

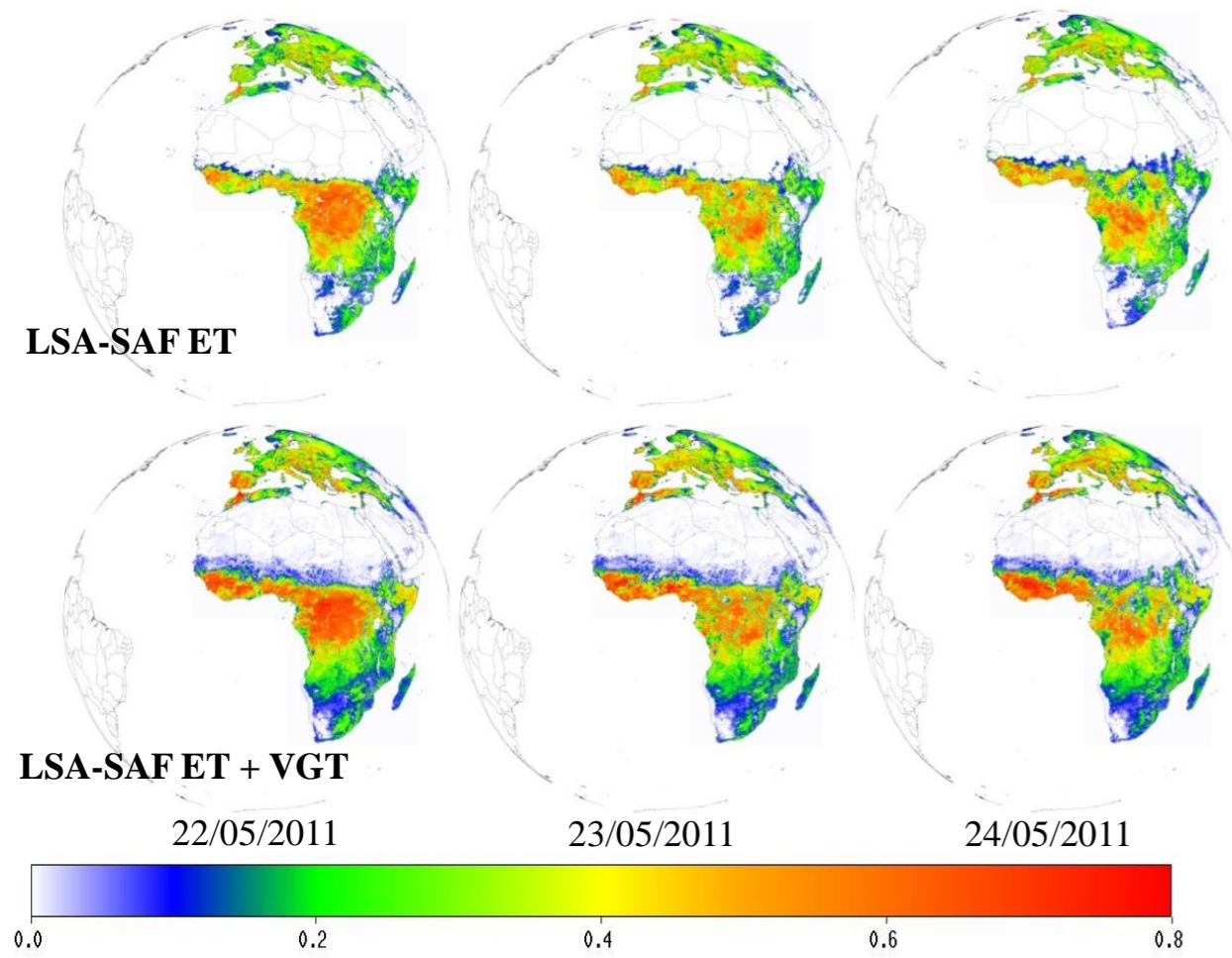
## Summary

- The LSA-SAF evapotranspiration products (LSA-SAF ET) have been operationally produced for approximately 6 years.
- Users from environmental services (eg drought monitoring, river management) show interest for the ET products.
- From both user's experience and own LSA-SAF validation, we have worked towards correcting some deficiencies in semi-arid environments and adding more features.
- LSA-SAF ET V2 is being finalized. It relies on more satellite data (two additional families of LSA-SAF products), and will additionally deliver the surface heat fluxes, and an estimate of the uncertainty.

## Two new families of LSA-SAF products exploited in the algorithm

### Exploitation of LSA-SAF vegetation variables (LAI, FVC)

The use of vegetation state variables derived from satellites presents the advantage that it allows the detection of short-term local fluctuations and inter-annual variability of vegetation phenological state. The leaf area index used in this context is produced daily by LSA-SAF. In an intermediary algorithm (LSA-SAF ET + VGT), we evaluated the impact of using LSA-SAF LAI and new parameterization.



Impact:

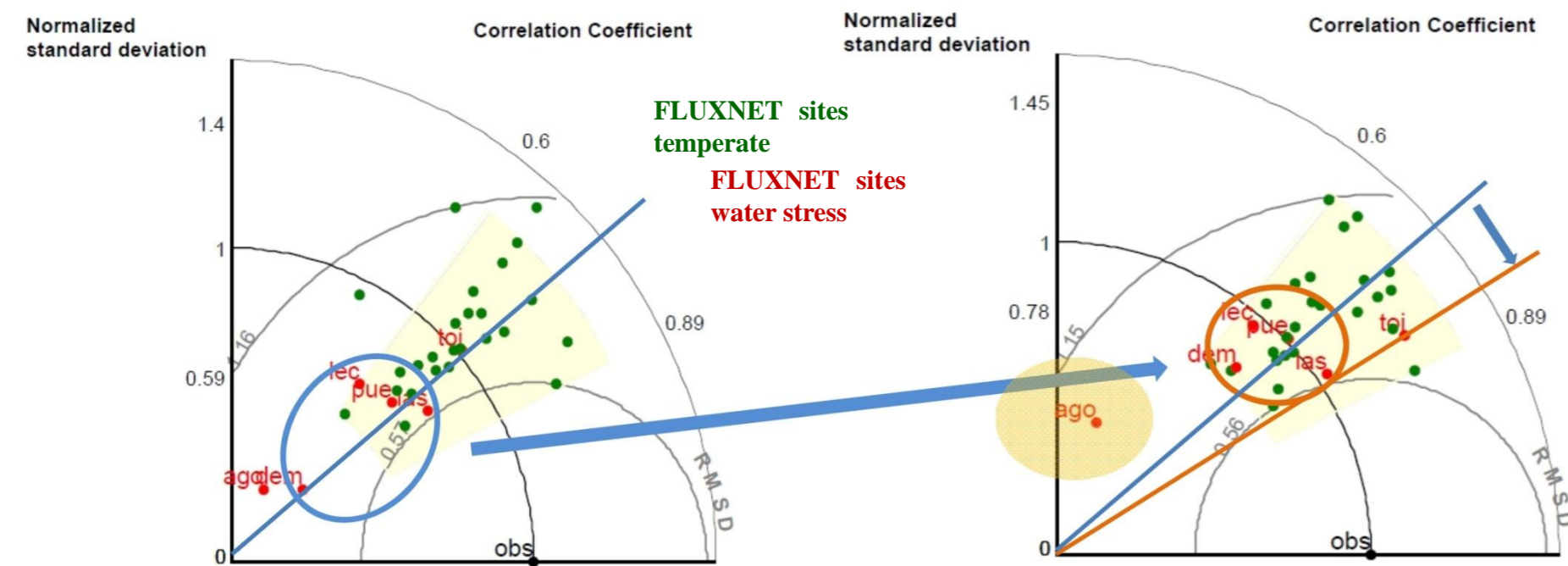
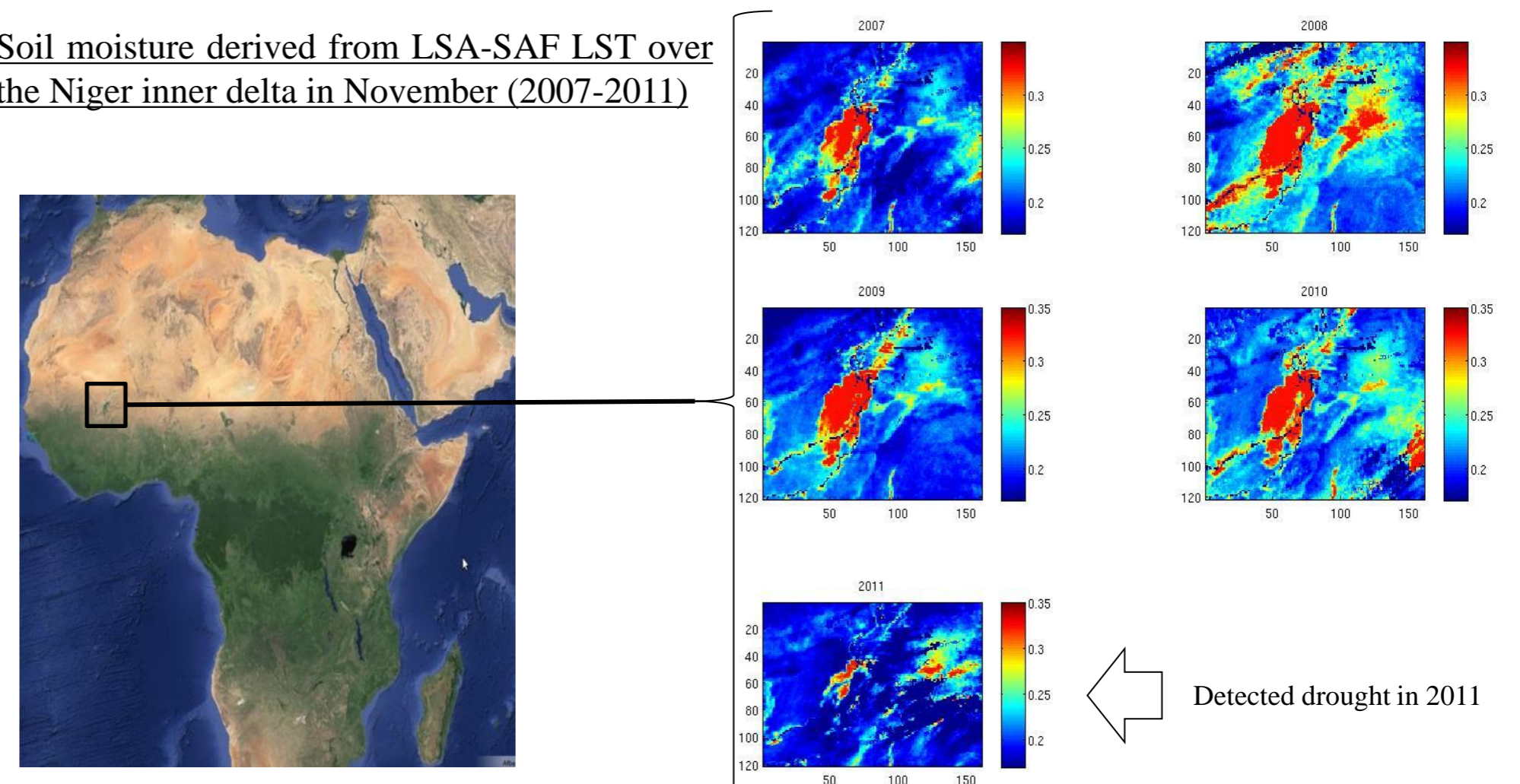
- Moderate/High impact over arid/semi-arid areas (eg Sahel)
- low or no impact in temperate regions of Europe.

### Exploitation of LSA-SAF Land Surface Temperature (LST)

Radiative temperature obtained from satellites contains information on soil water content. LSA-SAF LST has been exploited to extract daily surface soil moisture index at continental scale for clear sky days.

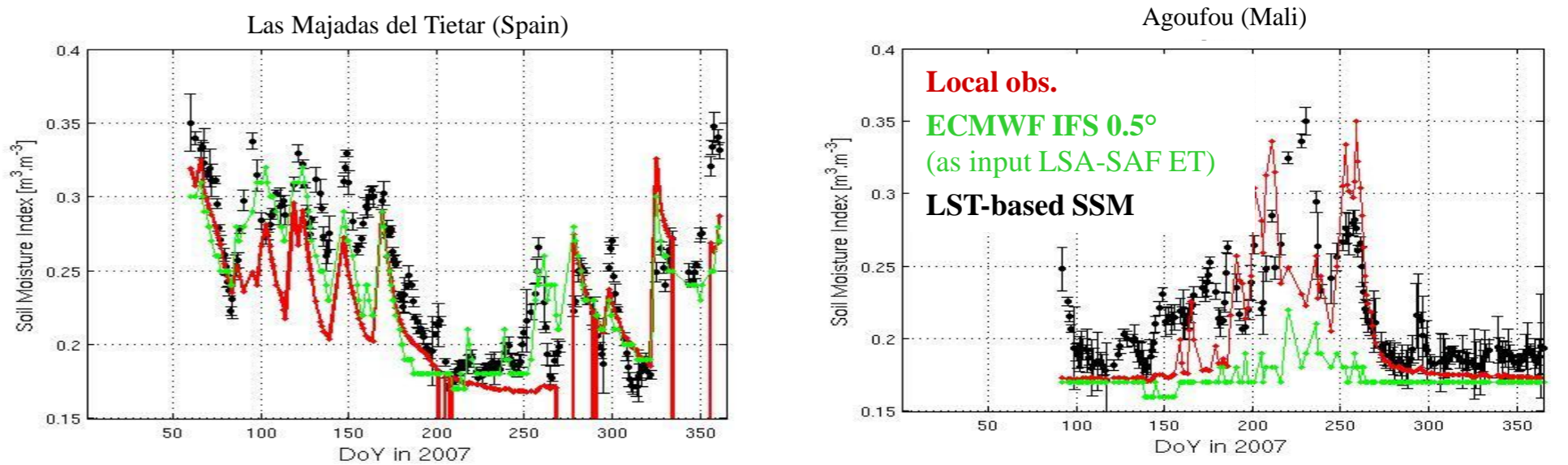
The obtained daily soil moisture estimates were compared to ground measurements (ISMN, FLUXNET), showing good agreement over the Sahel and semi-arid/water-stressed regions of Europe. Additionally, the obtained soil moisture detects irrigated areas and wetlands

Soil moisture derived from LSA-SAF LST over the Niger inner delta in November (2007-2011)



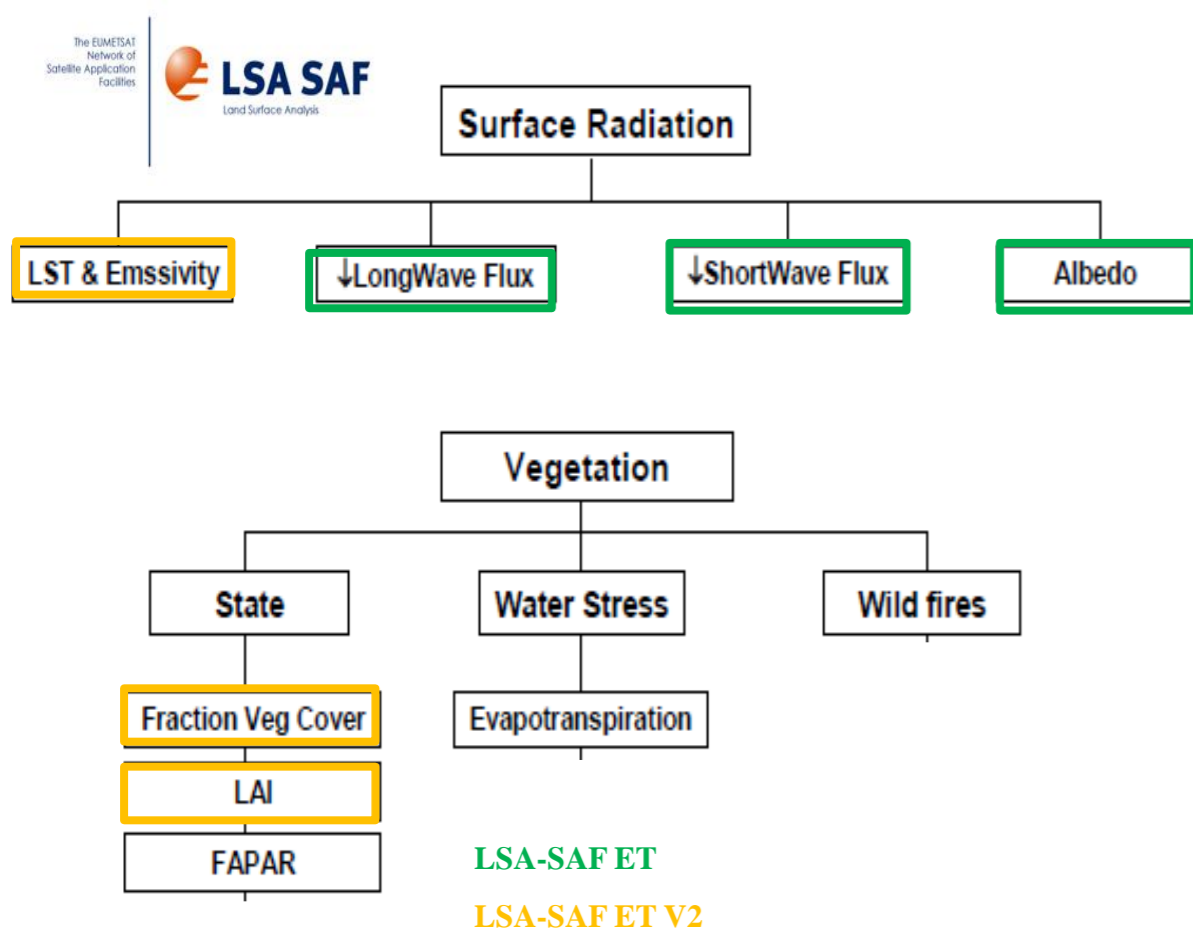
Comparing LSA-SAF ET and LSA-SAF ET + VGT to ground observations shows a clear improvement over semi-arid/soil water stressed areas (correlation scores improved, and variability is comparable to the observations) However, the scores at Sahelian sites are still low, indicating that for those regions, the algorithm is more sensitive to soil water availability than to vegetation.

### In-situ validation of soil moisture derived from LSA-SAF LST



LST derive soil moisture shows a good performance when compared to ground observation, and outperforms the NWP soil moisture forecast used in LSA-SAF ET at some station

## Summary of new developments: input, output and impact map over Africa

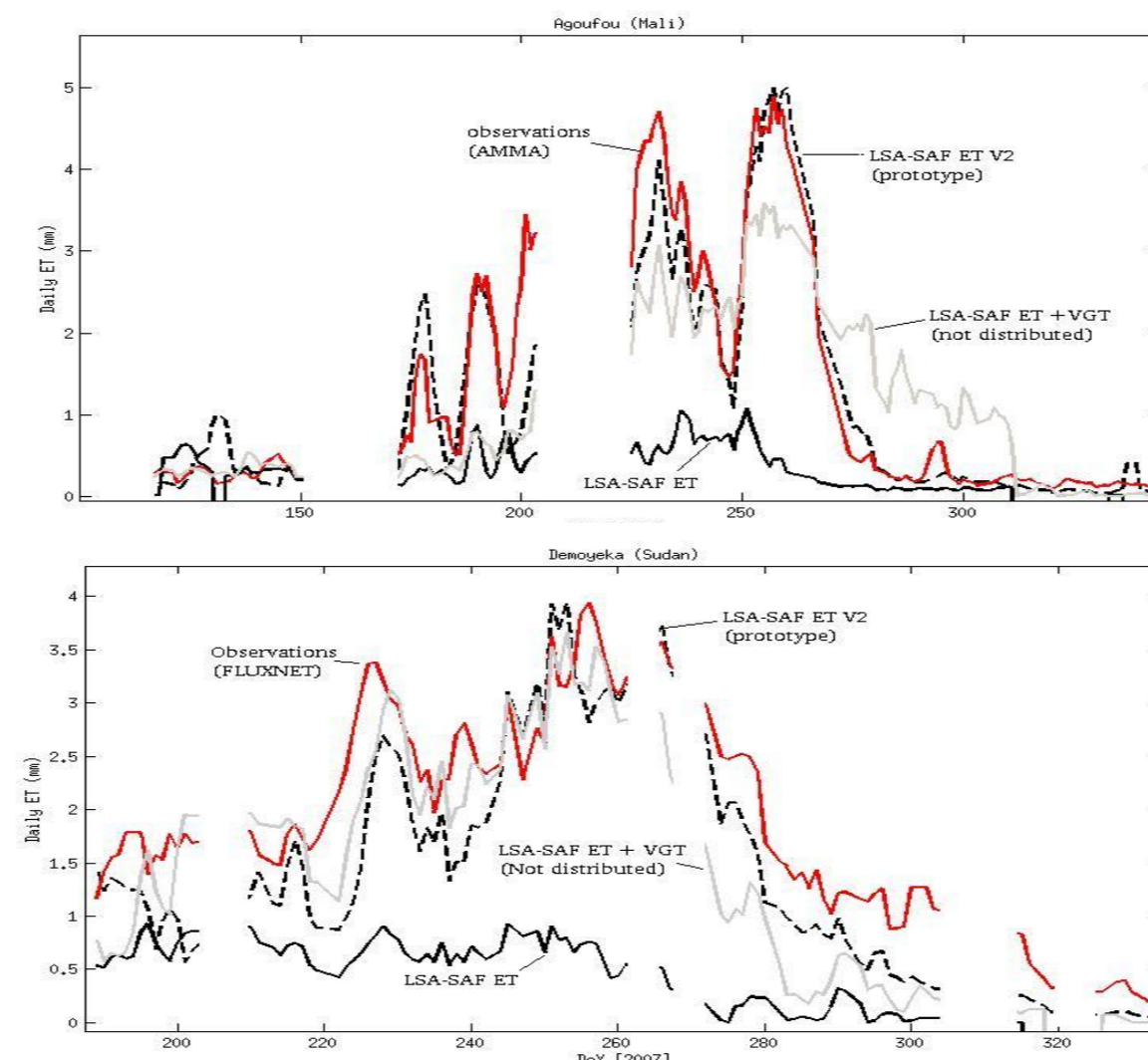


More LSA-SAF products are exploited in LSA-SAF ET V2:

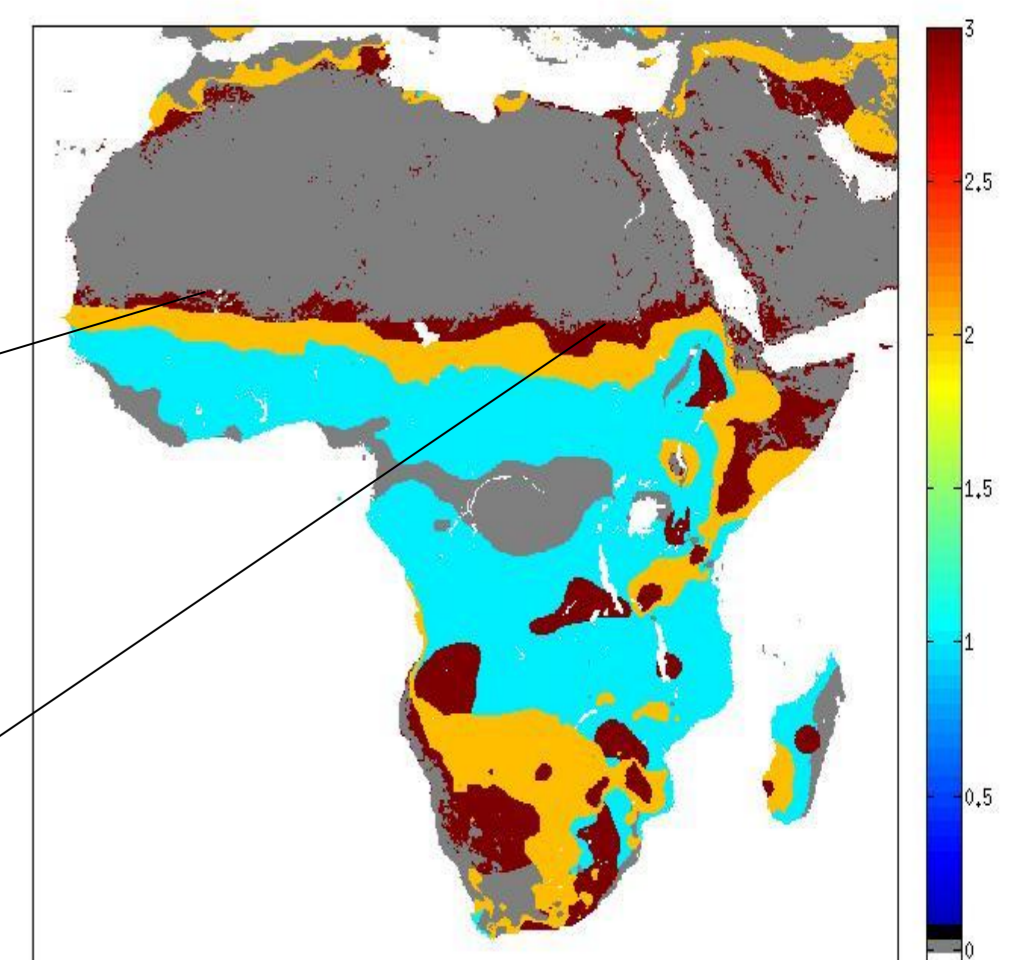
- LSA-SAF LAI & FVC for a better vegetation representation
- LSA-SAF LST for a better constrain on soil moisture

### In-situ validation of prototype LSA-SAF ET V2

The combined used of vegetation variables and soil moisture from LST considerably improves the model performances over arid and semi-arid regions.



### Impact map of new developments in LSA-SAF ET V2



Based on results obtained at measurement sites in different climatic regions, a map presenting the areas for which the use of new satellite variables can improve model performances over Africa was created.

- Dark-red areas: expected high improvement
  - Grey: unknown impact (lack of measurement sites)
  - Yellow: neutral impact areas
  - Blue: slightly negative impact (use current ECMWF soil moisture)
- LSA-SAF ET V2 will show an improvement over the dark-red areas, and equal performance for the other areas.

## Discussion

Feedback from the users is important to focus further developments and supplement adds-in for the LSA-SAF ET products. Therefore, we highly appreciate and value the users point of view and criticism in term of accuracy, timeliness, and characteristics. (more info on LSA-SAF ET products on <http://landsaf.ipma.pt>).

## References

- Ghilain, Arboleda, Gellens-Meulenberghs (2011), Hydrology Earth System Sciences.  
 Ghilain, Arboleda, Sepulcre-Canto, Batelaan, Ardó, Gellens-Meulenberghs (2012), Hydrology Earth System Sciences.  
 Ghilain, Arboleda, Gellens-Meulenberghs (2013), EUMETSAT conference proceedings.

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