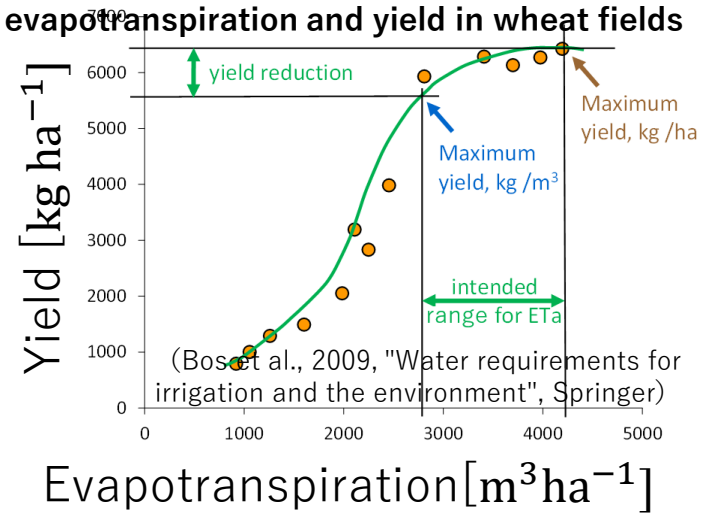
SGLI Research Product: Evapotranspiration Index (ETID) Algorithm

■Significance of evapotranspiration index products

- Evapotranspiration is an important parameter for hydrological water resources
- In the agricultural field, there is a strong relationship between evapotranspiration and crop growth and yield (right figure), so water demand is traditionally calculated from evapotranspiration.
- If evapotranspiration can be calculated using SGLI, which has a high frequency (it can be observed once a month even during the rainy season) and has a resolution of 250 m in practice, it will be of great social significance because it can be used to predict crop yield fluctuations around the world and measure the effects of irrigation

Relationship between actual evapotranspiration and yield in wheat fields



■Overview of ET Estimation Methods

①Reference evapotranspiration (Penman-Monteith)
…Evapotranspiration from grass land with a well-moist, healthy plant height of 12 cm and an albedo of 0.23

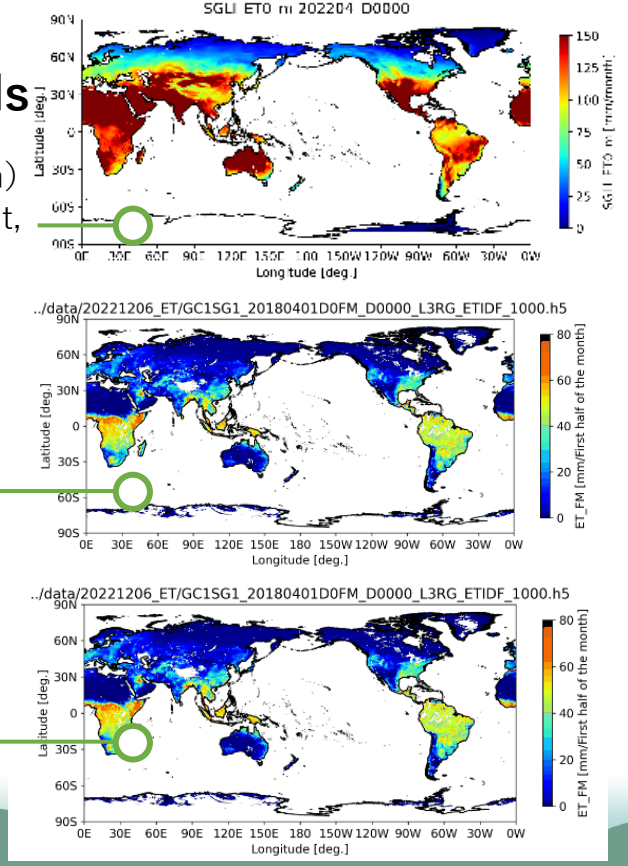
$$\mathrm{ET}_o = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T_{mean}+273} u_{2\_day}(e_s - e_a)}{\Delta + \gamma(1 + 0.34 \cdot u_{2\_day})}$$

②Evapotranspiration index
…What percentage of the standard evapotranspiration is evaporated?(Depends on conditions such as land cover)

$$\mathrm{ET}_{index} = C_{adj} \times \frac{T_s(dry) - T_s(act)}{T_s(dry) - T_s(wet)}$$

③Evapotranspiration = ①×②

$$\mathrm{ET} = ET_0 \times ET_{index}$$



Mainly from solar radiation
Calculated from the heat balance formula

Calculated from LST and sheathing.
Defects due to clouds, etc.
To minimize
Composite for 17 days.

Calculate ET for each day, and output 8day, half-month, 1month statistical data.

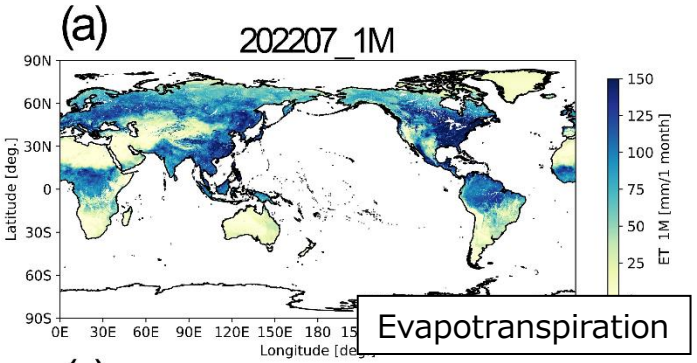
Developed by Tasumi (PI) @University of Miyazaki

Combined use of Penman-Monteith & Surface Energy Balance

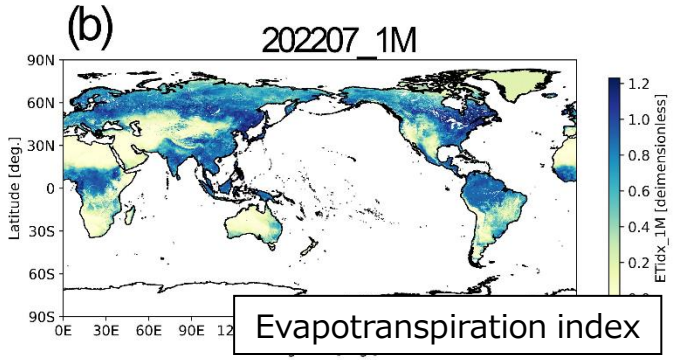
About Evapotranspiration Index (ETID) Product Output and QA Flags

✓ Reasonable results have been obtained with high ET and ETidx in places with abundant vegetation.

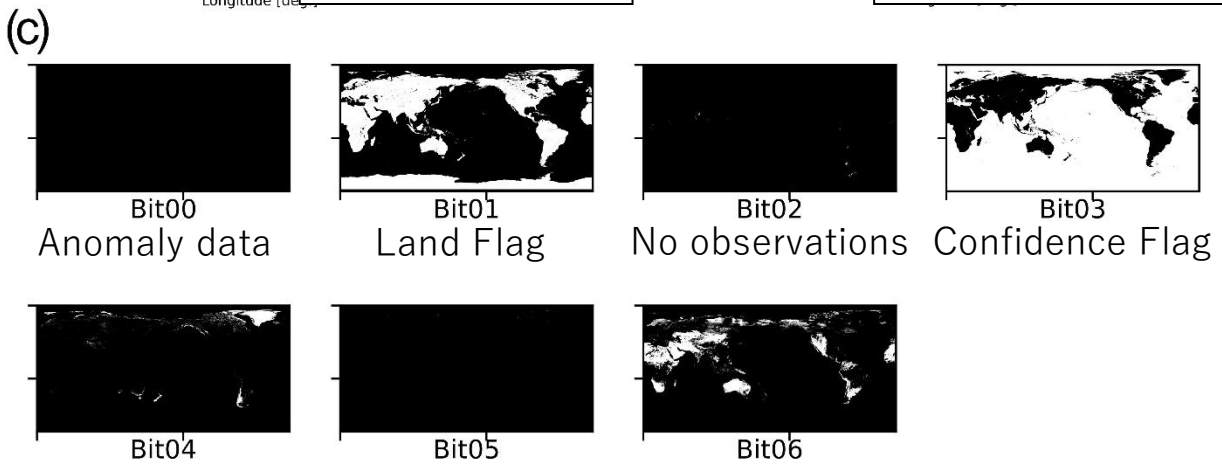
■Global Image Output
Spatial resolution：5 km
Period：2022/7（1month）



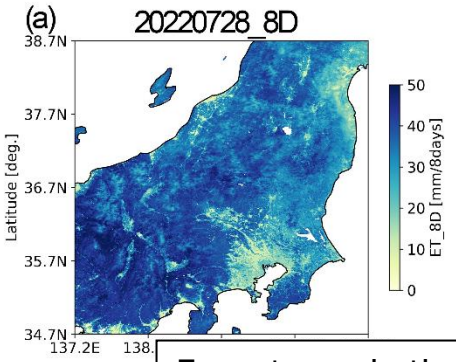
Evapotranspiration



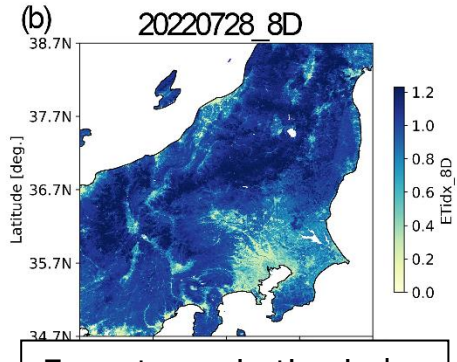
Evapotranspiration index



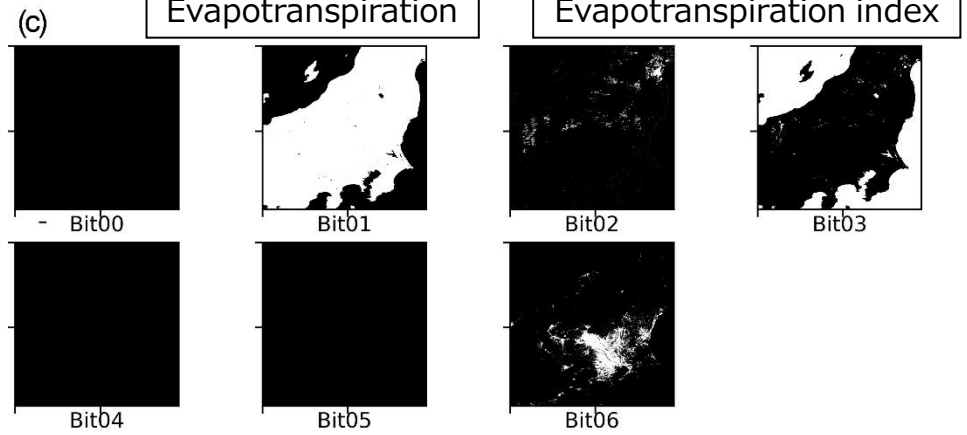
■Image output in Japan
Spatial resolution：250 m
Period：2022/7/28- 8/3（8days）



Evapotranspiration



Evapotranspiration index



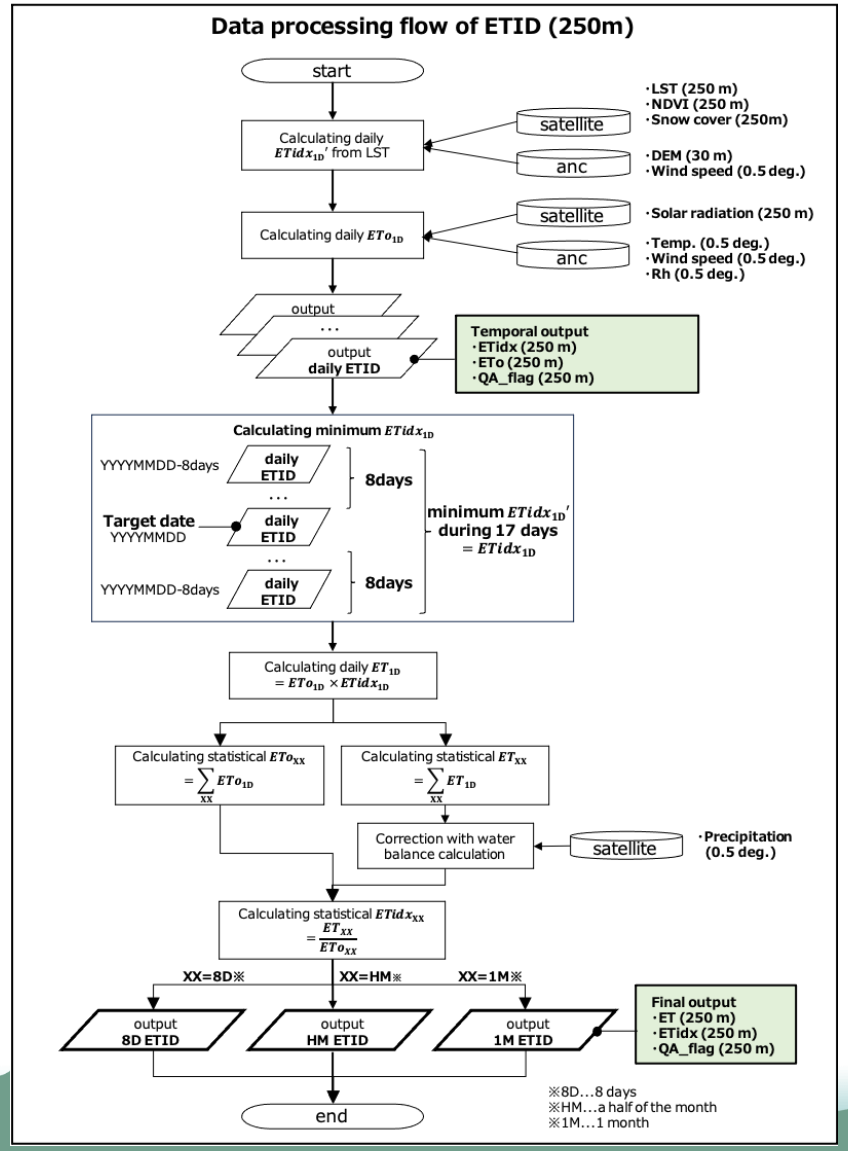
- Basically, it is a design that can be used without using QA flags.
- Mask Bit02, Bit03, Bit05 for demanding quality

✓ Urban areas absorb and drain rainwater rapidly, making it easy to underestimate
→Correction by water balance model using precipitation data is applied in Kanto area.

Evapotranspiration Index (ETID) Algorithm Flow

■ Implementation of the ET algorithm

Calculation flow



- output : **Evapotranspiration index** (ETidx) , **Evapotranspiration** (ET)
  (Reference evapotranspiration (ETo) can be calculated from the above two.)
- Temporal resolution : 8days, half-month, 1month
- Spatial resolution : 250m in Japan, 5km in global
- Calculation frequency: Activated every 8 days/half-month/month, with input from the current day plus the preceding and following 8 days (total of 17 days)

Output	Input data	Data source	Spatial resolution (TILE / Global)
①ETo	**Solar radiation**	**SGLI**	**250m / 1/24deg.**
	wind speed	GANAL	0.5 deg.
	temperature	GANAL	0.5 deg.
	humidity	GANAL	0.5 deg.
	altitude(DEM)	ASTGTM2	250m / 1/24deg.
	Surface pressure	Calculated from DEM	250m / 1/24deg.
②ETidx	**LST**	**SGLI**	**250m / 1/24deg.**
	NDVI	**SGLI**	**250m / 1/24deg.**
	Snow Cover	**SGLI**	**250m / 1/24deg.**
	wind speed	GANAL	0.5 deg.
	altitude(DEM)	ASTGTM2	250m / 1/24deg.
Water Balance Correction	precipitation	GSMaP	0.5 deg.
③ET	ETo, ETidx	-	250m / 1/24deg.