Irrigation Management

More efficient irrigation management will contribute to food security, poverty alleviation and economic growth by sustainable use of water. Satellites can help provide important decision material for irrigation.

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The challenge

Irrigation is one way to expand agricultural production and ensure increased crop productivity.

Due to the rapid growth of population as well as drought and rainfall pattern changes caused by climate changes, it is expected that irrigation will play a more and more essential role in future agriculture.

However, while irrigation schemes provide an operational platform for efficient water mobilization and distribution, farmers/managers need to know when to irrigate, and how much, in order to derive optimal water use.

Evapotranspiration is a key parameter and part of the water cycle in agriculture. New technology for assessment of evapotranspiration based on Sentinel has been developed.

The space-based solution

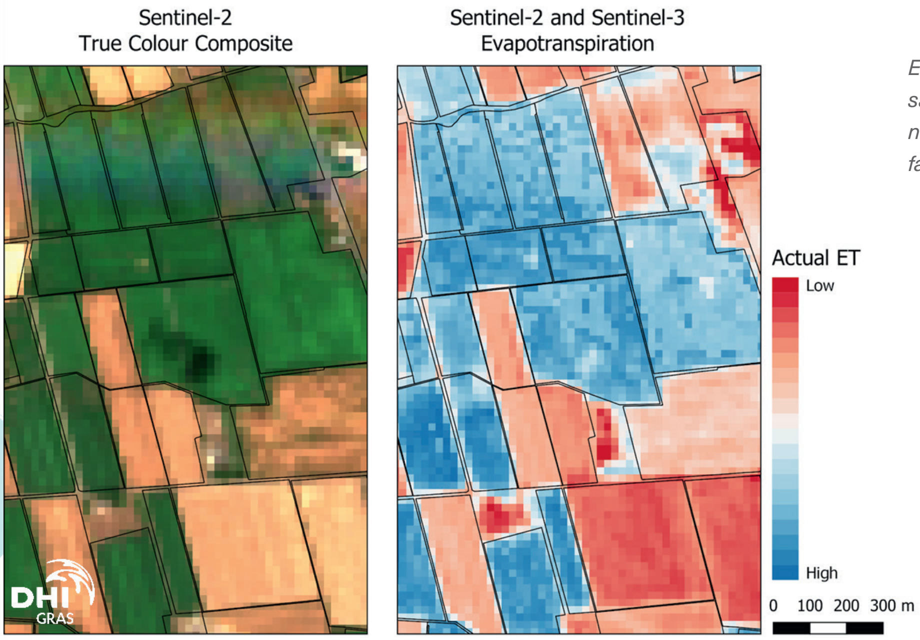
Satellites can assist irrigation management by exploring irrigation potential and providing reliable information on spatially distributed Crop Water Stress as decision material for the irrigation managers.

Easy access to reliable estimations of Evapotranspiration is considered a key requirement for this since Crop Water Stress is derived from evapotranspiration measurements. When evapotranspiration is successfully estimated at high resolution, it can be used to map crop water stress at field scale.

While extensive research has assessed evapotranspiration for water management using EO data at a regional scale, previous technology and satellite sensors have not allowed assessment of evapotranspiration at field level (farm level).

This has now changed, and Sentinel 2 (optical 10m) and Sentinel 3 (thermal 1km) European Space Agency satellites have the right combination of frequent revisit times, novel spectral capabilities and high-resolution images that makes the satellites ideally positioned to derive evapotranspiration at field scale.

Thermal data is essential for the estimation of evapotranspiration since land surface temperature (LST) forms the lower boundary in the land surface-atmosphere energy transfer system. The land surface temperature is produced from thermal observations of the Sentinel-3 satellite with a 1 km spatial resolution. This resolution is not sufficient for field-scale crop water stress monitoring, and



Evapotranspiration determined from satellites in high resolution. This technology will be used in the future by farmers to manage irrigation better.

therefore it is sharpened to 20 m resolution with the use of Sentinel-2 optical observations.

This sharpening is novel and will be applying machine-learning. Initial findings show that the sharpening technique performs the best when strong thermal contrast is present within the scene as is the case in an irrigated landscape.

> **"Farmer access to decision material based on reliable field scale evapotranspiration data could potentially change how farmers irrigate water intensive crops."**
>
> *Rita Hørfarter, SEGES*

This sharpening concept builds on already well-proven and previous engineering and scripting code based on combination and integration of open source software packages such as QGIS, BEAM and SNAP.

So far, results from this new method have been published and tested in the European Space Agency project Sentinels for evapotranspiration. New users are currently testing the product with promising results. See project website http://esa-sen4et.org/

Benefits to citizens

Beneficiaries are irrigation schemes in drought-prone countries eager to implement the source code and work with similar methods.

Outlook to the future

It is expected that the technology can lead to significant water savings for the same yield, which would greatly benefit farming community and irrigation managers.

Acknowledgements

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