



**POLITECNICO**  
MILANO 1863

# Smart Irrigation From Soil Moisture Forecast Using Satellite And Hydro–Meteorological Modelling

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**European Geosciences Union**  
**General Assembly 2017**

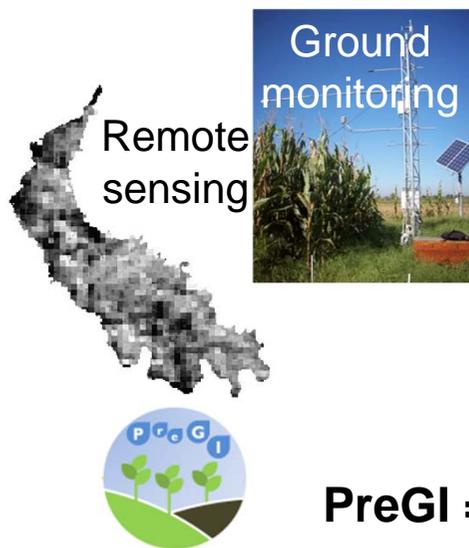
Vienna | Austria | 23–28 April 2017

# Motivation

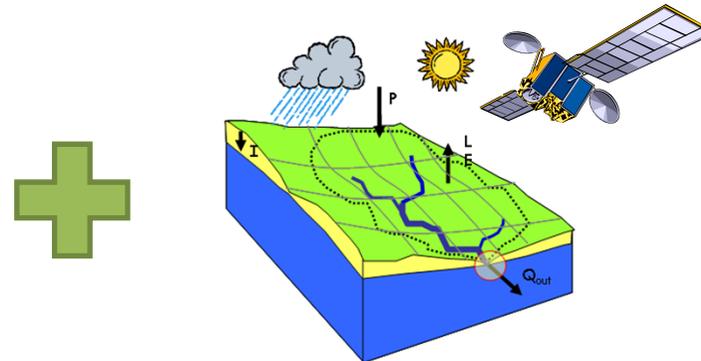
Improve **irrigation scheduling** to face **increased water demand** and **climate change** impacts.

## METHODS

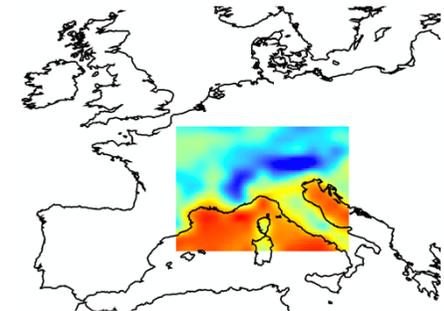
### Initial State



### Hydrological Modeling and Satellite data



### Meteorological Forecast



**PreGI = Predicting and Guiding Irrigation System**

# The SIM project

**SIM**

SMART IRRIGATION FROM SOIL MOISTURE FORECAST USING SATELLITE AND HYDRO – METEOROLOGICAL MODELLING

Coordinator:  
Politecnico di Milano (Italy)

Team:  
Delft University (The Netherlands)  
University of Valencia (Spain)  
University of Baleary (Spain)  
Radi-Academy of Science (China)  
University of Tuscia (Italy)  
Epson meteo (Italy)  
MMI srl (Italy)



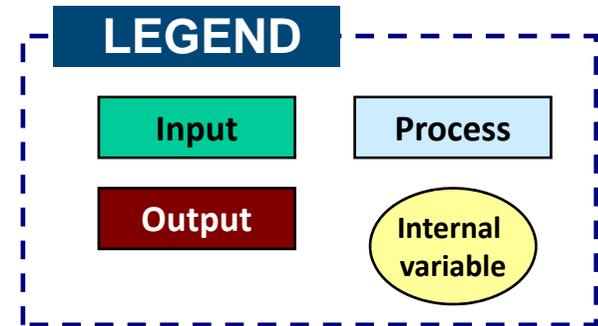
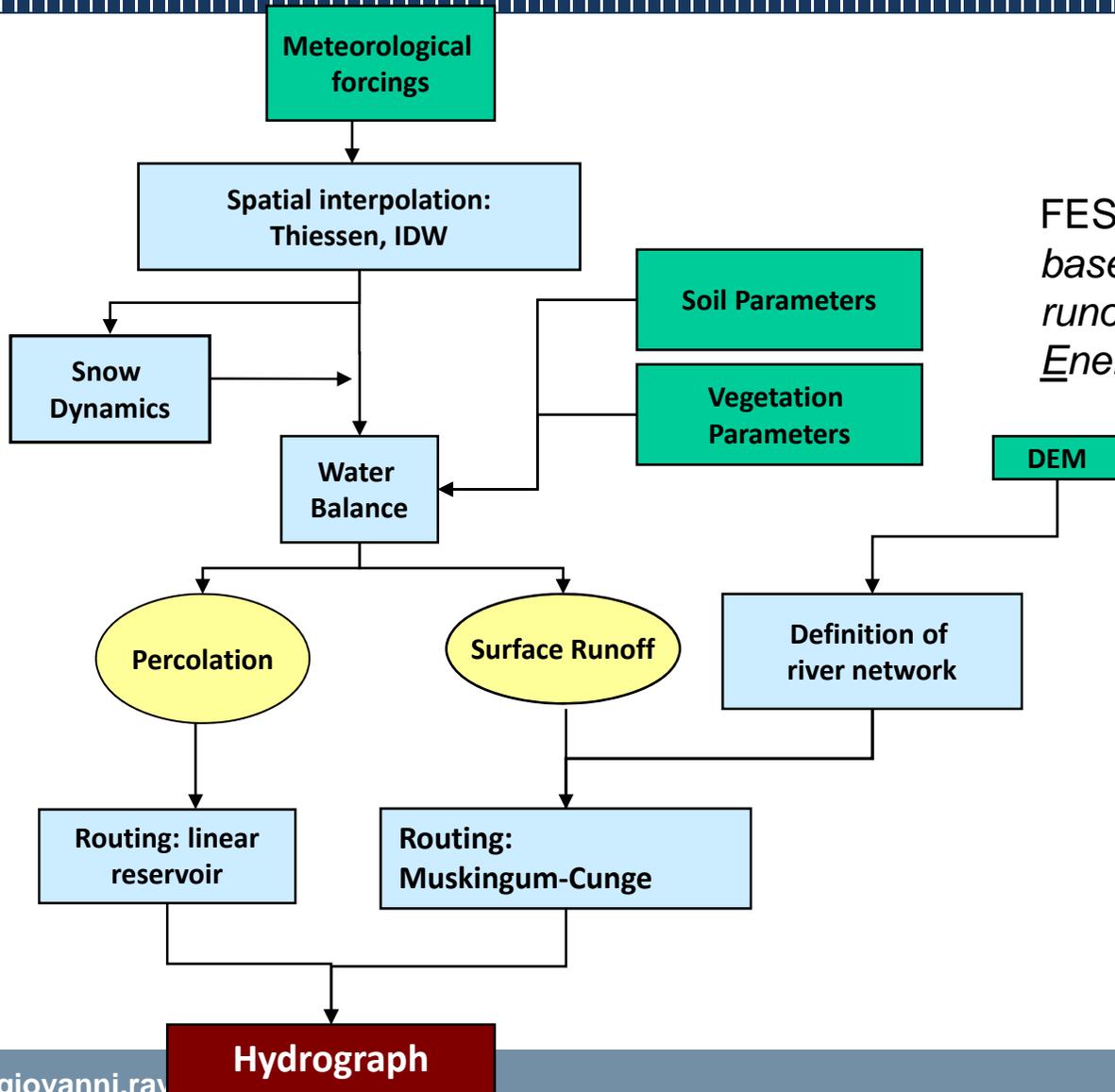
WATERWORKS 2014 COFUNDED CALL

The **SIM** project funded by EU in the framework of the WaterWorks2014 - Water Joint Programming Initiative aims at developing an **operational tool** for **real-time forecast** of crops irrigation **water requirements** to support parsimonious water management and to optimize irrigation scheduling. Test use of **meteorological forecast** and **satellite data**

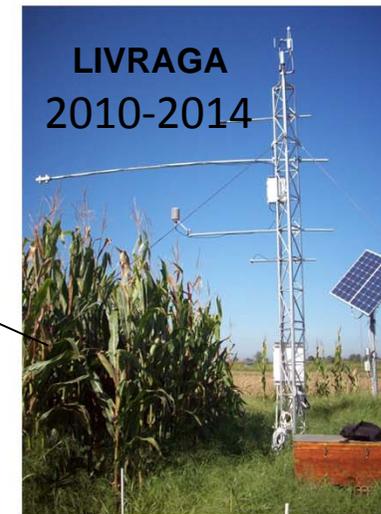
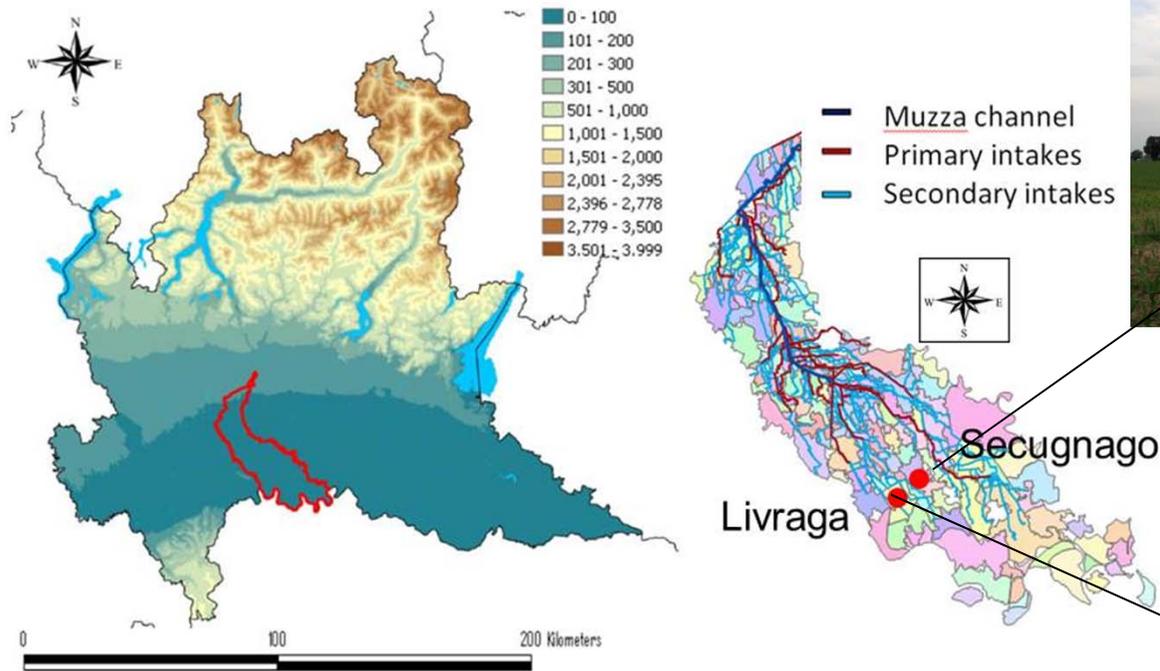
# The FEST-EWB hydrological model

[www.fest.polimi.it](http://www.fest.polimi.it)

FEST-EWB: *Flash – flood Event – based Spatially – distributed rainfall – runoff Transformation – including Energy Water Balance*



# Test site: Muzza Bassa Lodigiana consortium

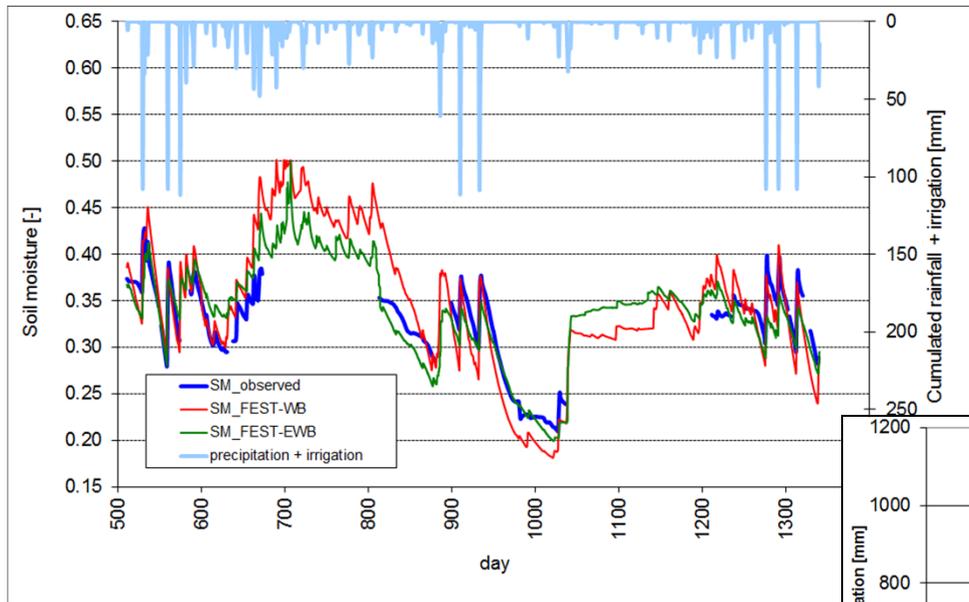


Muzza Bassa Lodigiana consortium  
(MBL) area 740 km<sup>2</sup>

# Irrigation technique: flood at prearranged intervals, every 14 days

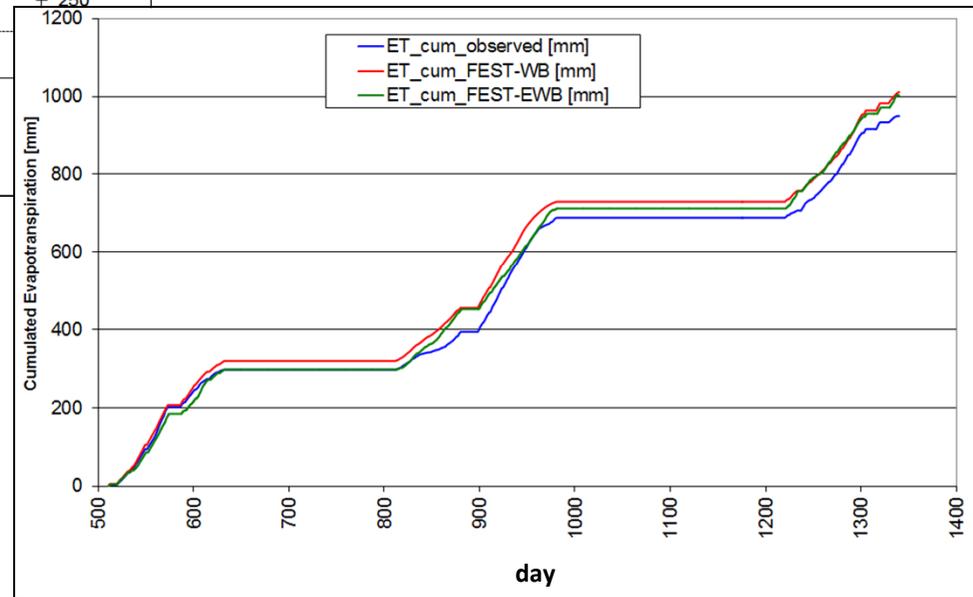


# Hydrological models calibration at local scale (Livraga) 2010-2012



SOIL MOSITURE

EVAPOTRANSPIRATION

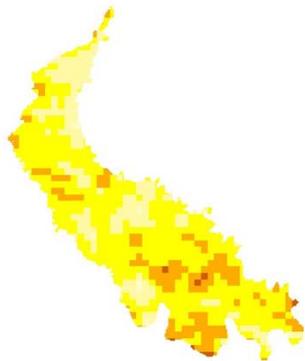


# FEST-EWB calibration at large scale

6 July 2012 13:00

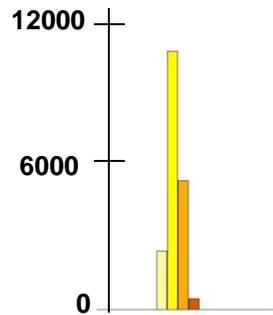
**MODIS**

$\Delta x=1\text{km}$



$\mu=32.6^\circ\text{C}$   $\sigma=7.5$

Pixel numbers



**LST**

**FEST-EWB**

$\Delta x=200\text{ m}$

Not calibrated

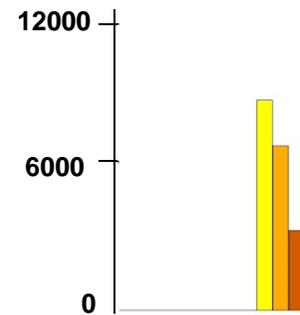
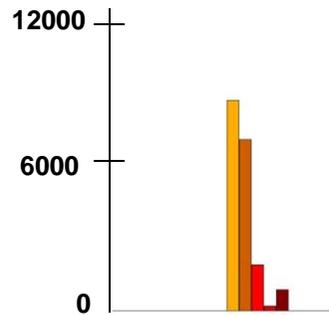
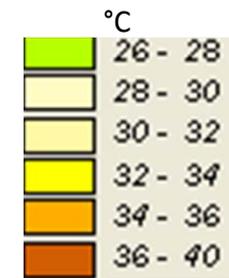


$\mu=35.7^\circ\text{C}$   $\sigma=3.5$

calibrated



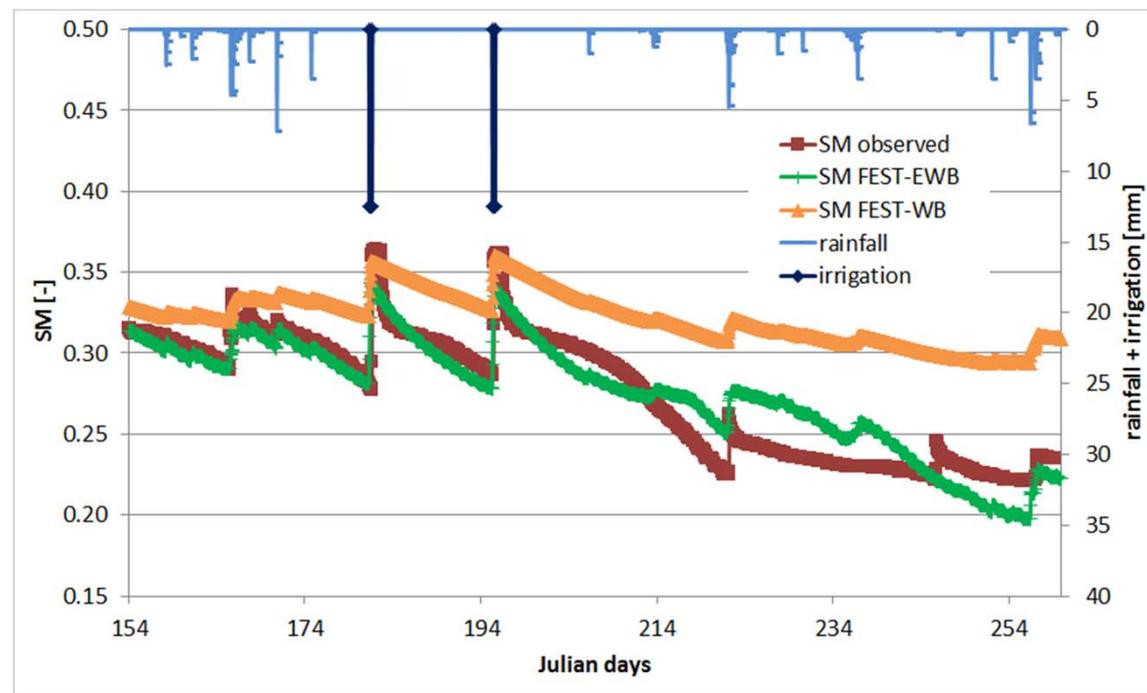
$\mu=32.1^\circ\text{C}$   $\sigma=7.0$



**2010-2012  
130 images**

**Mean difference =  
2.1 °C  
RMSE=2.8 °C**

# FEST-EWB validation at Secugnago in 2015



# Meteorological forecast



WRF version 3.61

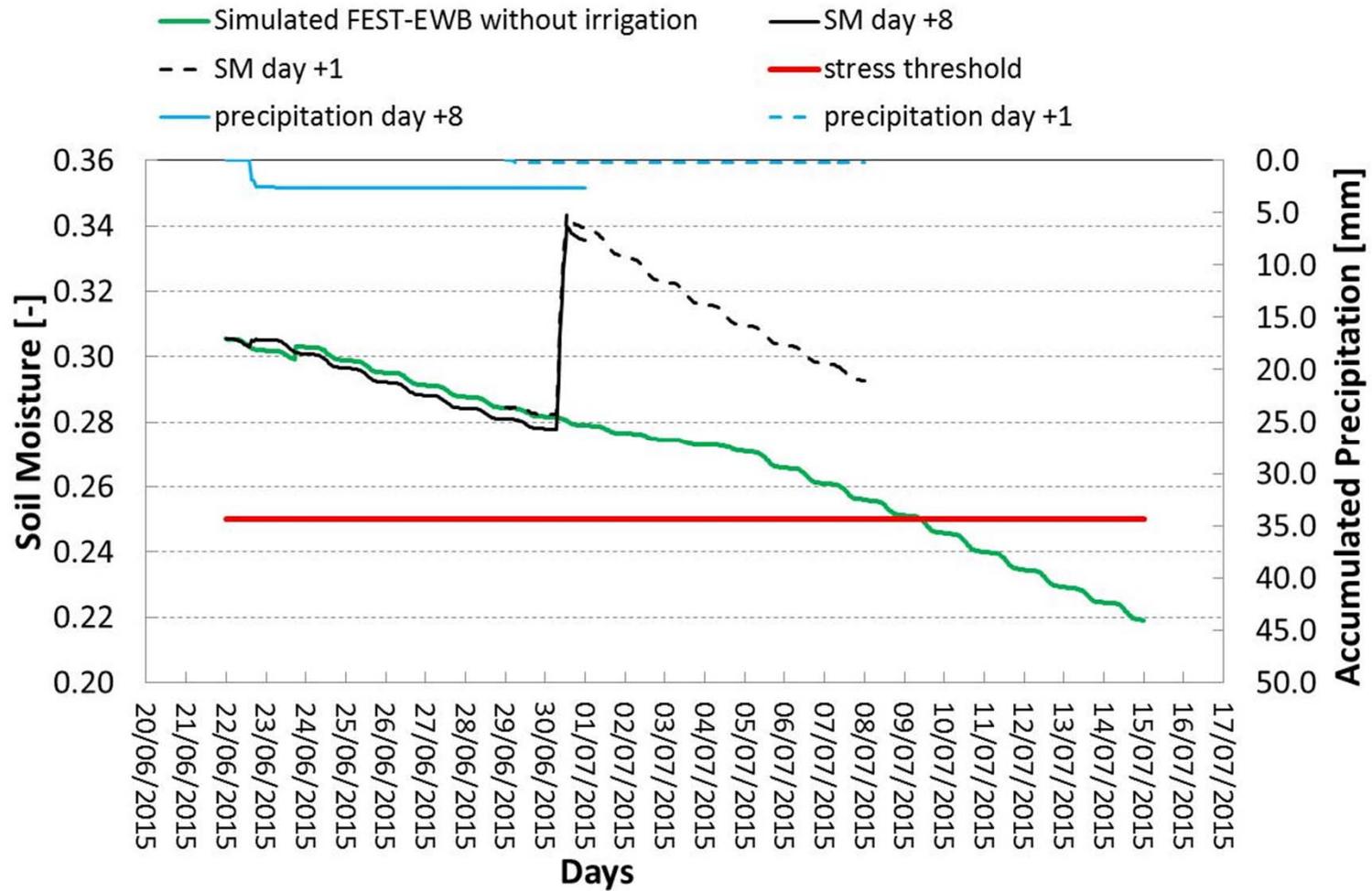
Simulations operated by Terraria

Spatial resolution = 3 km

Temporal resolution = 1 h

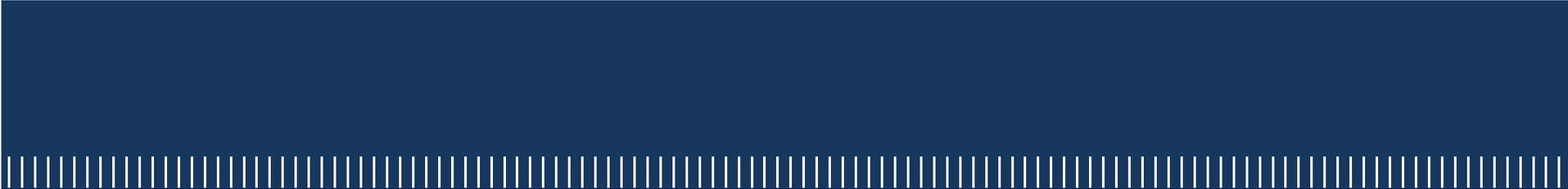
Forecast horizon = 8 days

# Irrigation scheduling



# Conclusions

- Satellite data are very useful for calibrating grid-based hydrological model that solves energy and water balance
- Combined use of hydrological and meteorological models provides soil moisture prediction effective in scheduling irrigation



THANK YOU  
FOR YOUR  
ATTENTION

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