A comparison of the SWAT-T and remote sensing products for the Mara basin

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SWAT Seasonal plant growth simulation

Tropics

Temperate

Controlling factors

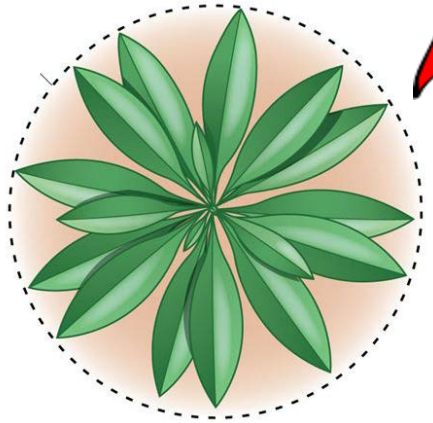
Rainfall

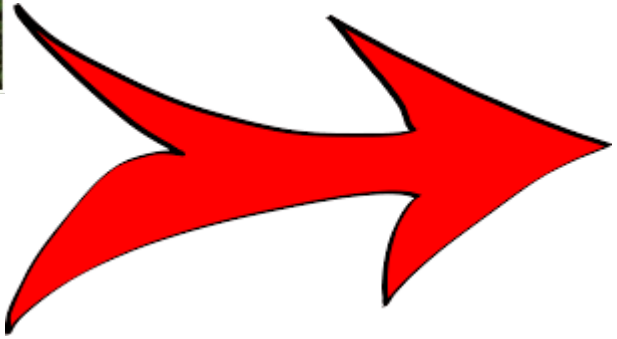
Temperature

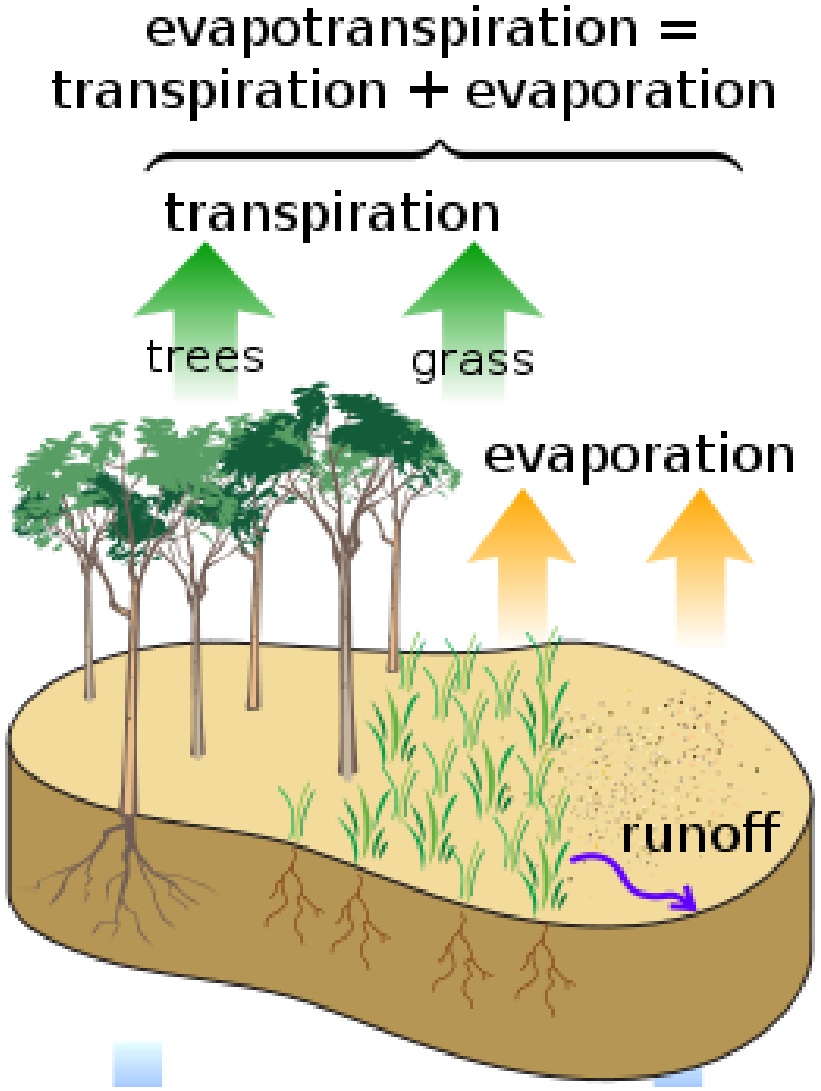
Realistic representation of seasonal growth dynamics

SWAT-T Goal - improve vegetation growth module in the Tropics

LAI





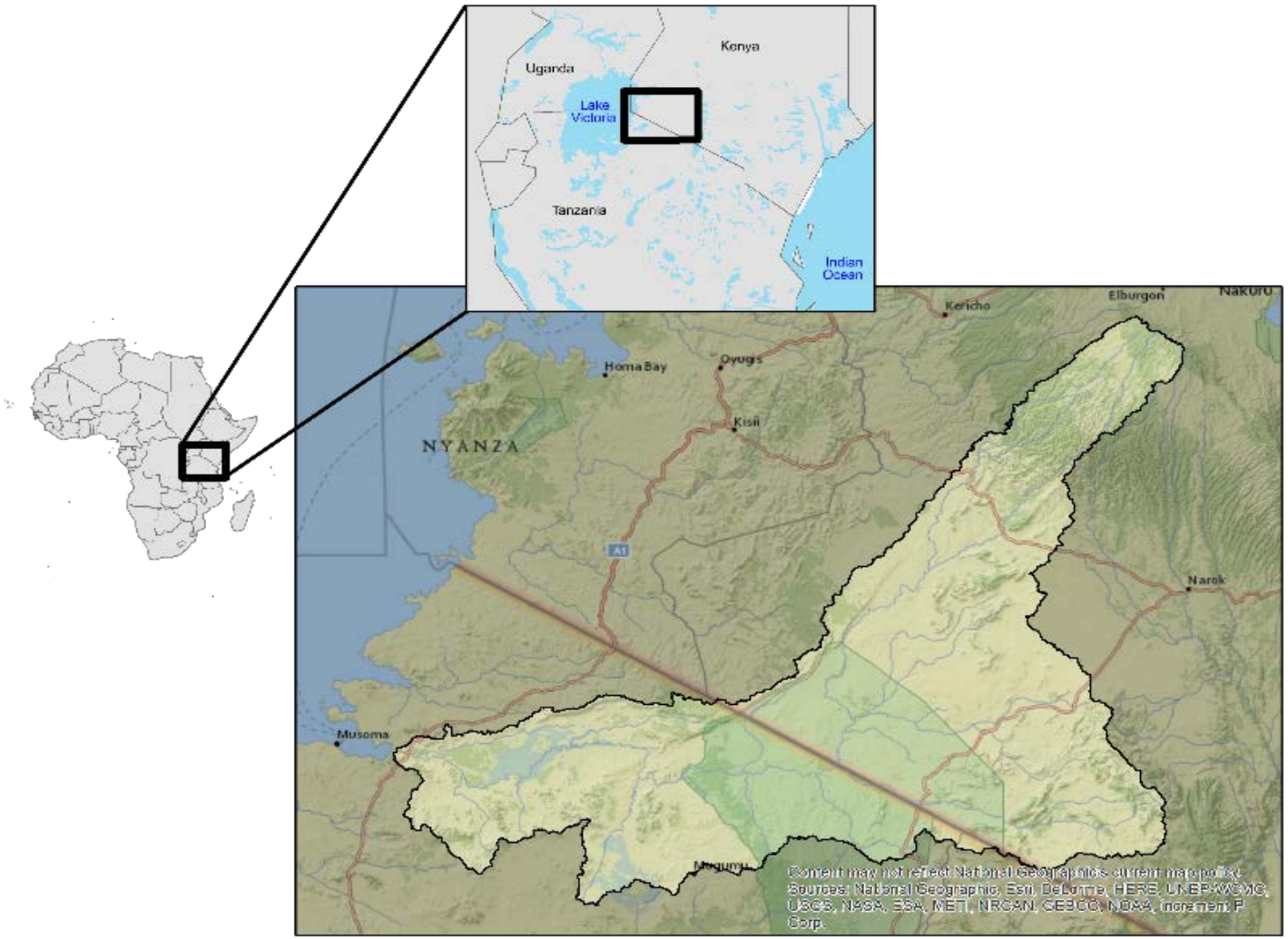


How does SWAT-T work in the Tropics?

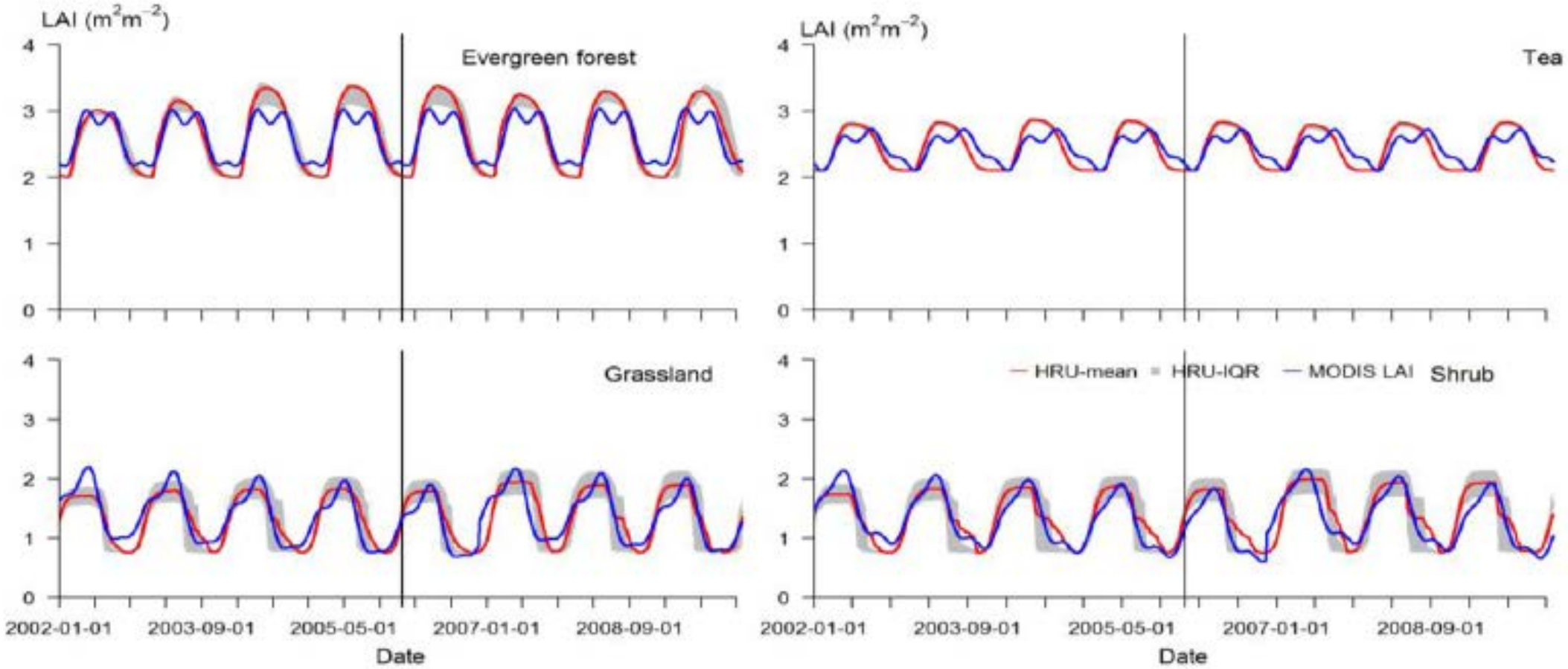
$$\frac{\text{Rainfall}}{\text{PET}} = \textbf{Soil Moisture Index}$$

Triggers a new growing season

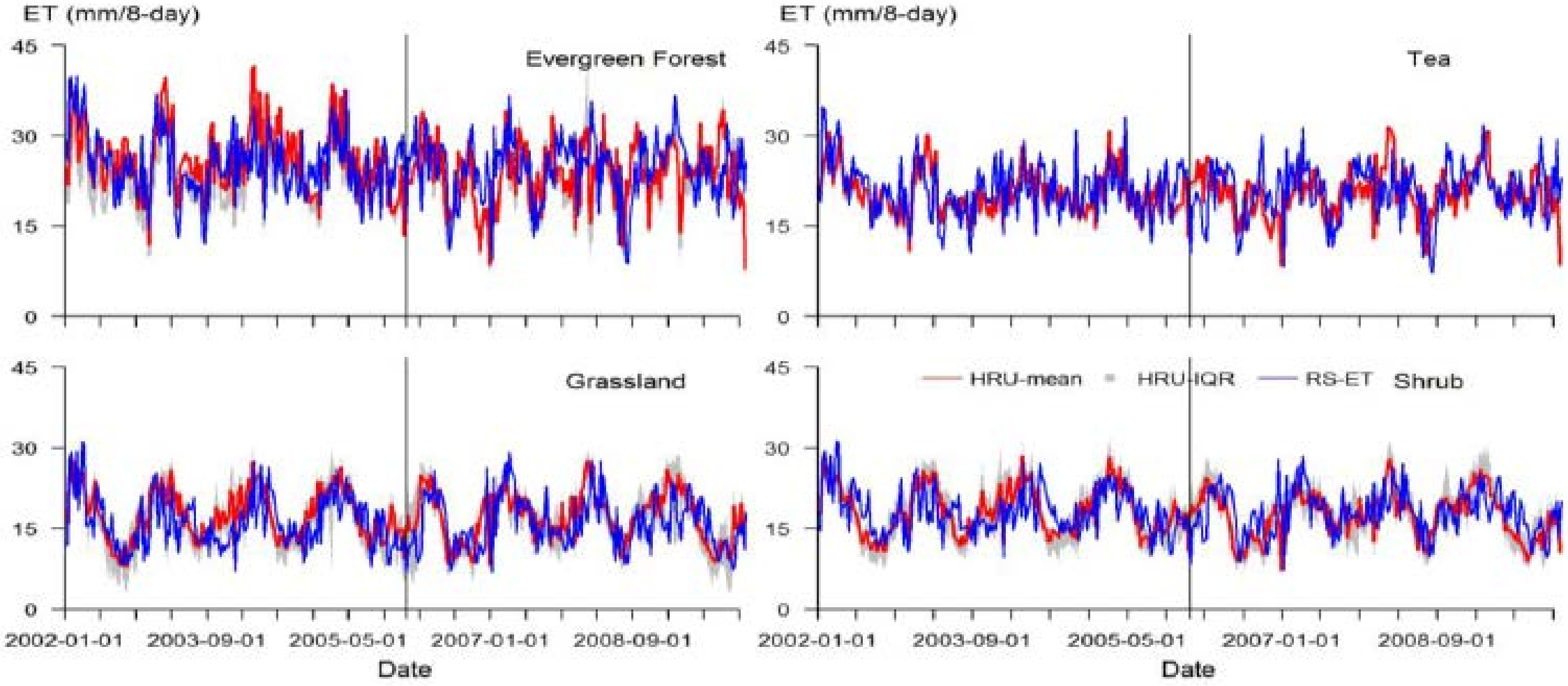
Mara basin, Kenya & Tanzania



LAI Comparison with MODIS LAI



ET Comparison with MODIS ET

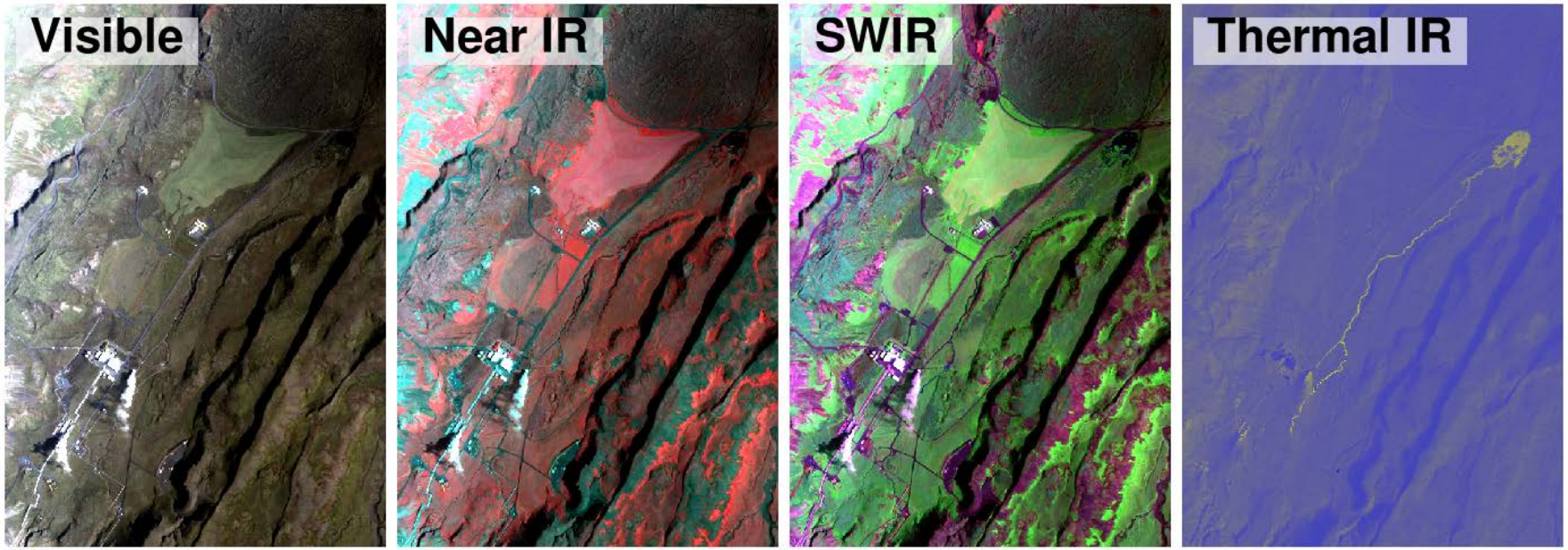


SEBAL Algorithm for RS data

$$R_n - \lambda E_y - G - H_y = 0$$

SEBAL needs:

- **Visible Bands, NIR**
- **Thermal Band**



SEBAL implementation in python = pySEBAL

SEBAL

- Input:
  - Landsat (30 m)
  - Meteodata (Temp, Wind, etc.)
  - DEM

- Output:
  - ETact
  - ETpot
  - ET0 (reference ET)
  - Tpot
  - Tact
  - Soil moisture top soil
  - Soil moisture root zone
  - Biomass Production

pySEBAL can now use VIIRS/PROBA-V

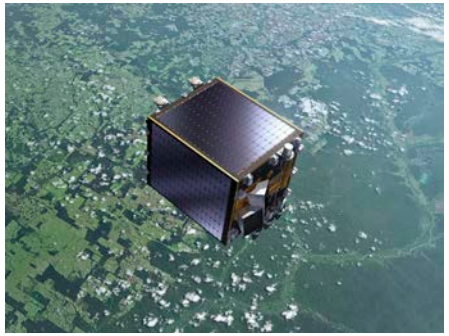
Landsat –7 and 8, 30 m, 8 days

Thermal

Visible

VIIRS, 375 m, 1 day

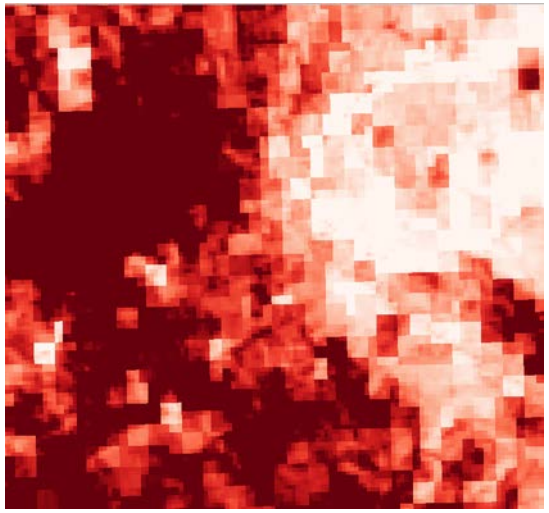
Proba-V, 100 m, 5 days



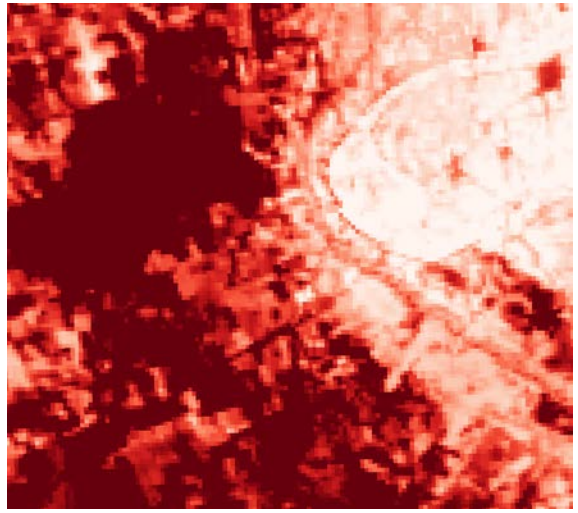
Thermal Sharpening:

Downscale VIIRS thermal band (375m) to 100m by using NDVI from PROBA-V

VIIRS 375 m



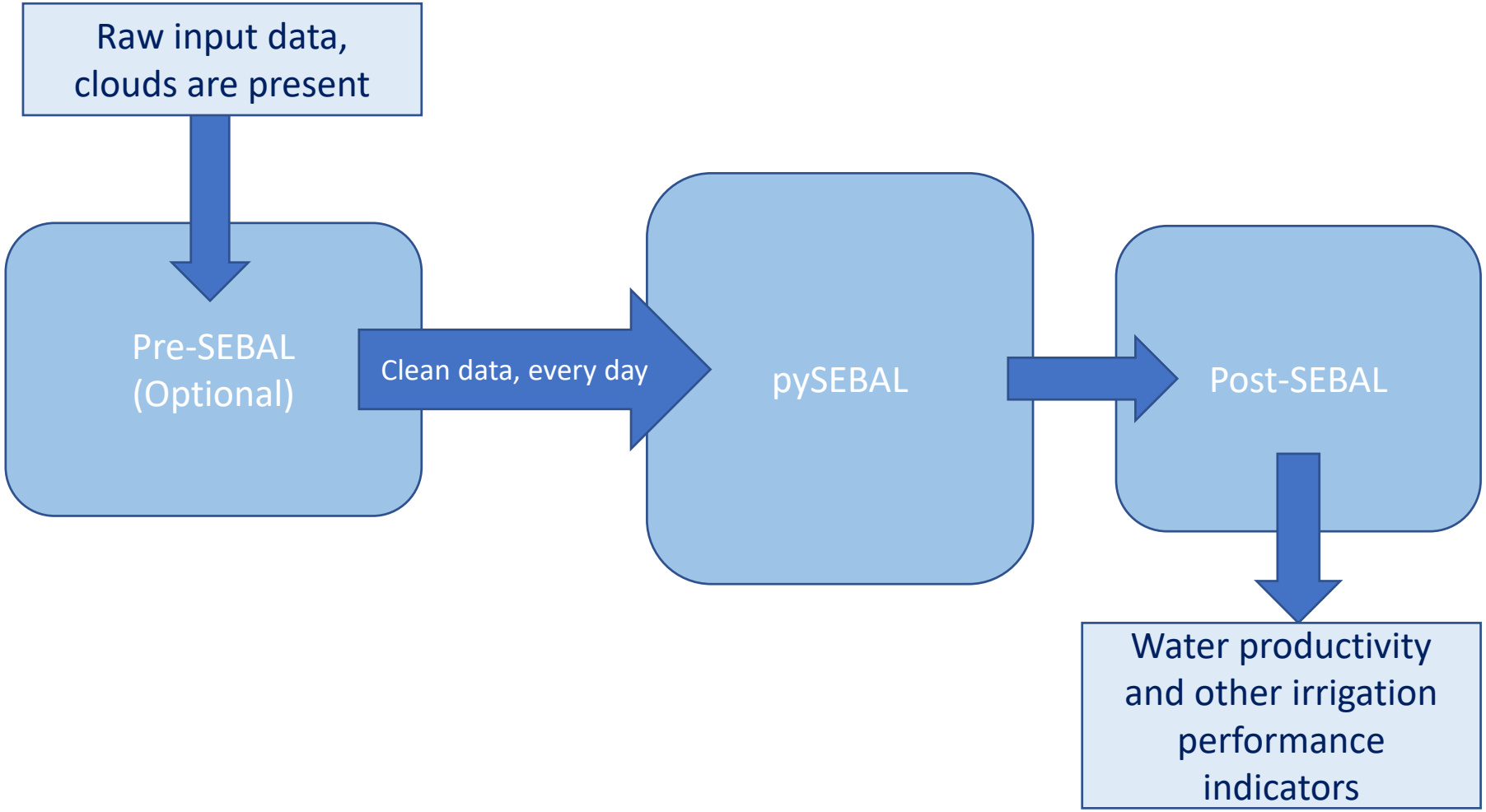
VIIRS 100 m (Thermal Sharpening)

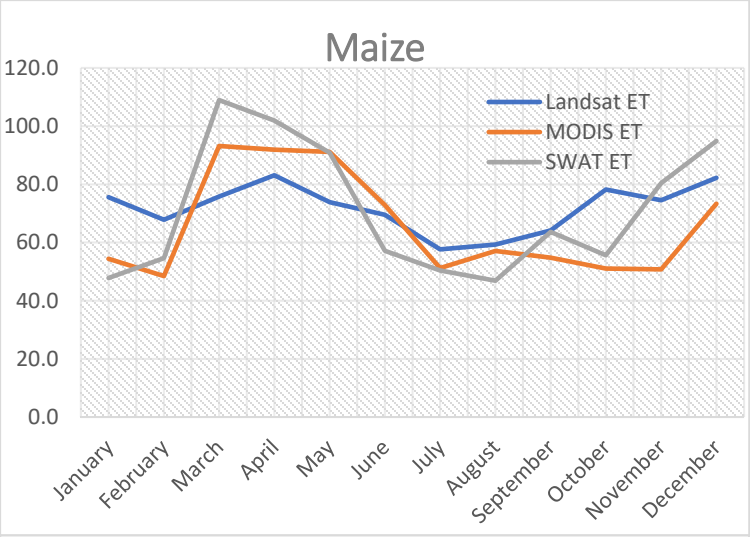


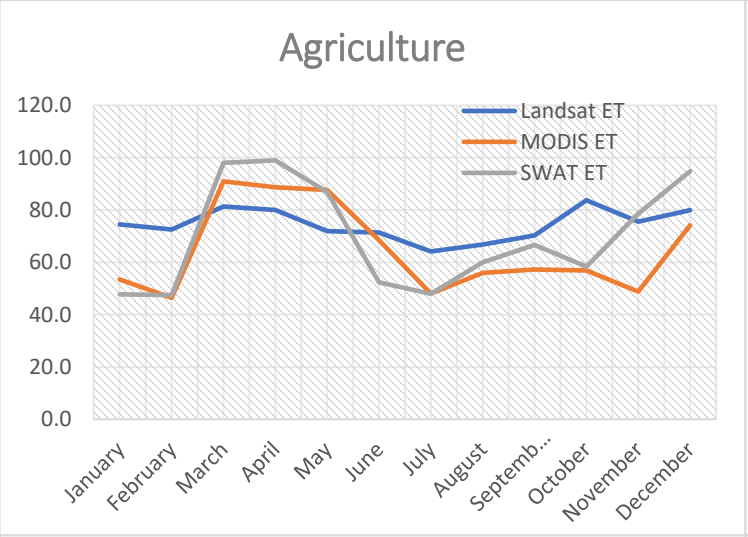
LS run: 30m 8-daily

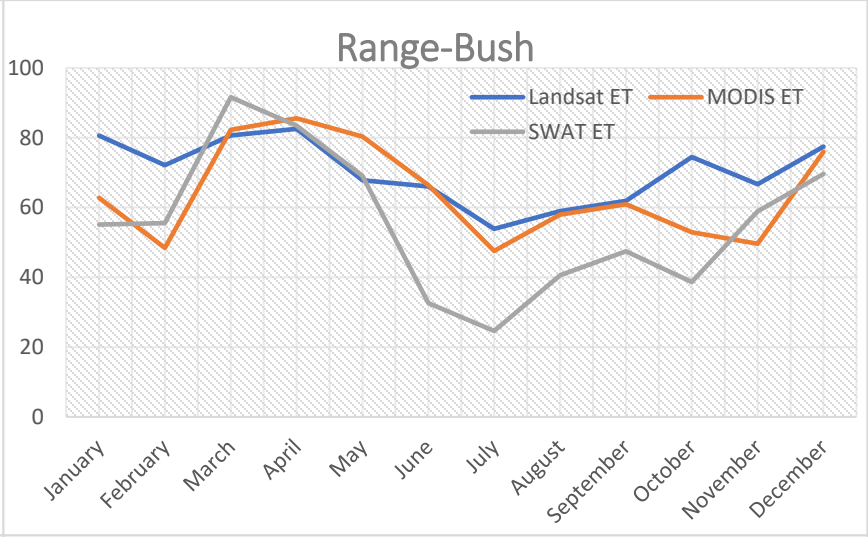
PROBA-V/VIIRS run: 100m daily

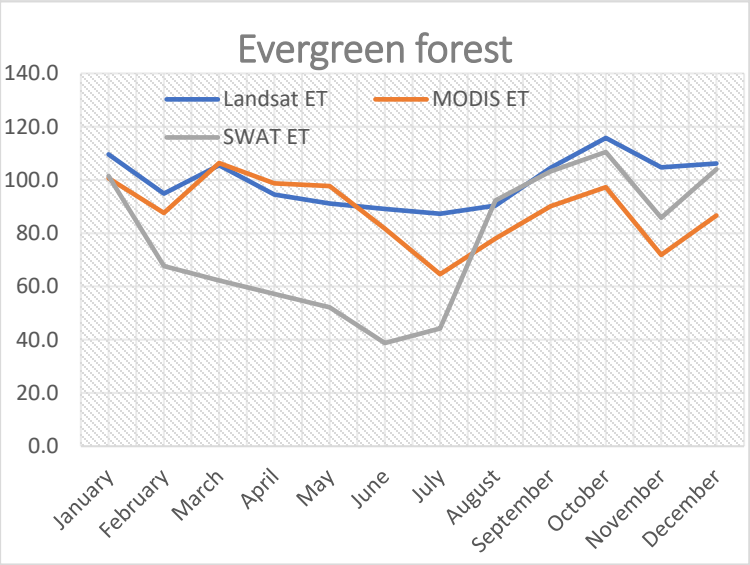
pySEBAL developments

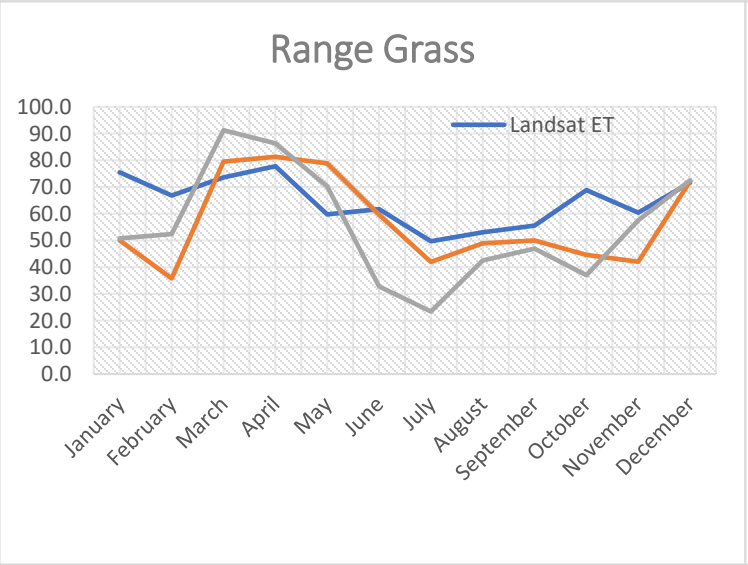


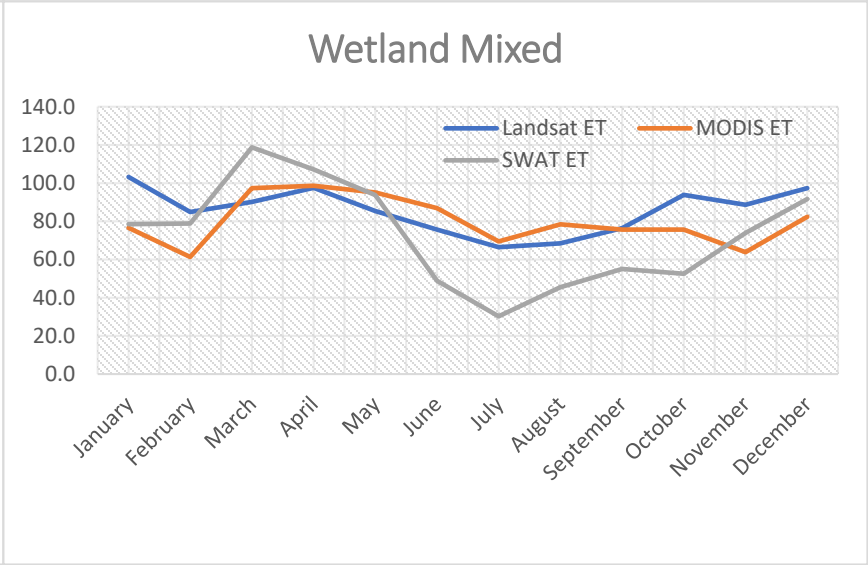

Maize
Landsat ET
MODIS ET
SWAT ET
120.0
100.0
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December


Agriculture
Landsat ET
MODIS ET
SWAT ET
120.0
100.0
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
Septemb...
October
November
December


Range-Bush
Landsat ET
MODIS ET
SWAT ET
100
80
60
40
20
0
January
February
March
April
May
June
July
August
September
October
November
December

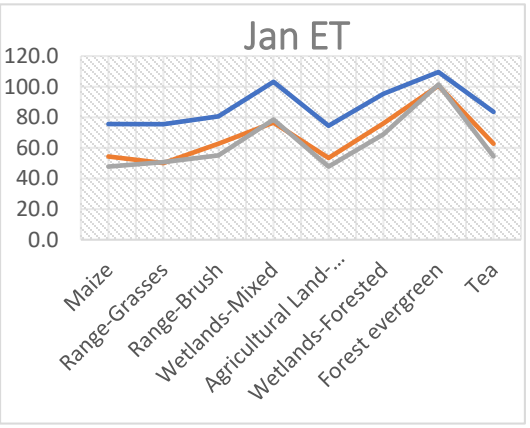

Evergreen forest
Landsat ET
MODIS ET
SWAT ET
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December

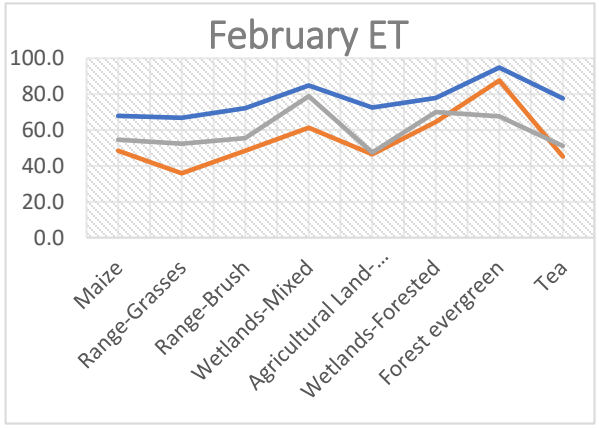

Range Grass
Landsat ET
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December

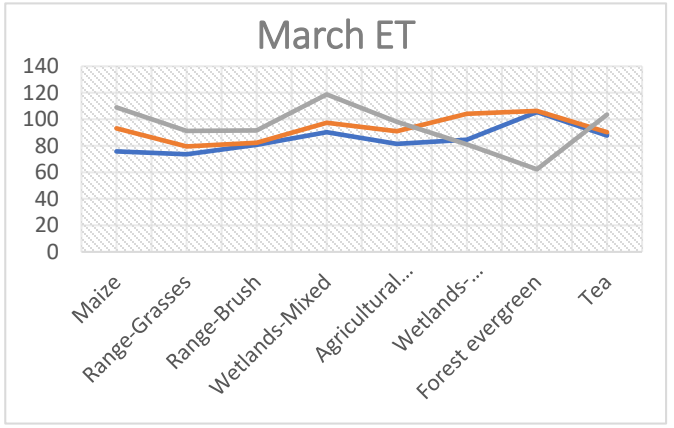

Wetland Mixed
Landsat ET
MODIS ET
SWAT ET
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December

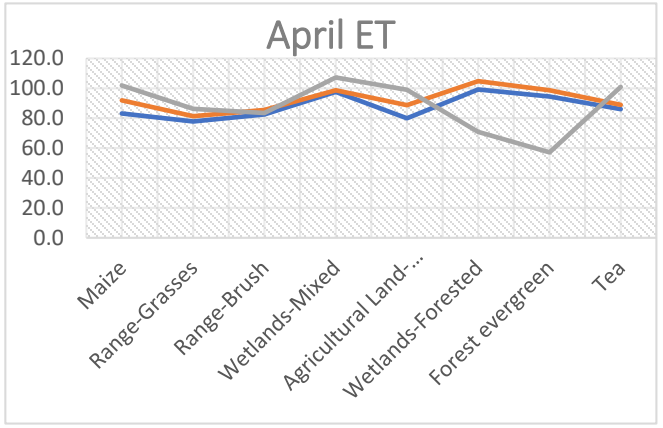
Landsat ET
MODIS ET
SWAT ET

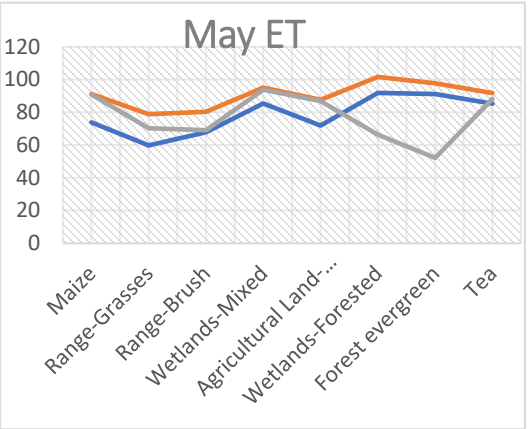
SWAT-T comparison with MODIS & Landsat

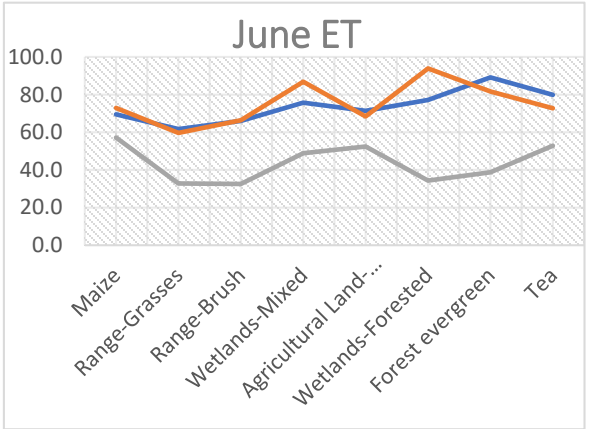


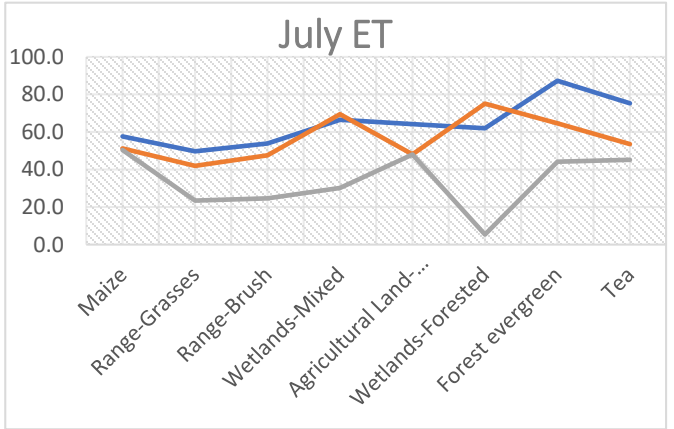


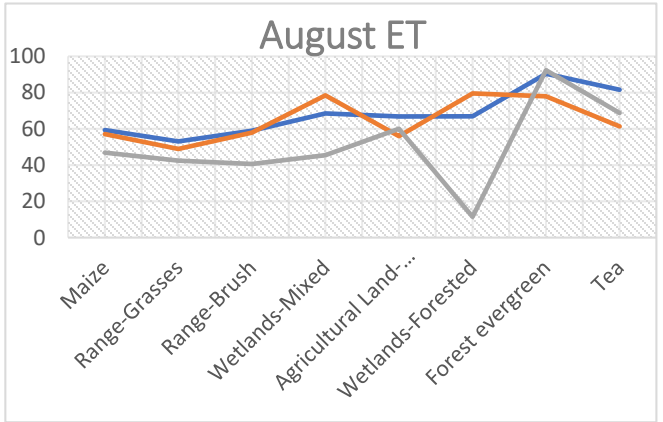






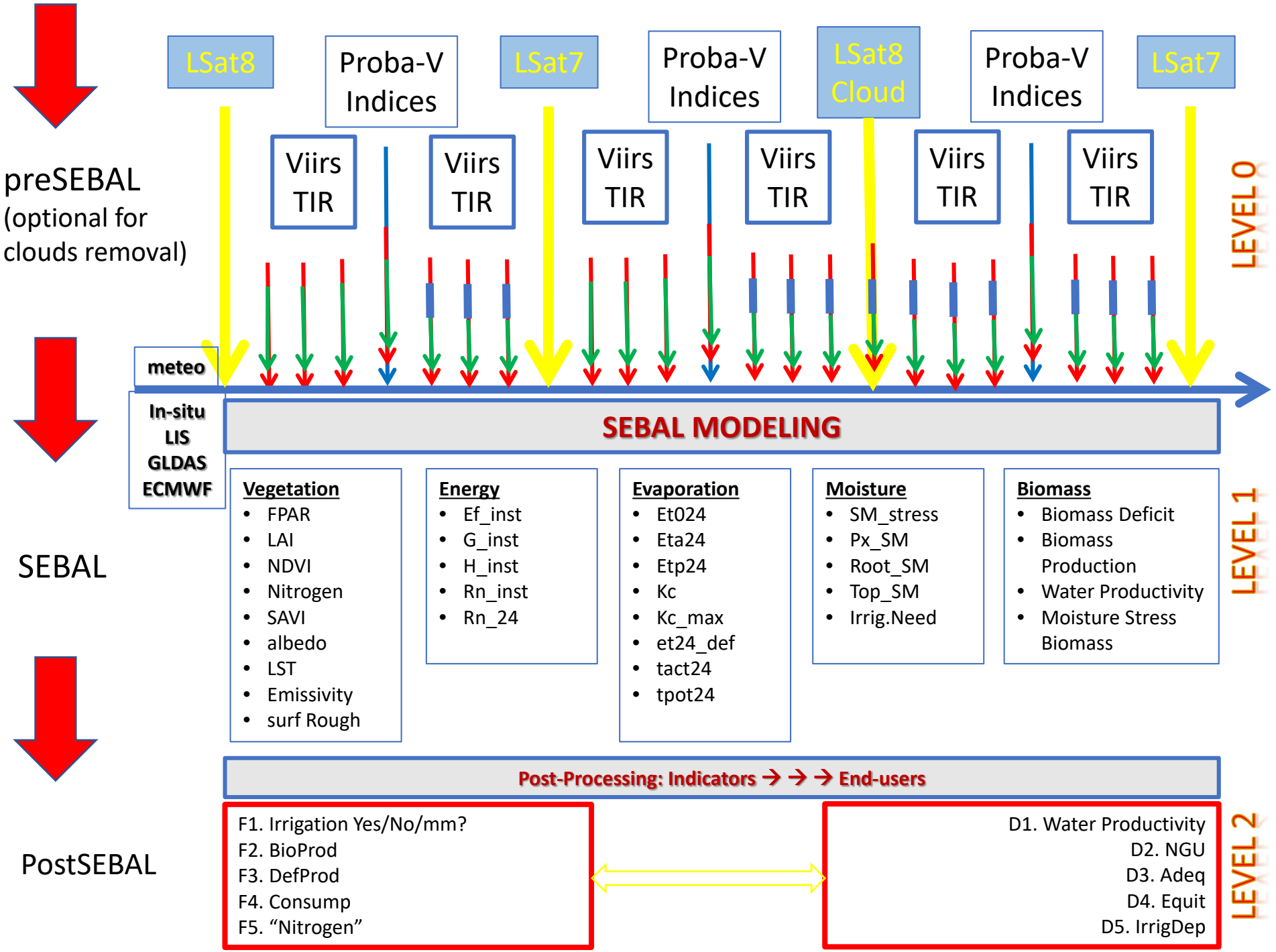






ongoing work

- Checking on Biomass, LAI and yield simulation in SWAT-T against RS
- SWAT-T water productivity mapping and compare with pySEBAL
- Water accounting from SWAT-T and RS products


preSEBAL
(optional for
clouds removal)
SEBAL
PostSEBAL
LSat8
Proba-V
Indices
LSat7
Proba-V
Indices
LSat8
Cloud
Proba-V
Indices
LSat7
Viirs
TIR
Viirs
TIR
Viirs
TIR
Viirs
TIR
Viirs
TIR
Viirs
TIR
LEVEL 0
meteo
In-situ
LIS
GLDAS
ECMWF
SEBAL MODELING
Vegetation
FPAR
LAI
NDVI
Nitrogen
SAVI
albedo
LST
Emissivity
surf Rough
Energy
Ef_inst
G_inst
H_inst
Rn_inst
Rn_24
Evaporation
Et024
Eta24
Etp24
Kc
Kc_max
et24_def
tact24
tpot24
Moisture
SM_stress
Px_SM
Root_SM
Top_SM
Irrig.Need
Biomass
Biomass Deficit
Biomass Production
Water Productivity
Moisture Stress Biomass
LEVEL 1
Post-Processing: Indicators → → → End-users
F1. Irrigation Yes/No/mm?
F2. BioProd
F3. DefProd
F4. Consump
F5. "Nitrogen"
D1. Water Productivity
D2. NGU
D3. Adeq
D4. Equit
D5. IrrigDep
LEVEL 2

Correspondence

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