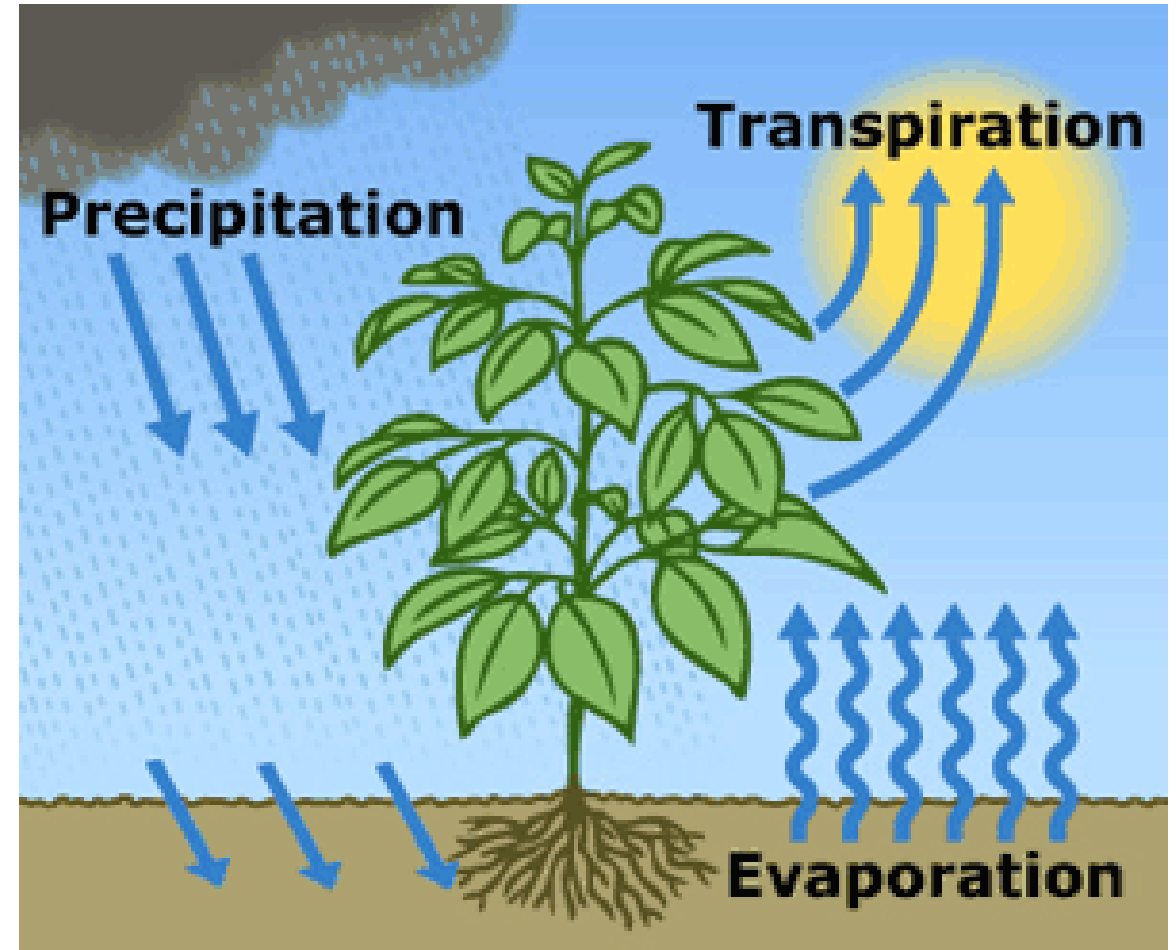


## Evapotranspiration (ET)

For more information visit: [ARSET ET Webinar](#)

# What is Evapotranspiration (ET)?

- The sum of evaporation from the land surface plus transpiration from plants
- ET transfers water from land surface to the atmosphere in vapor form.
- Energy is required for ET to take place (for changing liquid water into vapor).



Source: USGS



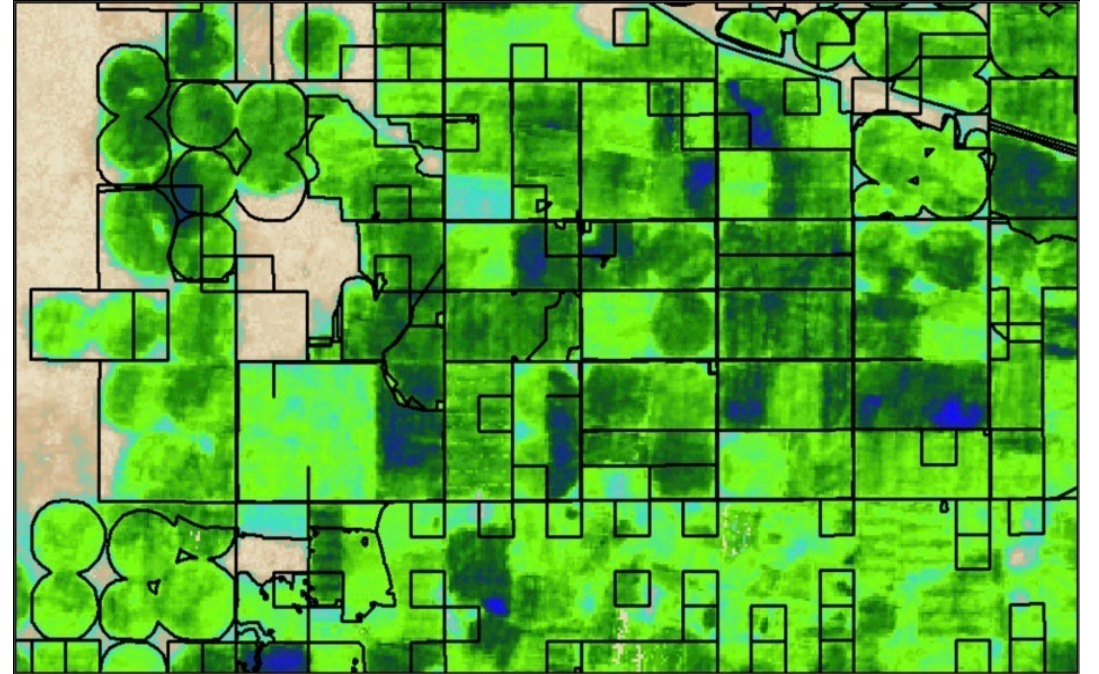
# Importance of ET

- ET is a critical component of the water and energy balance of climate-soil-vegetation interactions.
- Useful for:
  - Determining agricultural water consumption
  - Assessing drought conditions
  - Developing water budgets
  - Monitoring aquifer depletion
  - Monitoring crops and carbon budgets



# Challenges in Measuring ET

- ET depends on many variables:
  - Solar radiation at the surface
  - Land and air temperatures
  - Humidity
  - Surface winds
  - Soil conditions
  - Vegetation cover and types
  - Highly variable in space and time



# Ground Measurements of ET

## Limitation:

- These are point measurements and cannot capture spatial variability adequately.



Eddy Flux  
Towers



Lysimeters

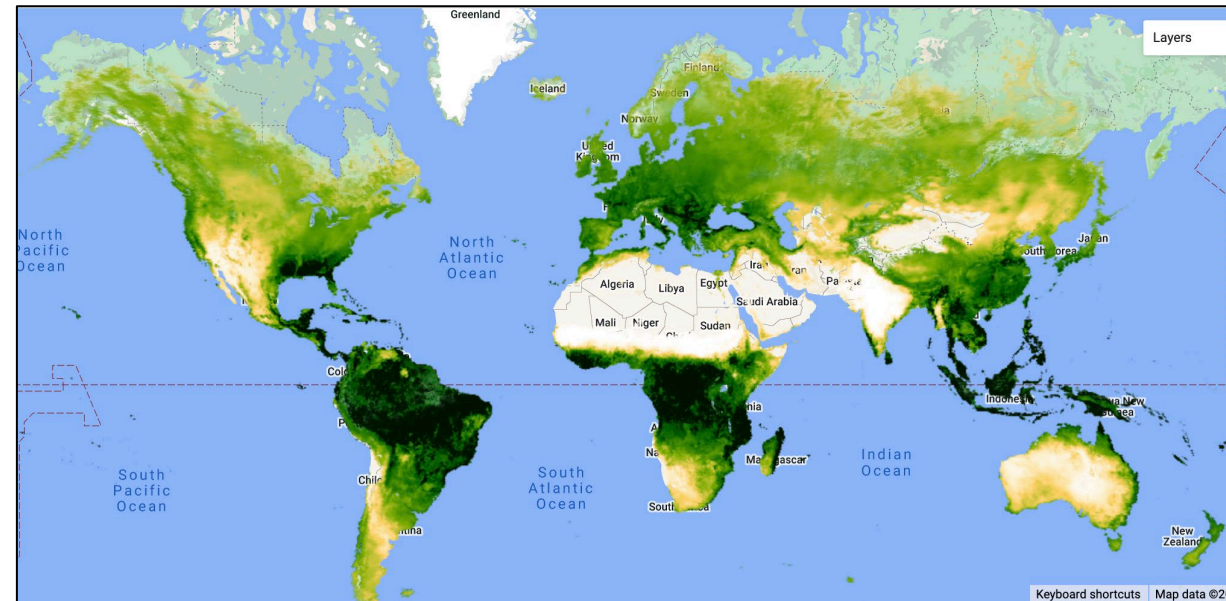


# Benefits of Estimating ET from Remote Sensing Data

Satellites provide relatively frequent and spatially continuous measurements of biophysical variables used in estimating ET at different spatial scales, including:

- Radiation
- Land surface temperatures
- Vegetation coverage and density
- Precipitation
- Soil moisture
- Weather and climate variables

MODIS-based Evapotranspiration



# Remote Sensors and Observations for ET

Satellite	Sensors	Parameters
Terra and Aqua	MODIS	Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI), Albedo (fraction of surface solar radiation reflected back)
Landsat	OLI and ETM+	Spectral Reflectance (Thermal band)



# Estimation of ET

ET can be derived primarily from:

- Surface Water Balance

$ET = \text{Precipitation} + \text{Irrigation} - \text{Runoff} - \text{Ground Water} + \text{Vertical Water Transport} \pm \text{Subsurface Flow} \pm \text{Soil Water Content}$

- **<sup>1</sup>Surface Energy Balance**

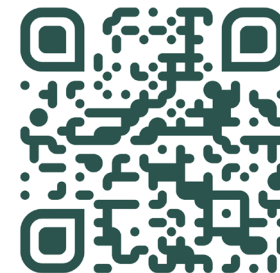
$ET \text{ (Latent Heat Flux)} = \text{Net Surface Radiation} - \text{Ground Heat Flux} - \text{Sensible Heating Flux}$

- Meteorological and **<sup>1</sup>Vegetation/Crop Data** (Penman-Monteith Equation)

- ET Estimation by Land Surface Models

– e.g., Global Land Data Assimilation System (GLDAS): <http://ldas.gsfc.nasa.gov>

**<sup>1</sup>Based on: OLI, MODIS, VIIRS**





# ET Data Products based on Remote Sensing

- MOD16: MODIS Global Evapotranspiration Project  
<http://ntsg.umn.edu/project/mod16>
- METRIC: Mapping Evapotranspiration with high-Resolution and Internalized Calibration  
<http://eeflux-level1.appspot.com>
- GLDAS: Global Land Data Assimilation System  
<http://ldas.gsfc.nasa.gov/gldas/>



# METRIC ET

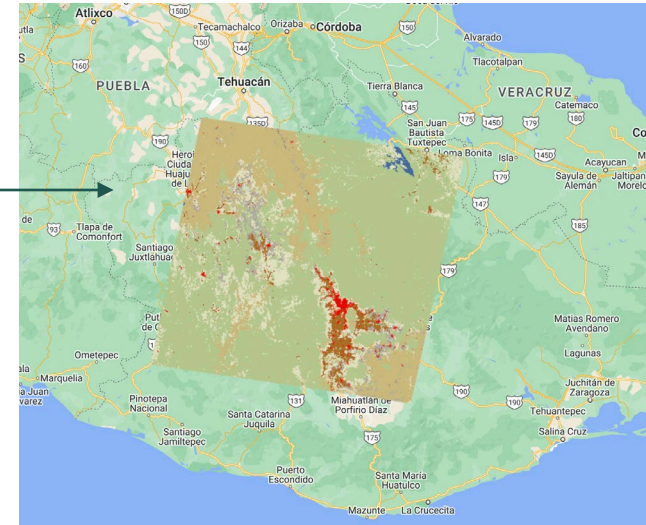
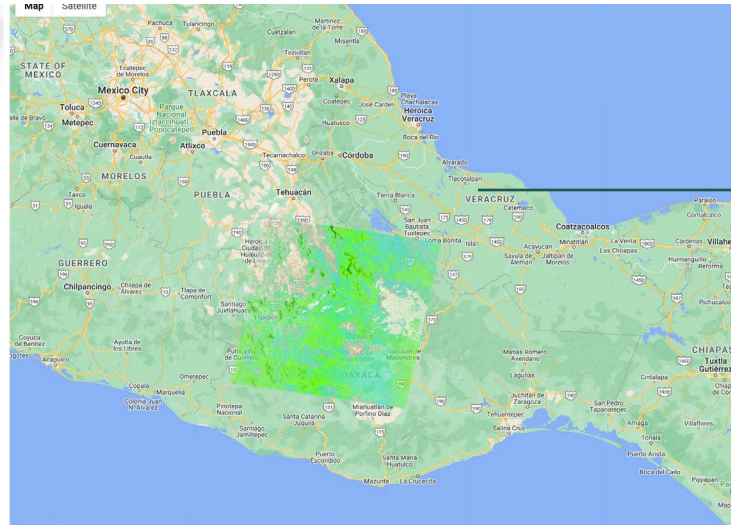
<http://eeflux-level1.appspot.com>

- Landsat-based ET
- Spatial resolution: 30 m
- Temporal resolution: 16-day



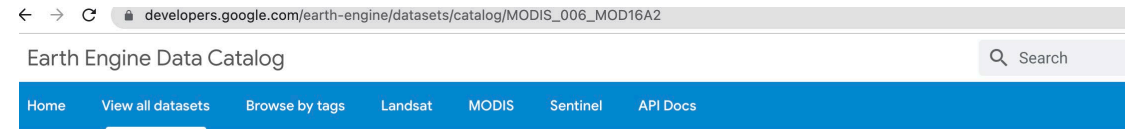
ET Derived from Landsat-8 image on 6 August 2022

Land Cover

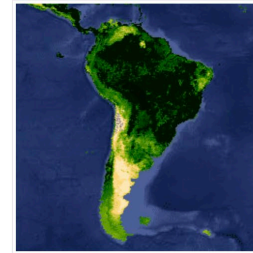


# MOD16A2 ET

- MODIS-based ET
- **We will use MODIS-based ET product Mod16A2, available from GEE**
- Spatial resolution: 500 m
- Temporal resolution: 8-day



## MOD16A2.006: Terra Net Evapotranspiration 8-Day Global 500m



### Dataset Availability

2001-01-01T00:00:00Z-2023-02-02T00:00:00

### Dataset Provider

[NASA LP DAAC at the USGS EROS Center](#)

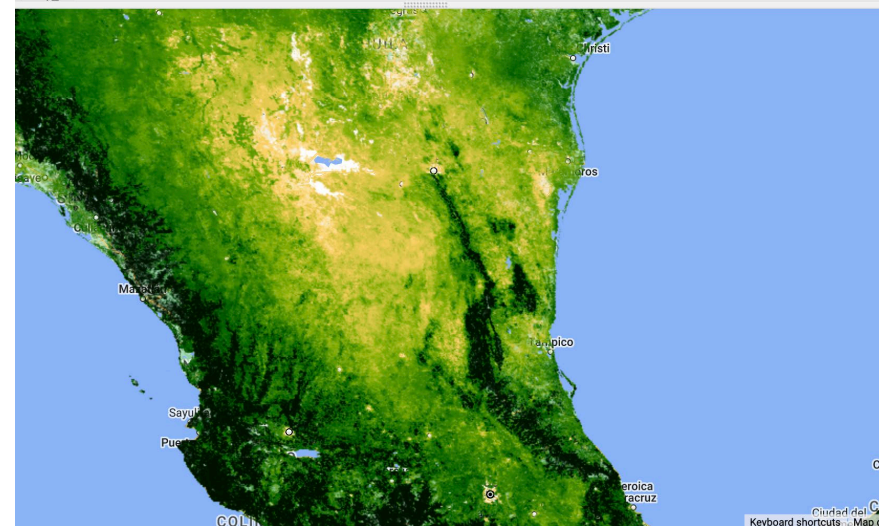
### Earth Engine Snippet

```
ee.ImageCollection("MODIS/006/MOD16A2")
```

### Tags

8-day evapotranspiration global mod16a2 modis nasa

```
MODIS_006_MOD16A2 *
1 var dataset = ee.ImageCollection('MODIS/006/MOD16A2')
2   filter(ee.Filter.date('2022-08-01', '2022-08-31'));
3 var evapotranspiration = dataset.select('ET');
4 var evapotranspirationVis = {
5   min: 0.0,
6   max: 300.0,
7   palette: [
8     'ffffff', 'fcd163', '99b718', '66a000', '3e8601', '207401', '056201',
9     '004c00', '011301'
10  ],
11 };
12 Map.setCenter(6.746, 46.529, 2);
13 Map.addLayer(evapotranspiration, evapotranspirationVis, 'Evapotranspiration');
14
```





**Thank You!**

