PALSAR 10m Global Forest/Non-Forest Map 2009

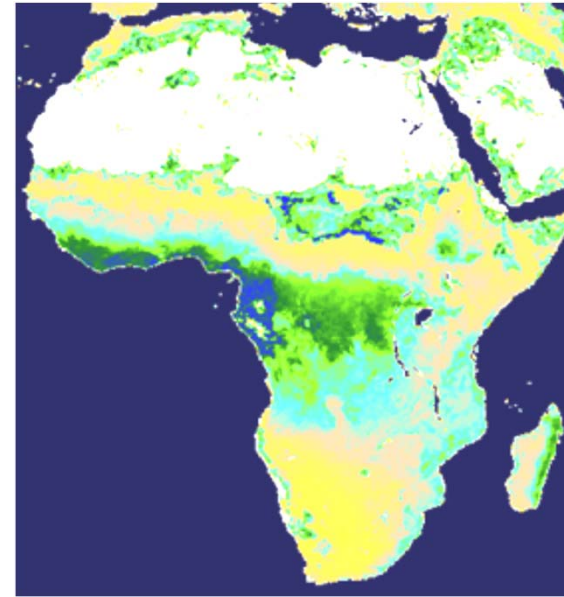


JAXA PALSAR Global Forest Map

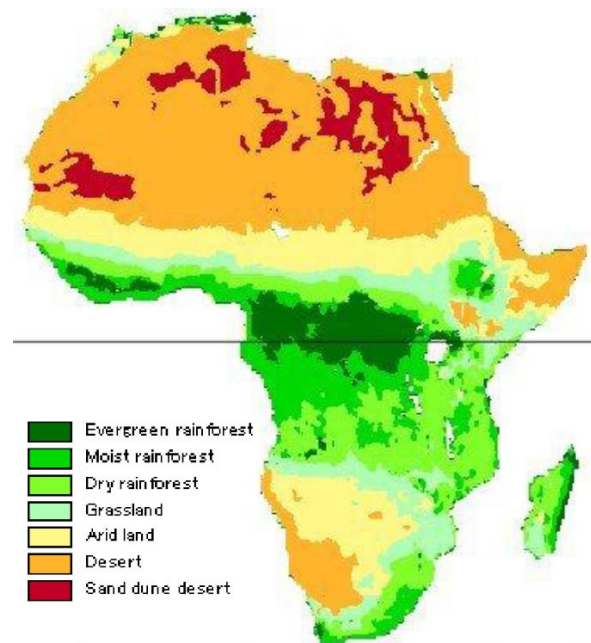
● Forest ● Non-Forest ● Water



Our result



MODIS ET Product



- Evergreen rainforest
- Moist rainforest
- Dry rainforest
- Grassland
- Arid land
- Desert
- Sand dune desert

Estimated Vegetation
map of Africa, by Dr.
Sanga of APU (2013)

RA#4 Research Proposal

Product Name : ET-Index

Definition : $ET\text{-Index} = ET_{act} / ET_{ref}$

Spatial Resolution = Same as Surface Temperature Product

Temporal Resolution = 16days (or daily if recomposed by 16days)

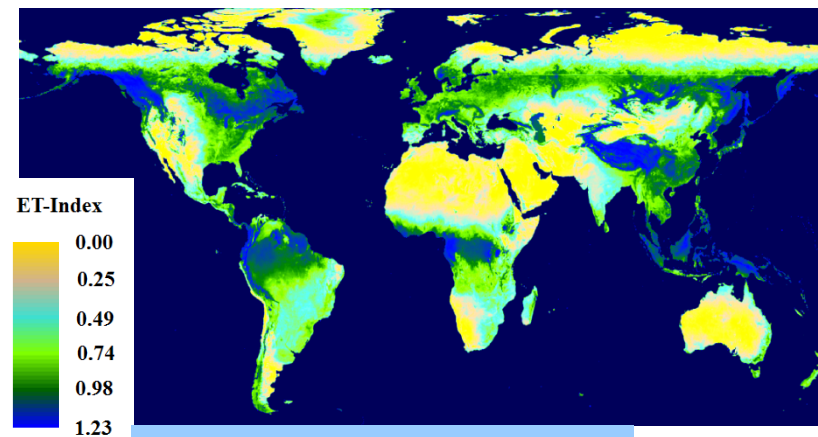
Target Accuracy (error) = 5-10% of “reference ET”
(in 1σ , in annual basis)

Primary purpose of research during RA#4

(1) Accuracy assessment

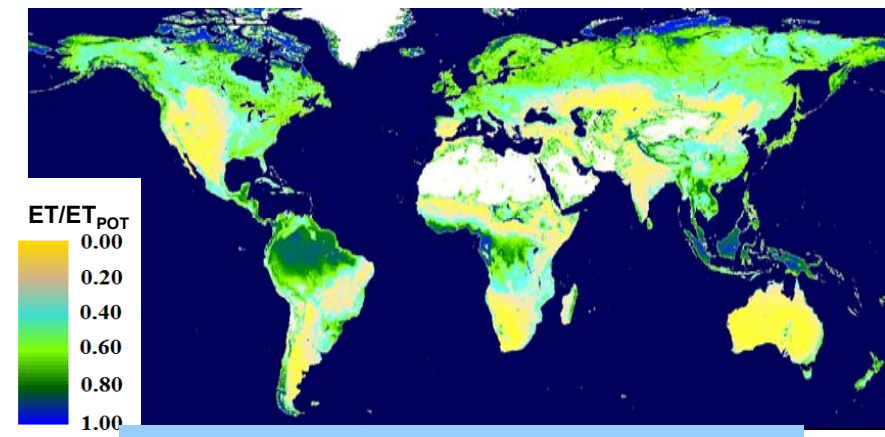
(2) Model improvement to achieve the proposed accuracy

Research Progress 1: ET Comparison with AmeriFlux using satellite-based estimated results (2001)



GCOM-C1, ET-Index

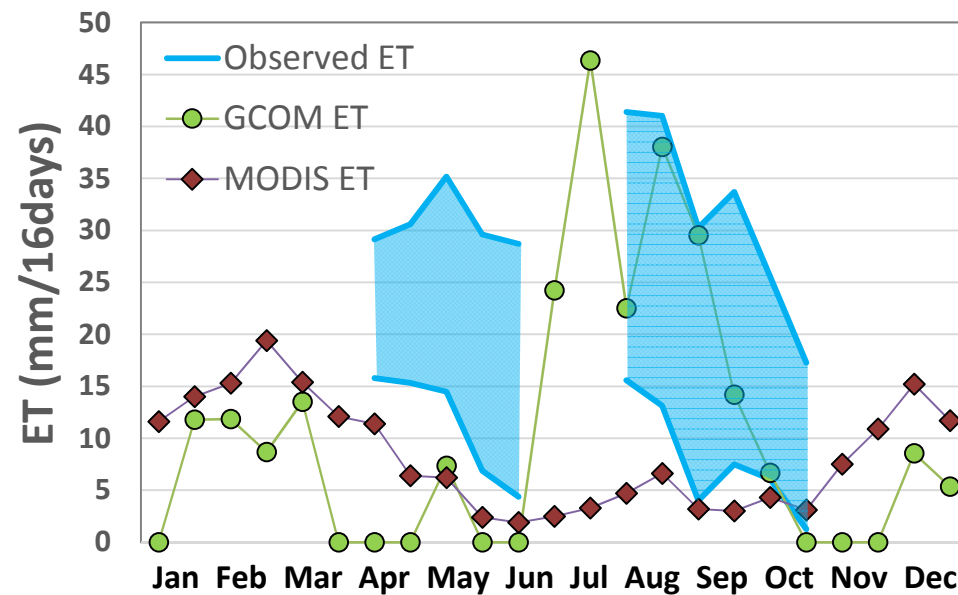
(5km res.)



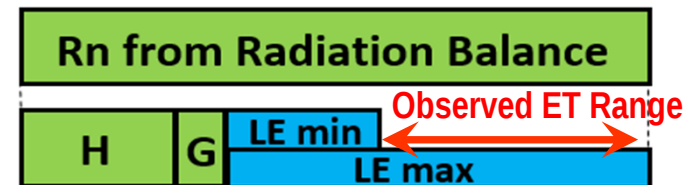
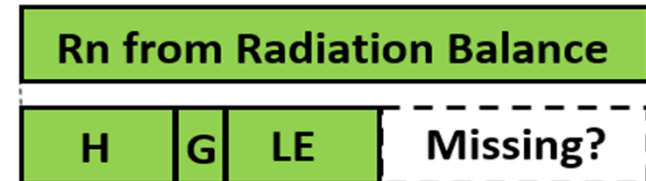
MODIS ET Product, ET/ET_{POT}

(1km res.)

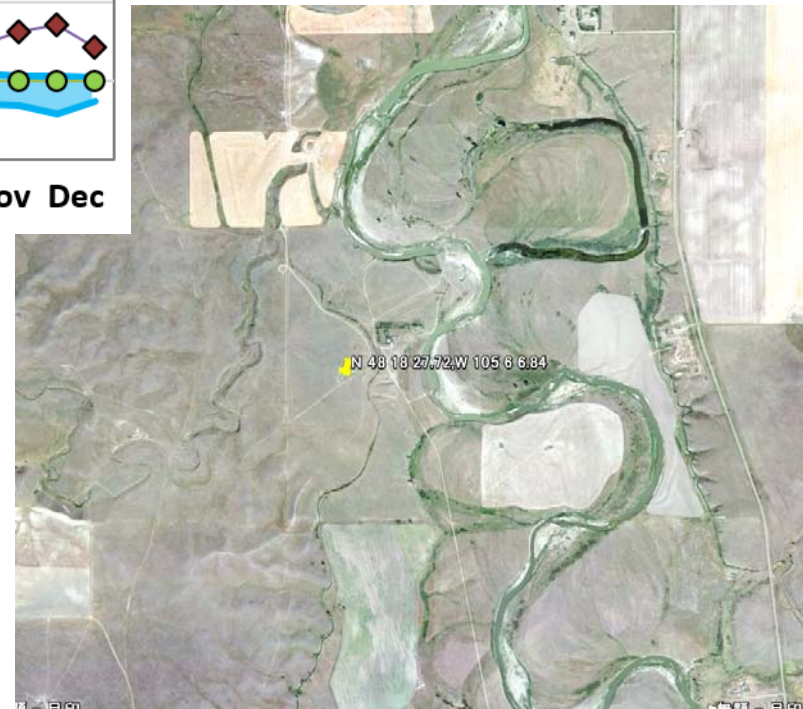
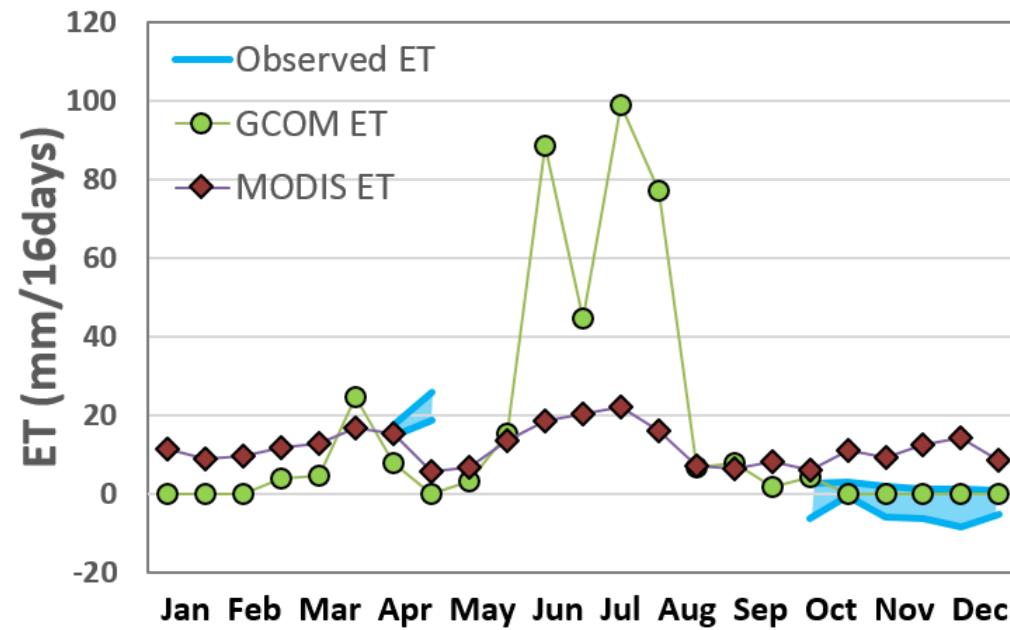
Site 1: Coral Pocket, Utah



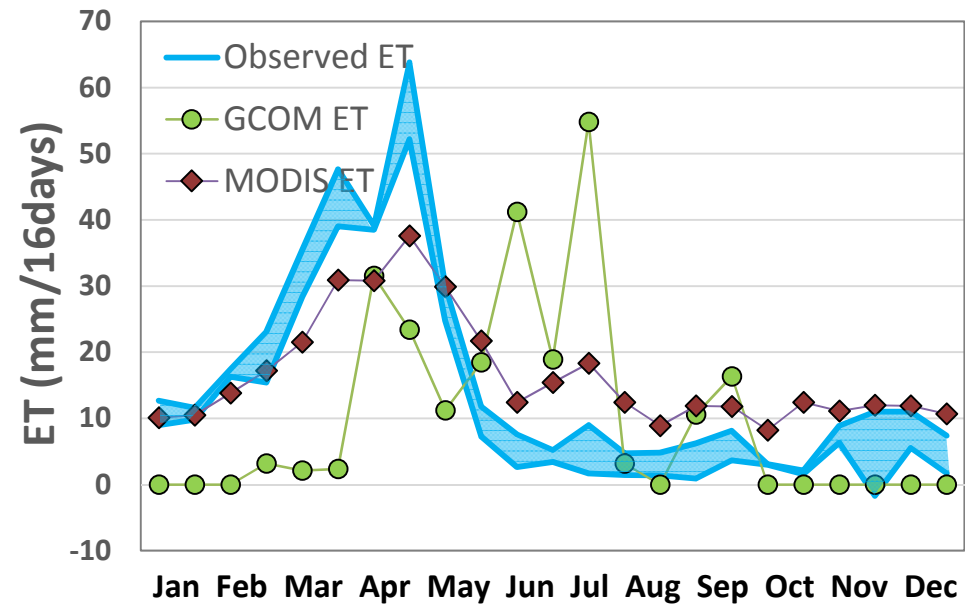
Ground based measurements can contain errors.



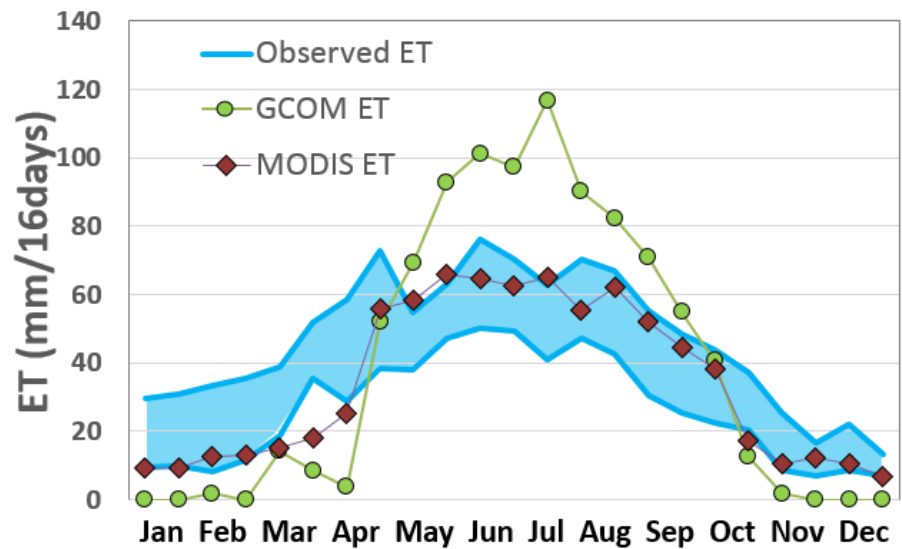
Site 2: Fort Peck, Montana



Site 3: Vaira Ranch, CA



Site 4: Duke Forest Open Field (NC)



**Grassland (100-150m fetch)
Surrounded by forests**

Research Progress 2: Comparison with Asia Flux Data

**Kherlenbayan Ulaan, Mongolia
(Grassland, Cold, Semi-arid)
Data by Asia Flux Database**

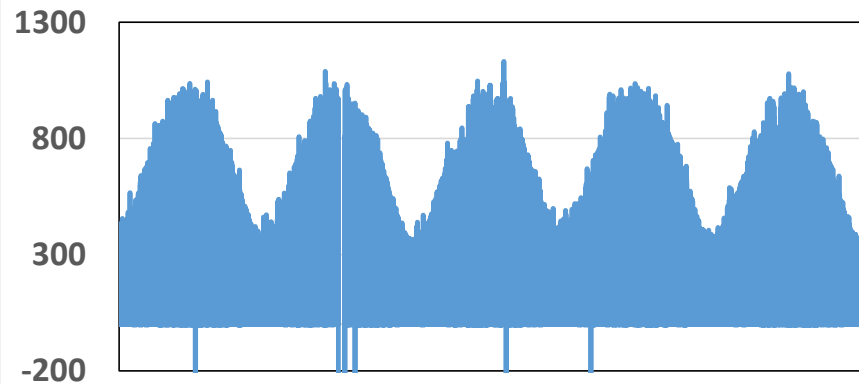
(Prof. Asanuma of Tsukuba-U.)



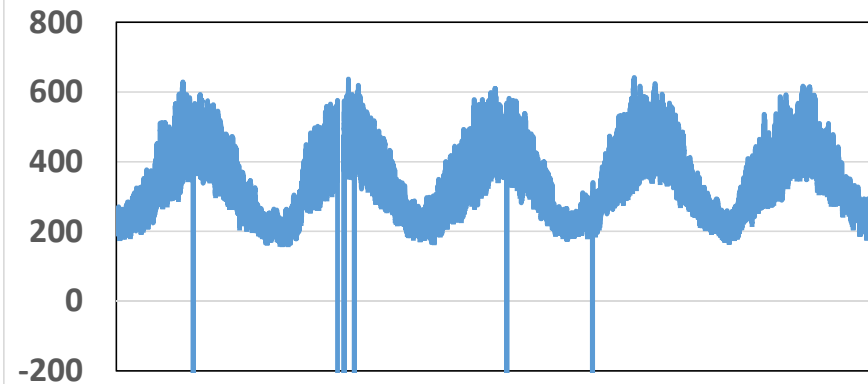
Flux data (KBU, 2004-2008)

High Quality Data in Radiation and general weather data

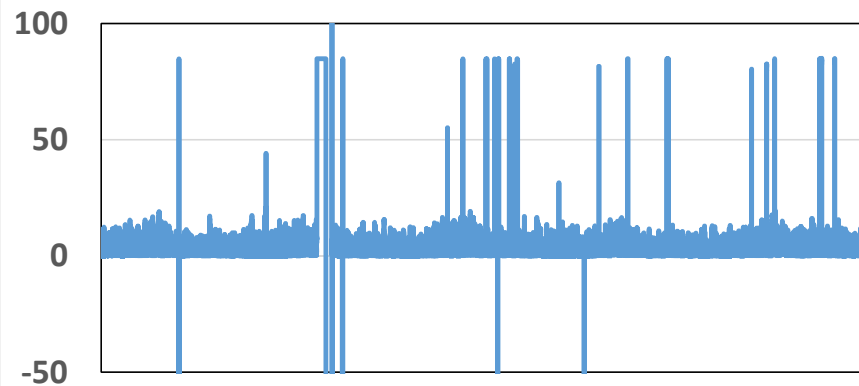
KBU 2004-2008 30-min Solar Radiation (W/m²)



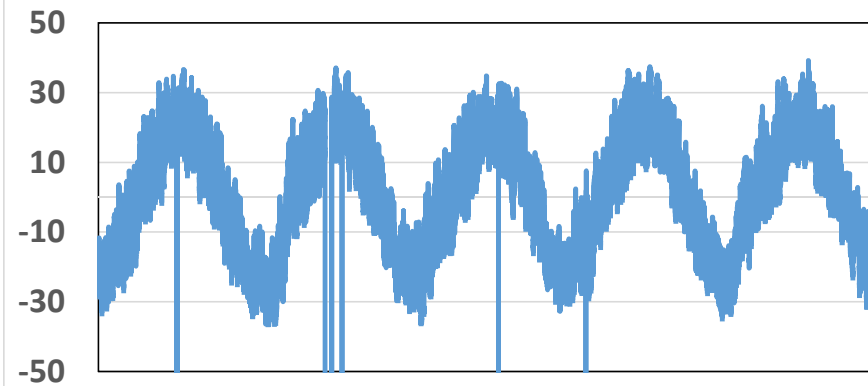
KBU 2004-2008 30-min Longwave_out (W/m²)



KBU 2004-2008 30-min Wind Speed (m/s)

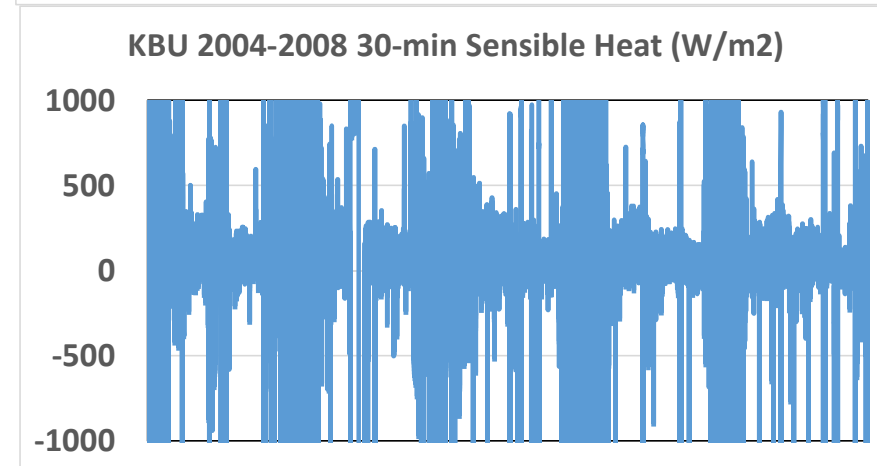
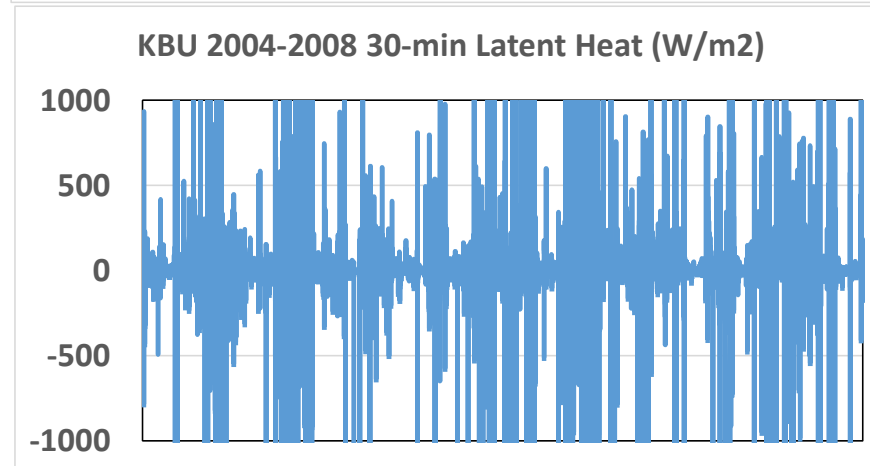
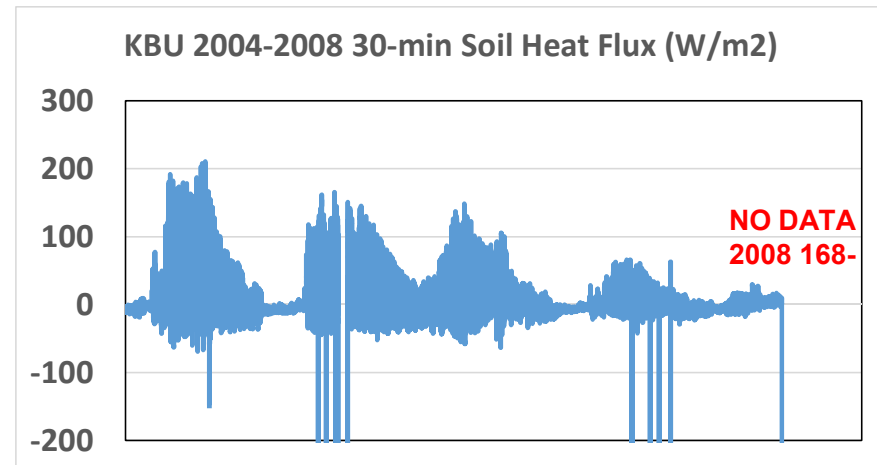
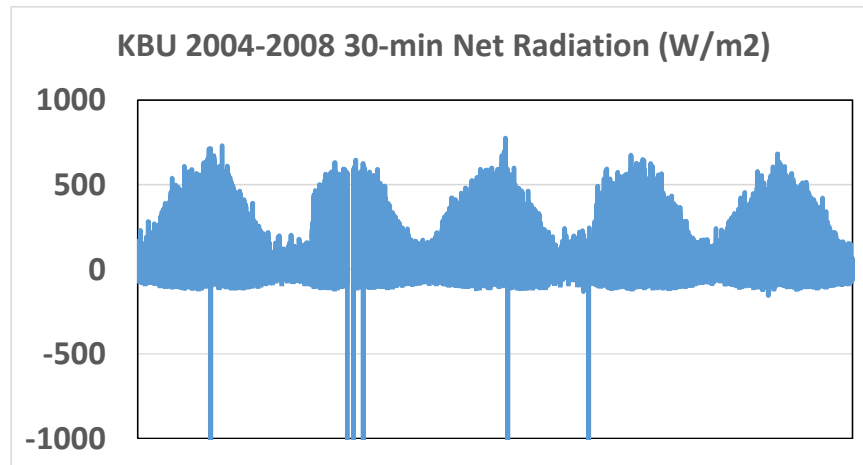


KBU 2004-2008 30-min Air Temperature (C)



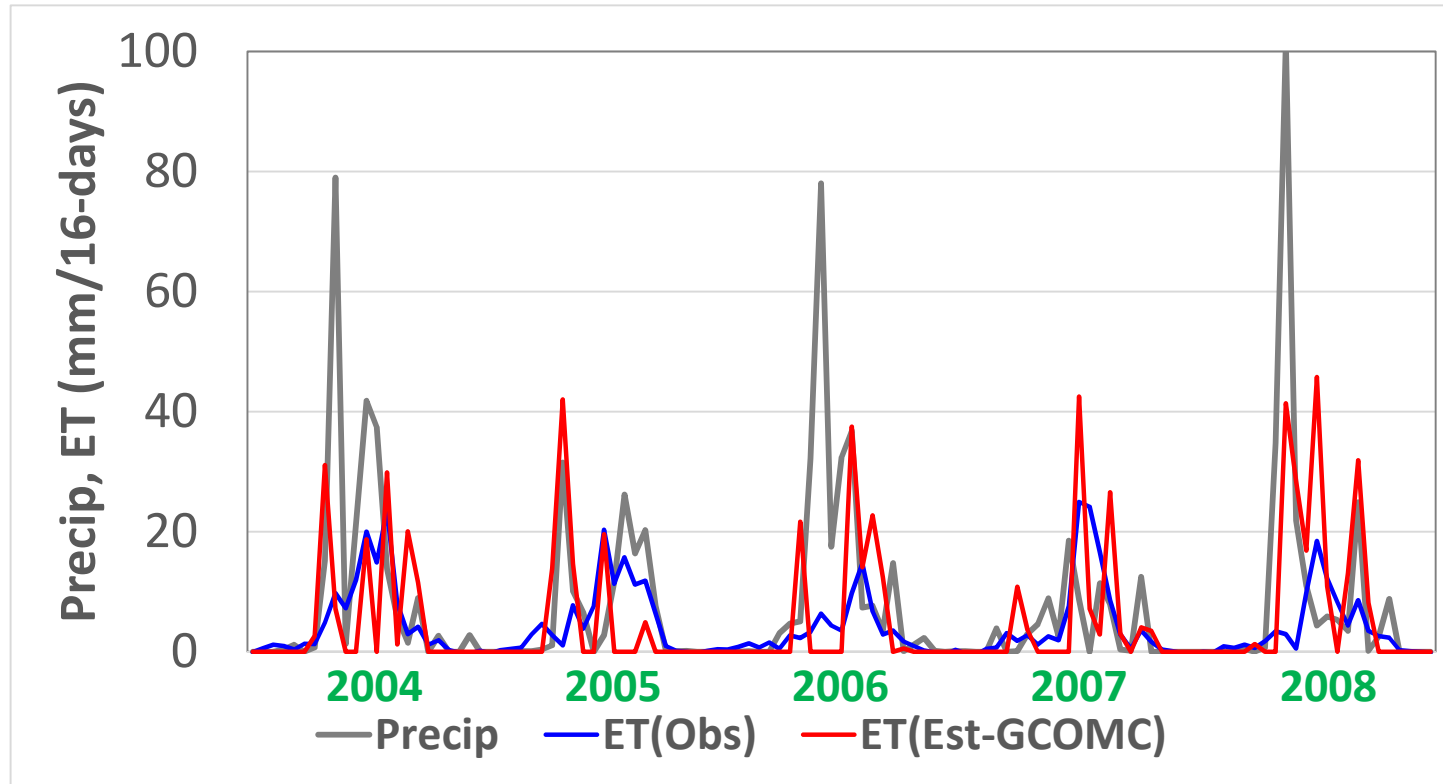
Flux data (KBU, 2004-2008)

Uncertainties in Latent and Sensible Heat Flux data



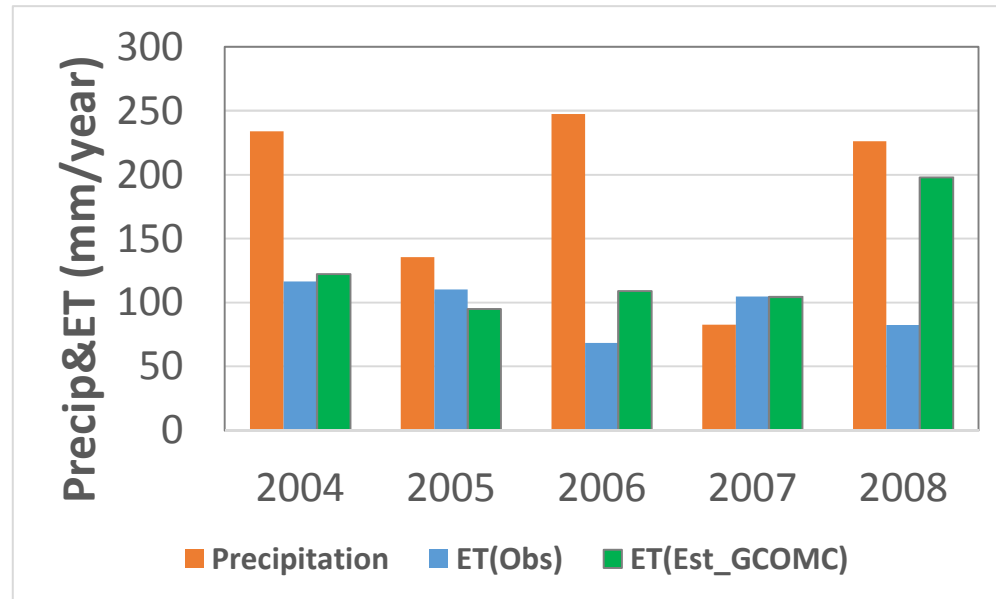
30 min Measured LE data was limited to not exceed available energy (Rn-G)

Results in 16-day basis

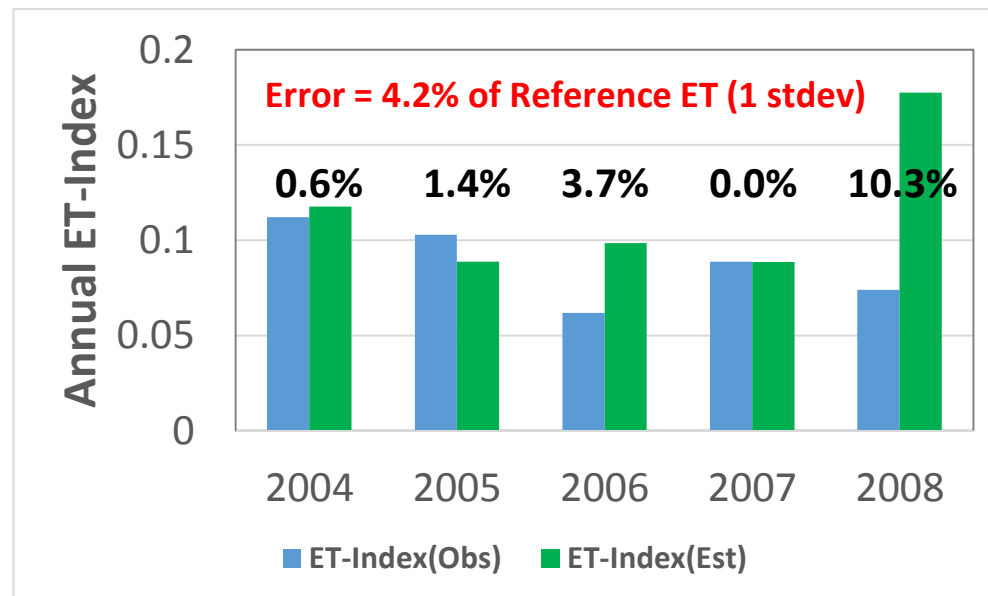


ET(Est-GCOMC) was estimated using GCOM-C1 ET-Index algorithm applied with observed **Ts**, **Rs** and **u**.

Results in annual basis



Assuming if Observed ET is the truth



This location was within our proposed accuracy range (10% error in annual basis, in 1σ).

Conclusions:

- 1. Working on accuracy assessment of ET-Index algorithm using Ameri-Flux and Asia-Flux datasets.**
- 2. A critical evaluation for satellite-based product was difficult because of resolution.**
- 3. A ground-based assessment indicated that proposed GCOM-C ET-Index algorithm (ver.1.1) had an affordable estimation accuracy in annual basis.**
- 4. Evaluation works will be continued in next-year, and statistically reliable accuracy information will be provided.**