MyWater

Merging hydrological models and EO data for reliable information on Water

An European SWAT soil database

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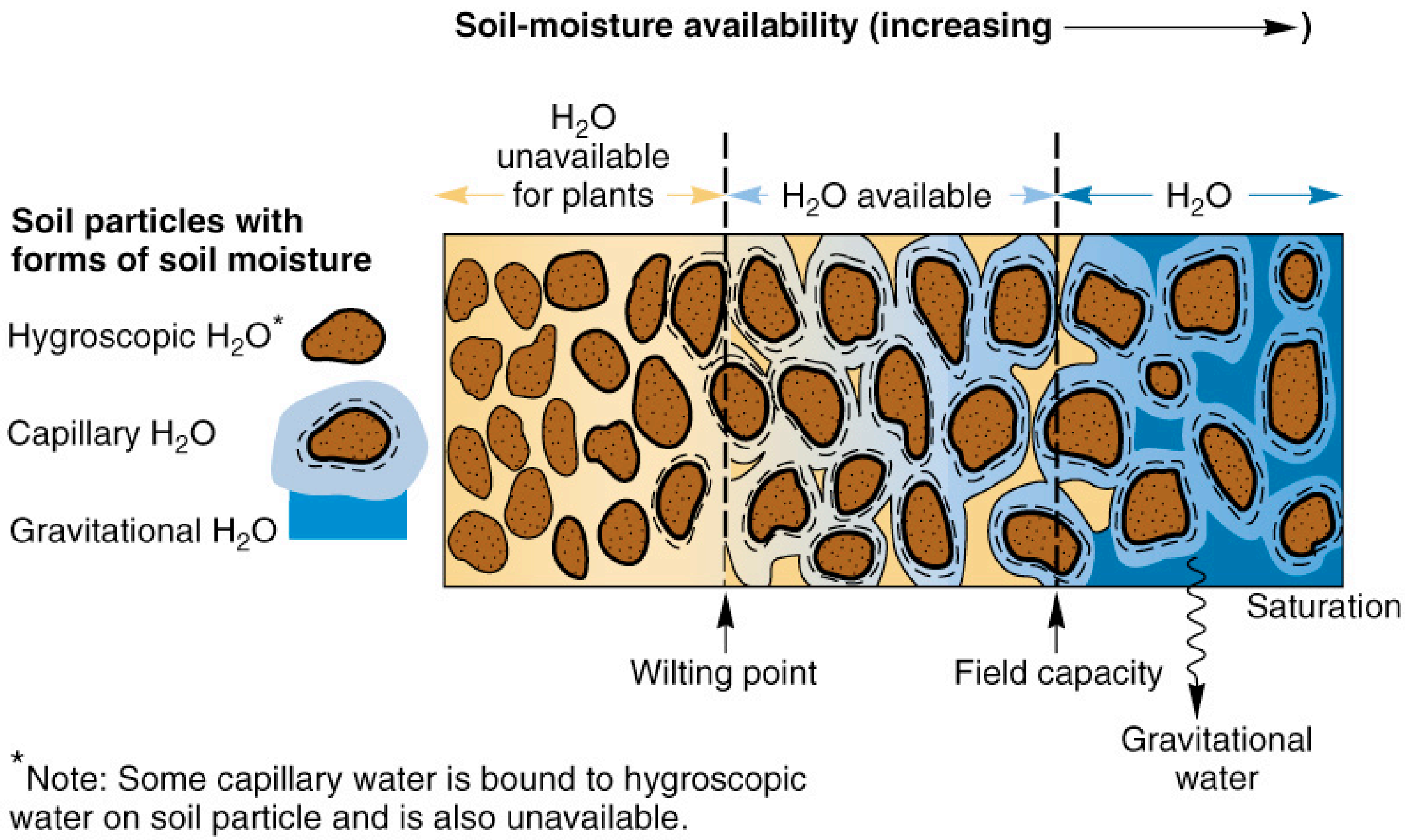
Overview

- Soil hidrology
- European Soil Database (ESDB),
- SWAT database of soils was produced for Europe.
- The SWAT model results in some Portuguese watersheds: Tâmega and Vouga.
- MyWater project (http://mywater-fp7.eu/)

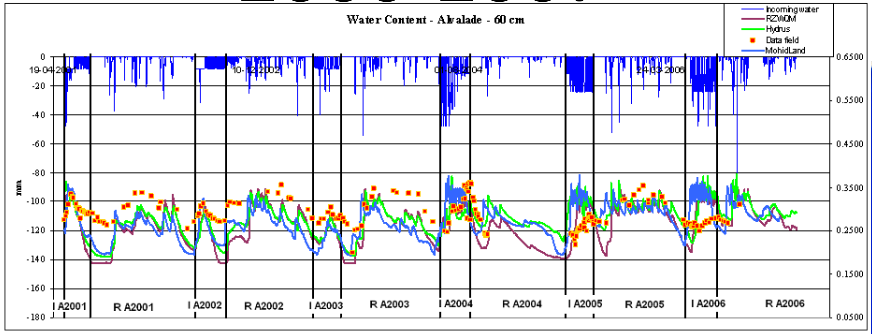
Soil Water

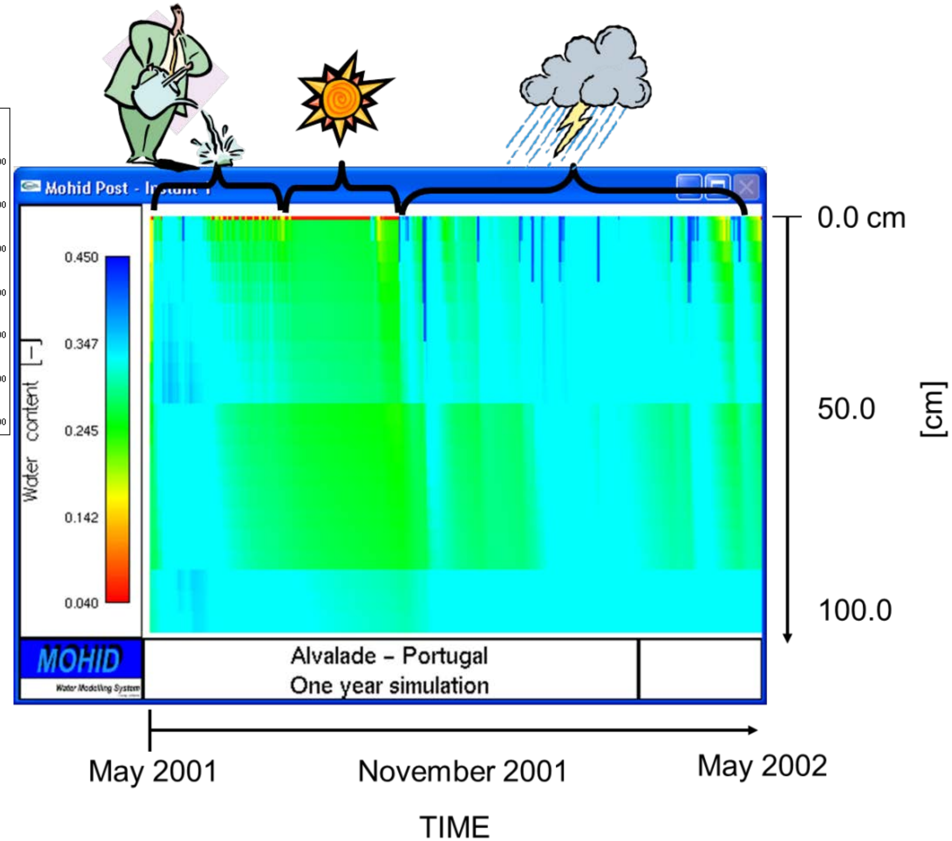
FIELD	R FILE	DESCRIPTION
SNAM		
HYDGRP		
SOL_ZMX		
ANION_EXC		
SOL_CRK		
TEXTURE		
NLAYERS		
SOL_Z*i*		
SOL_BD*i*		
SOL_AWC*i*		
SOL_K*i*		
SOL_CBN*i*		
CLAY*i*		
SILT*i*		
SAND*i*		
ROCK*i*		
SOL_ALB1		
USLE_K1		
SOL_EC*i*		



Continues water distribution in depth

- 2000-2007



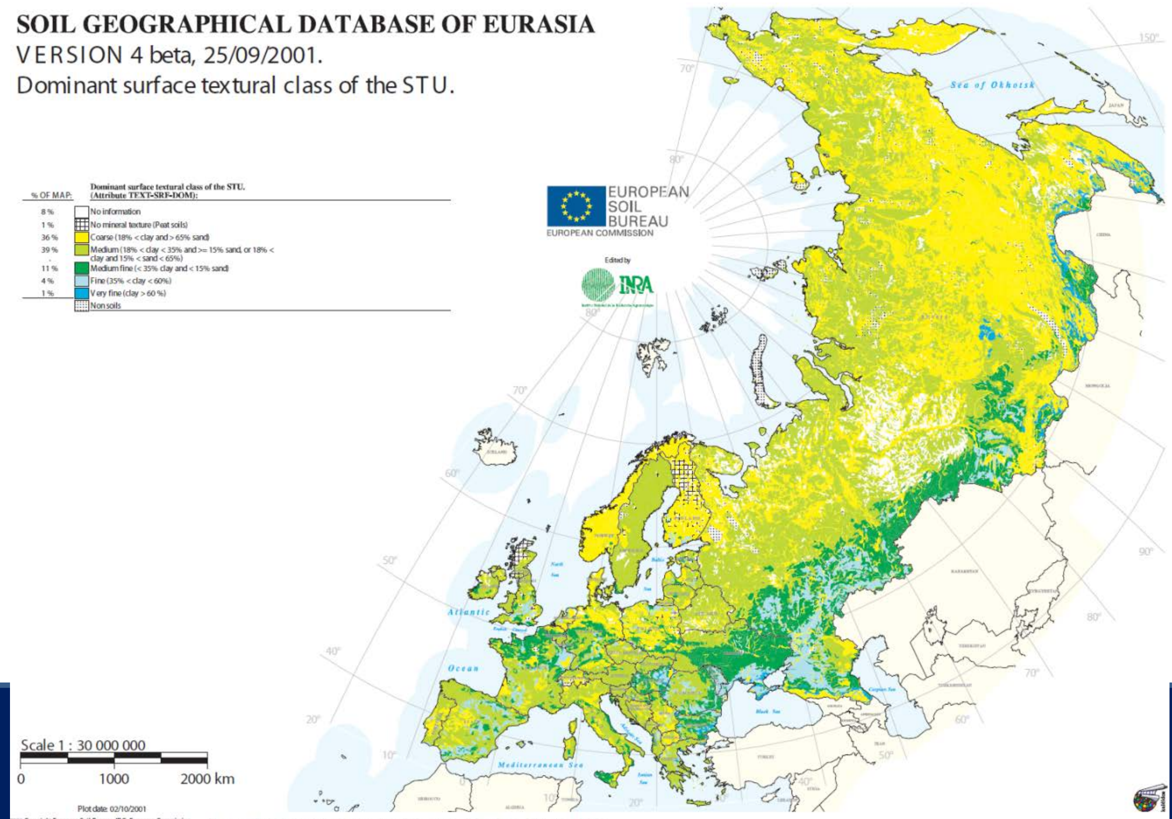


SMU and STU

- Soil typological units (STU): soil type having homogeneous properties over a certain area
- Soil mapping units (SMU): soil association composed of 1 to 10 STUs
- The soil properties are first gathered at the STU level (SWAT database) and are then delivered at the SMU level (Soil map), using the dominant STU.

European soil database

- The Soil Geographical Database of Eurasia (SGDBE) , Pedotransfer Rules Database (PTRDB),



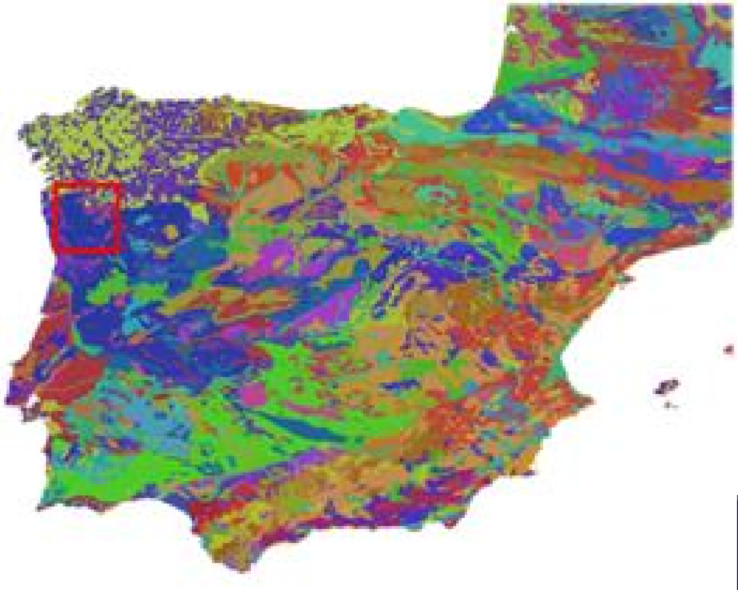
SEVENTH FRAMEWORK PROGRAMME

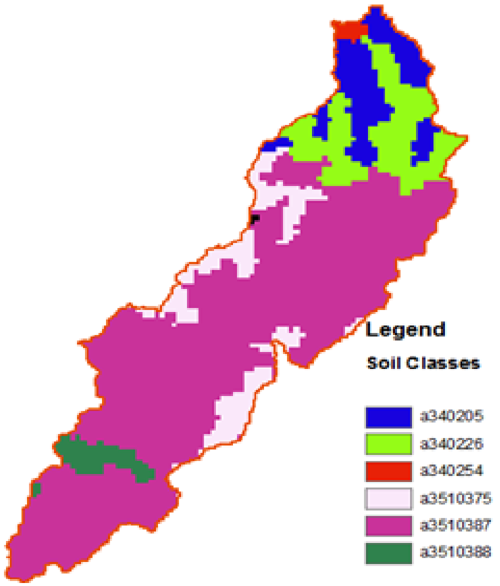
SWAT Soil Database

FIELD	R FILE	DESCRIPTION
SNAM		STU/SMU code
HYDGRP	hydrgrp.R	PTR based on topsoil and subsoil dominant texture classes and depth class of an impermeable layer.
SOL_ZMX	solzmx.R	Recode depth class of an obstacle to roots (ROO)
ANION_EXCL		Set to default value: 0.5
SOL_CRK		Set to default value: 0
TEXTURE		Layers texture codes
NLAYERS	solzmx.R	Default to 2.
SOL_Z*i*	solzmx.R	First layer set to 30 cm, second to SOL_ZMX
SOL_BD*i*		According to PTR PD_TOP and PD_SUB, set to 1.1, 1.6 or 1.9 g/cm^3
SOL_AWC*i*		Obtained from HYPRESclass PTF
SOL_K*i*		Obtained from HYPRESclass PTF
SOL_CBN*i*	OC_sub.R	According to OC_TOP, set to 0, 1.5, 4 or 10 % weight. For subsoil, based on Hiederer (2009).
CLAY*i*	av.text.R	Transform texture class (TEXTSRFDOM and TEXTSUBDOM) into clay, silt, sand contents.
SILT*i*	av.text.R	
SAND*i*	av.text.R	
ROCK*i*		According to PTR VS (volume of stone)
SOL_ALB1	albedo.R	Based on SWATxxx.mdb
USLE_K1		According to PTR ERODIBILITY and USDA-Agricultural Research Service (2006)
SOL_EC*i*		Set to default value: 0.

APPLICATION TO PORTUGAL

- soils inside watershed are typically sandy (40 % sand, 40% silt and 20% clay) with infiltration capacity above average.
- Area of 325 206 ha

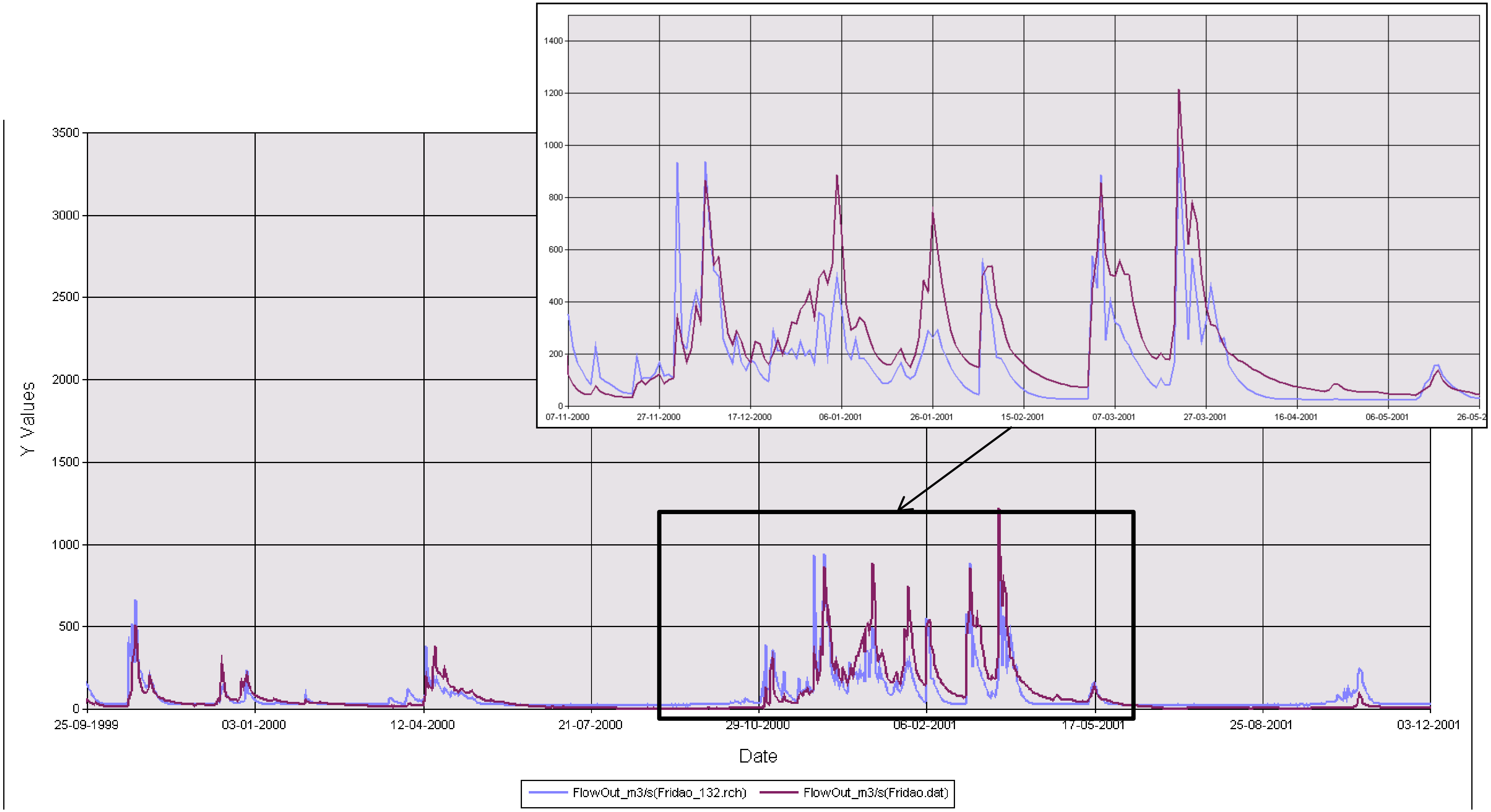




Input used in SWAT

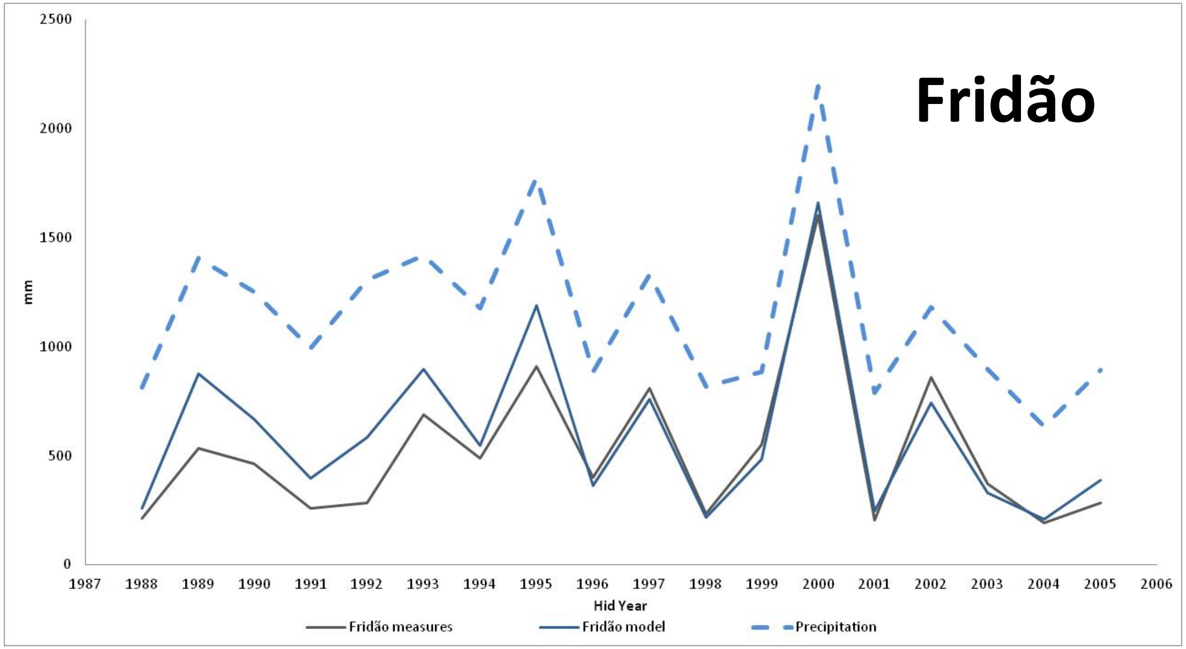
- SRTM DTM,
- Dailly precipitation and monthly for the rest,
- Land Cover (corine 2000)
- River measurments

SWAT models results

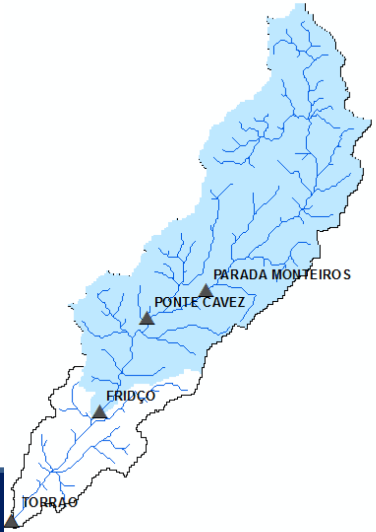


SWAT Model Results

- Flow annual analysis

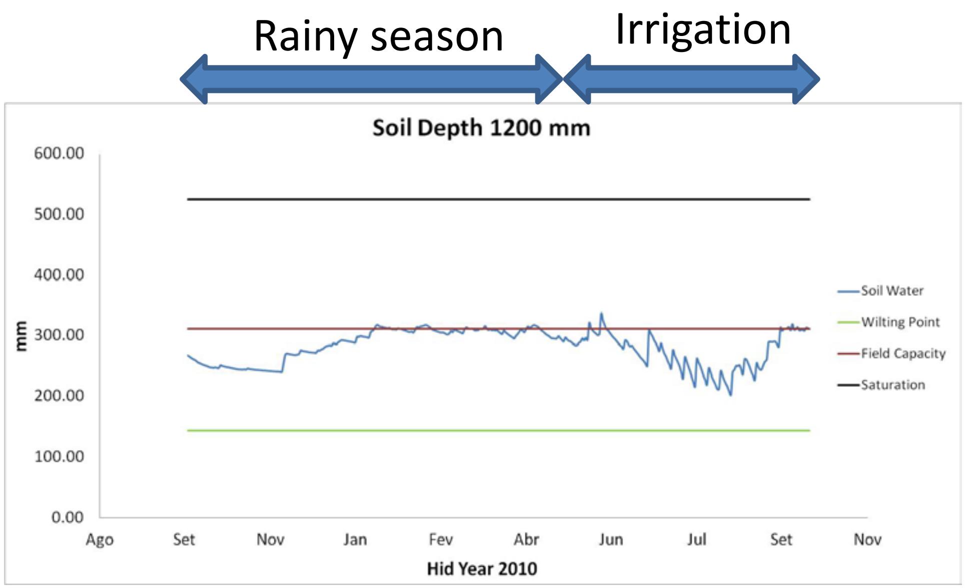


Model simulate very well the Fridão flow measures in the last 10 years, but in the first 8 years

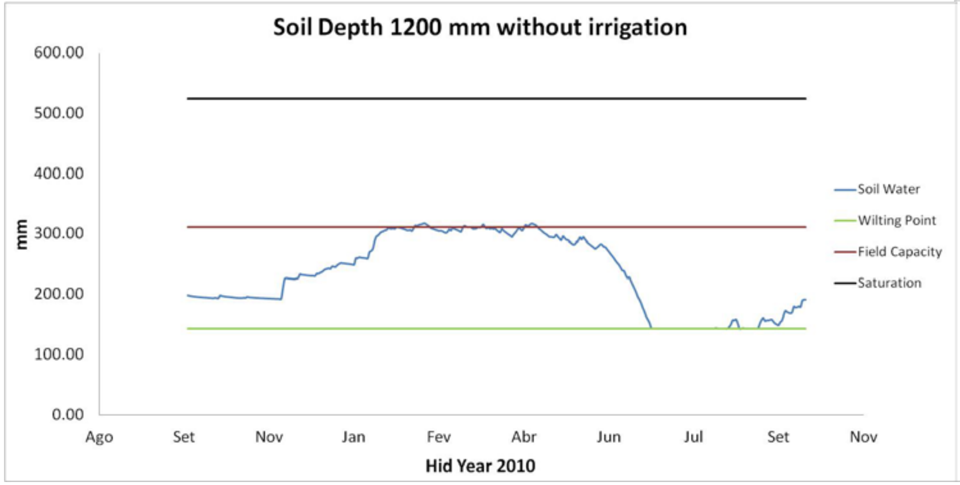


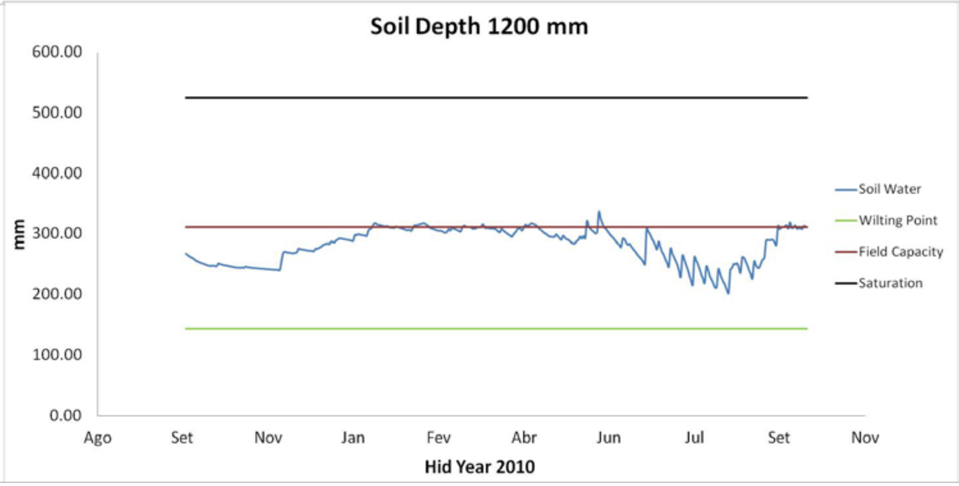
HRU based analysis

- Irrigated Corn field
- Soil depth 1200 mm



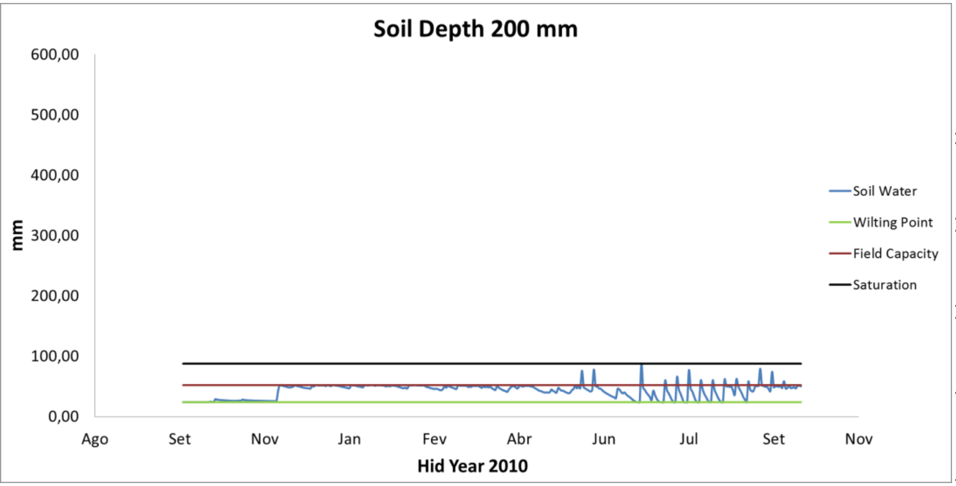
Irrigation

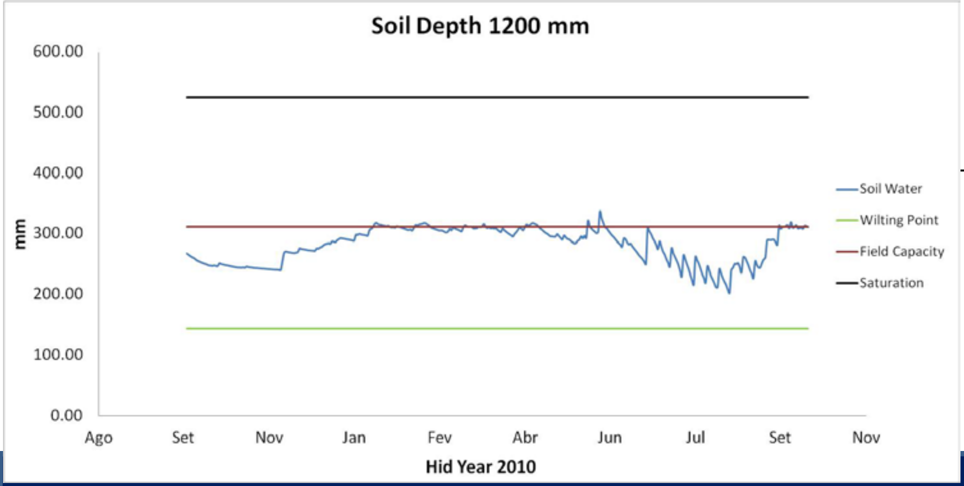

Soil Depth 1200 mm without irrigation
600.00
500.00
400.00
300.00
200.00
100.00
0.00
mm
Ago
Set
Nov
Jan
Fev
Abr
Jun
Jul
Set
Nov
Hid Year 2010
Soil Water
Wilting Point
Field Capacity
Saturation

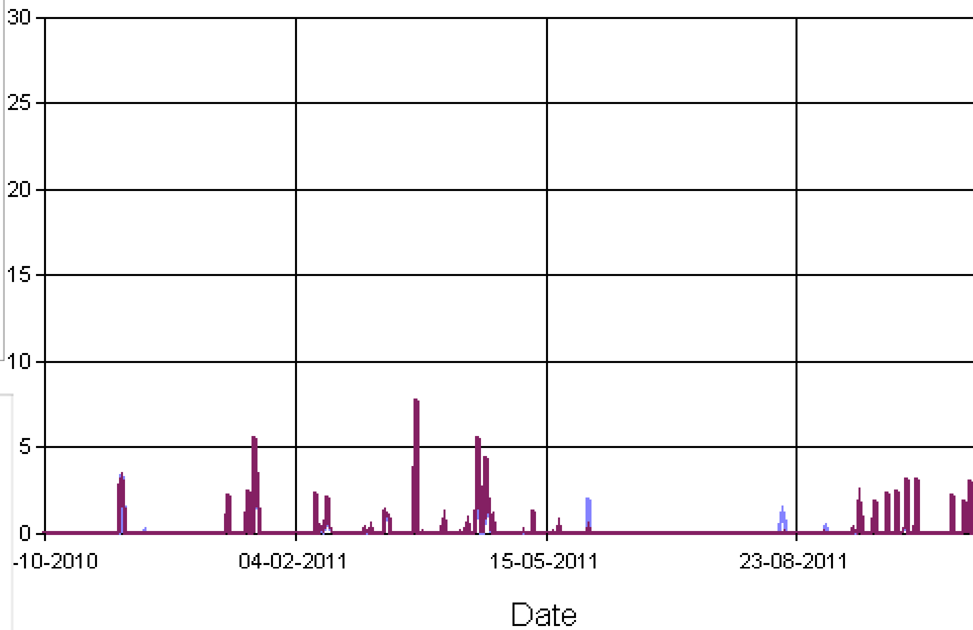

Soil Depth 1200 mm
600.00
500.00
400.00
300.00
200.00
100.00
0.00
mm
Ago
Set
Nov
Jan
Fev
Abr
Jun
Jul
Set
Nov
Hid Year 2010
Soil Water
Wilting Point
Field Capacity
Saturation

Run Ref	Min	Max
1200	200	1200

Soil Depth







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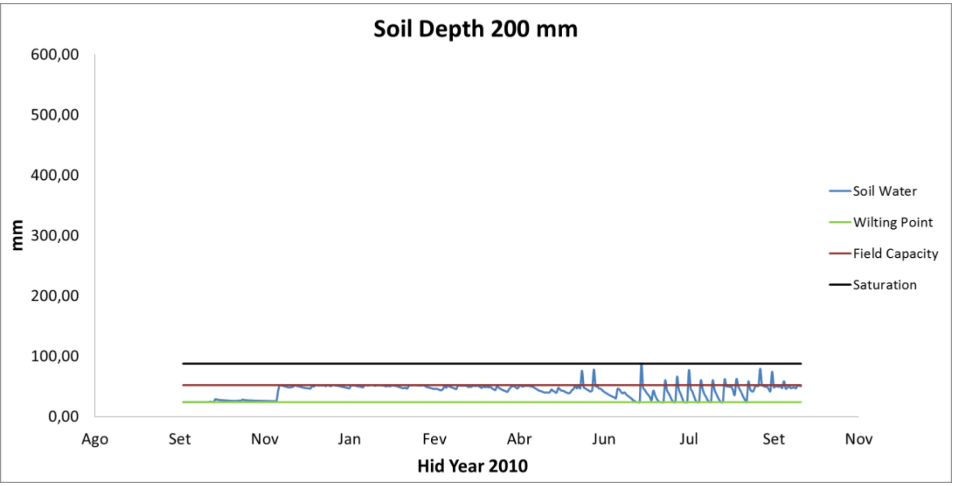
SEVENTH FRAMEWORK PROGRAMME

Soil Depth

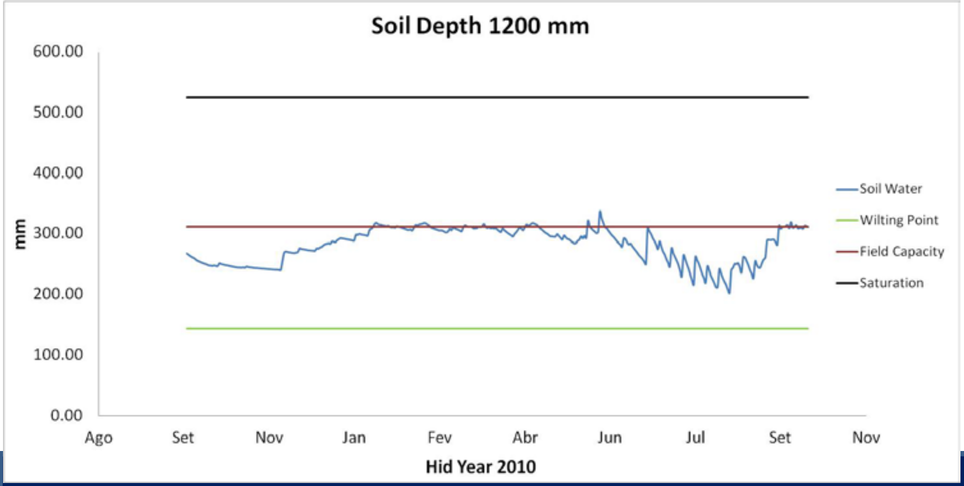


CN=85

cnday	SW
70	24
82	30
91	40
94	50
96	60
98	70
98	80

CN=40

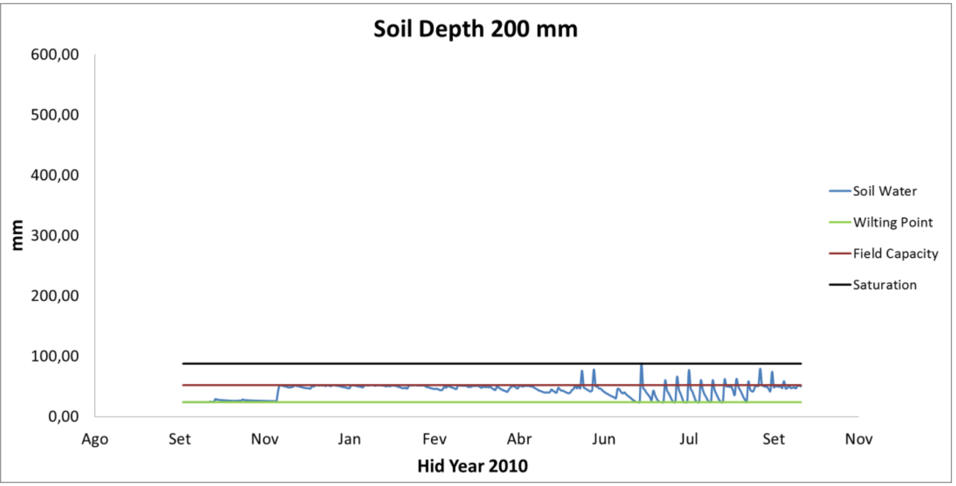
cnday	SW
20	24
24	30
34	40
49	50
64	60
77	70
86	80

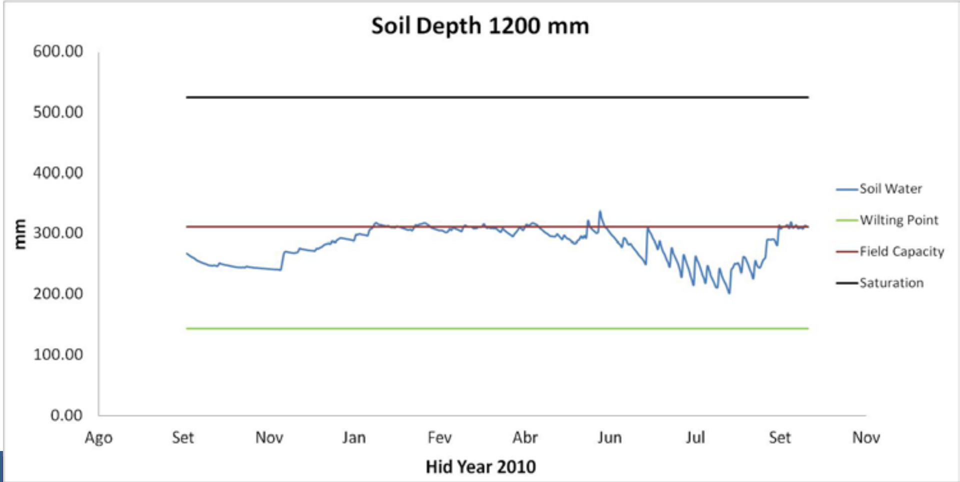


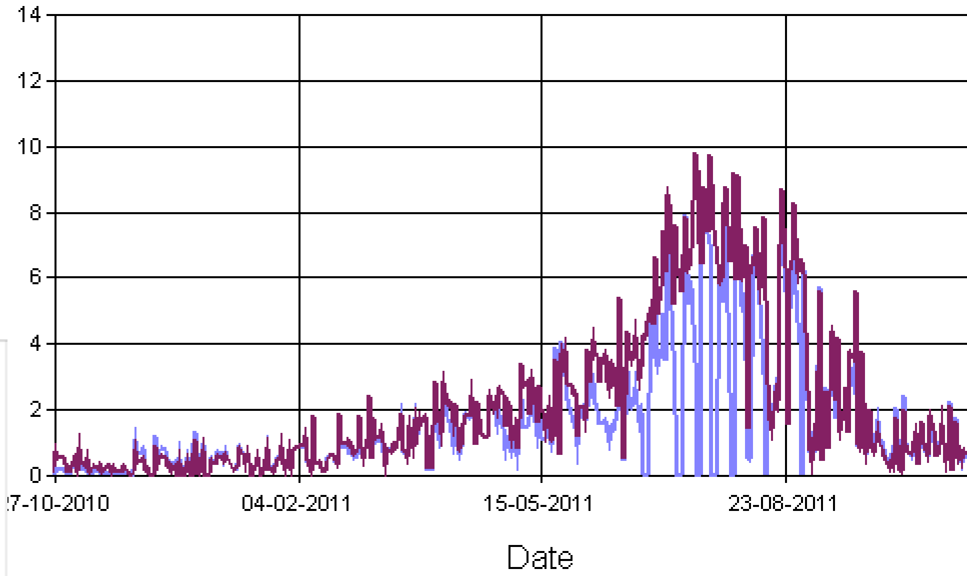
cnday	SW
70	143
96	240
98	340
99	440
99	540
99	640
99	740

cnday	SW
20	143
50	240
78	340
92	440
97	540
99	640
99	740

Soil Depth







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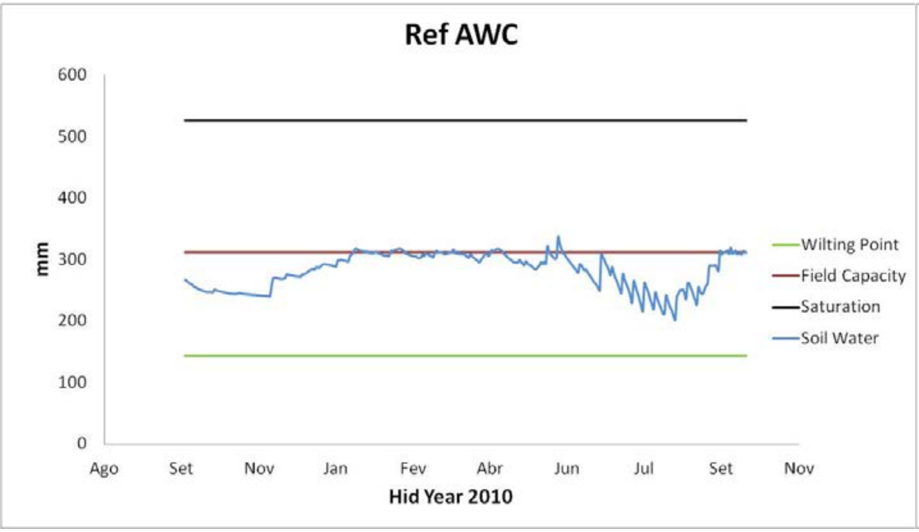
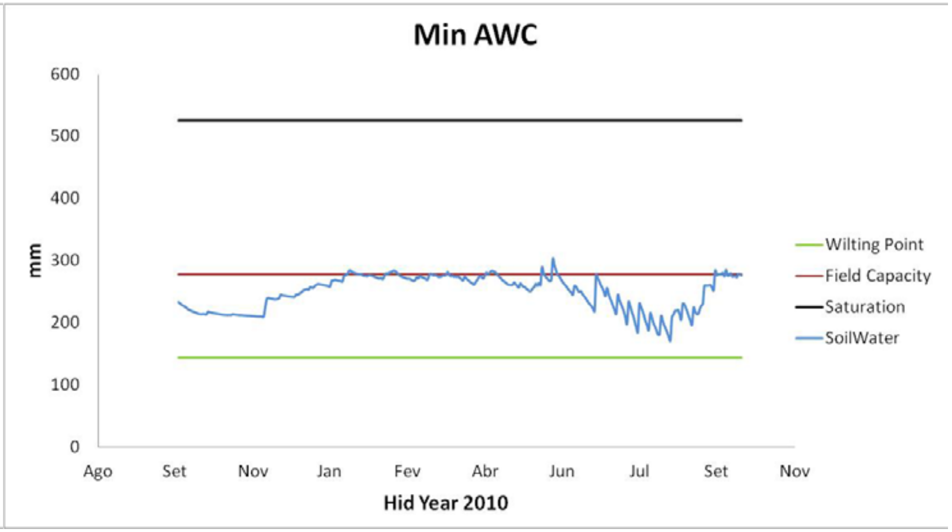
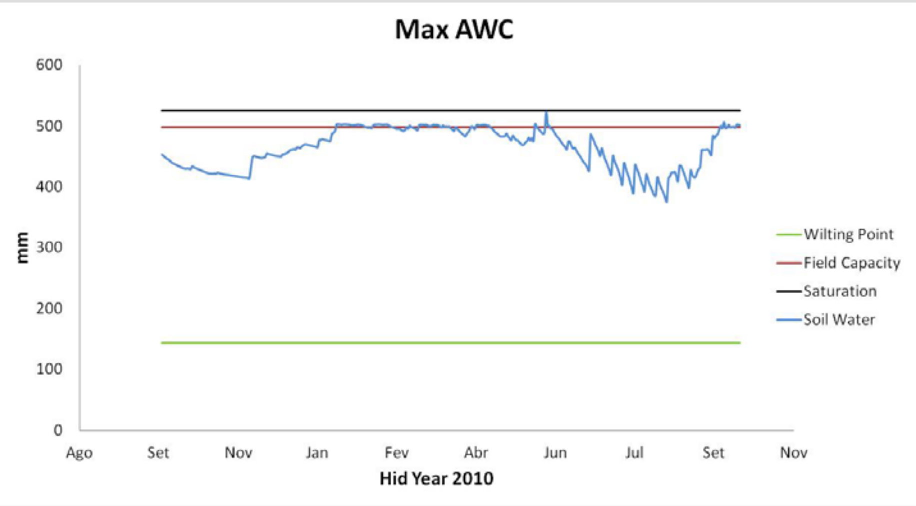
SEVENTH FRAMEWORK PROGRAMME

AWC tests

Run Ref	Min	Max
0.14084	0.113	0.296





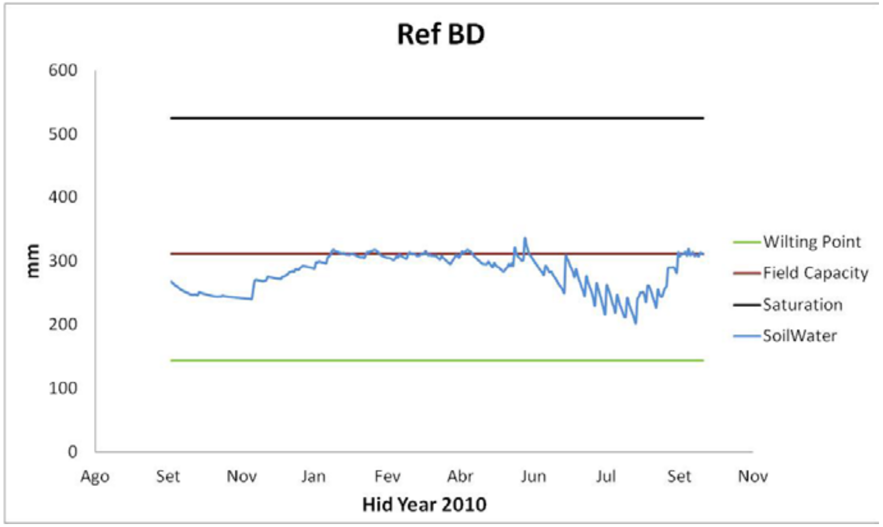


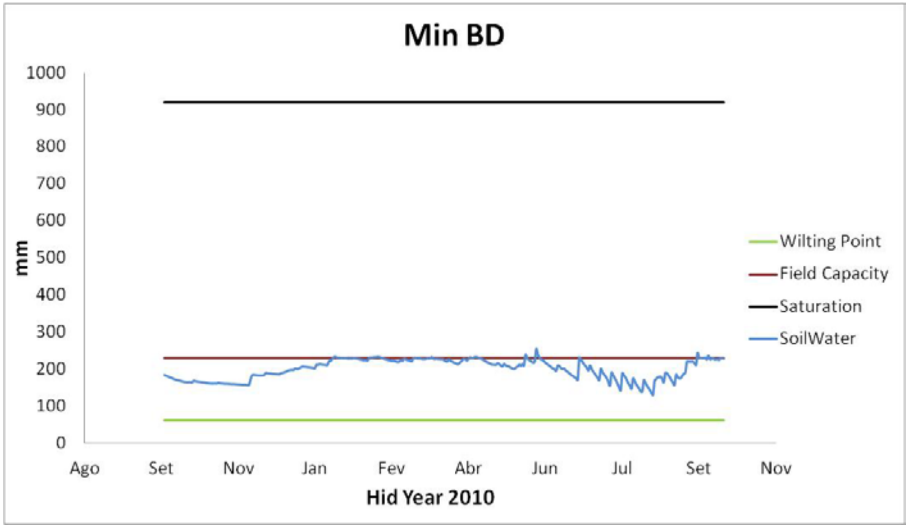
$$WP_{ly} = 0.40 \cdot \frac{m_c \cdot \rho_b}{100}$$

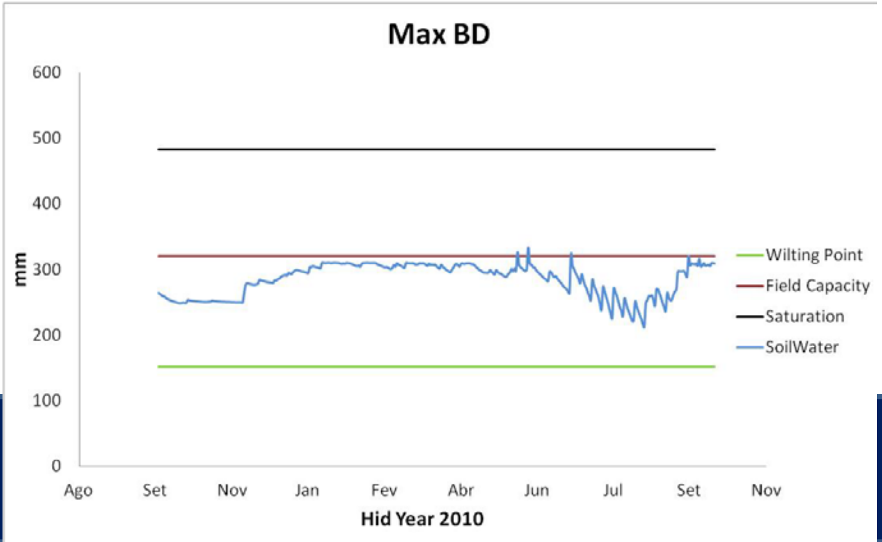
$$FC_{ly} = WP_{ly} + AWC_{ly}$$

BD tests

Run Ref	Min	Max
1.49	0.62	1.582



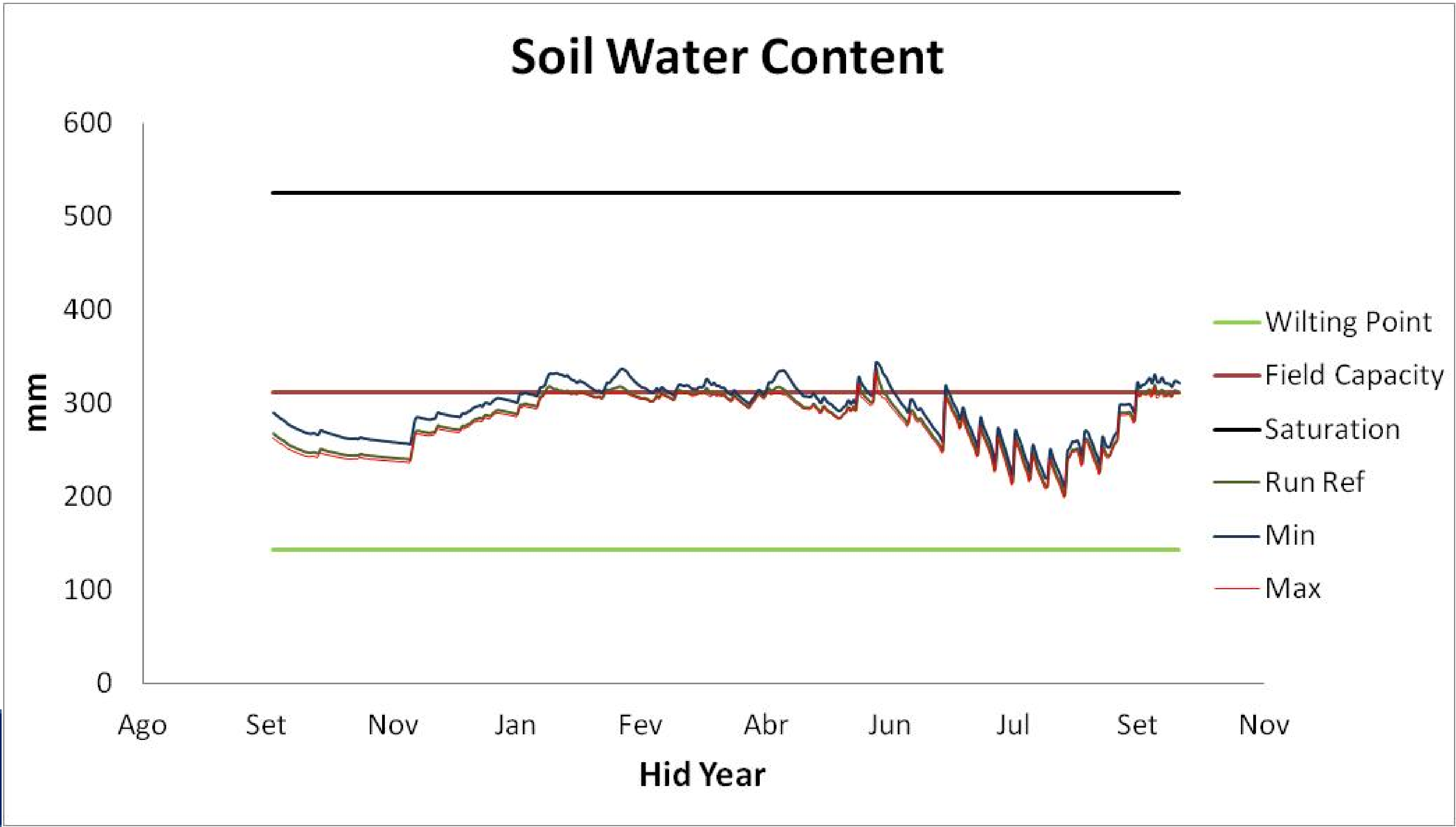




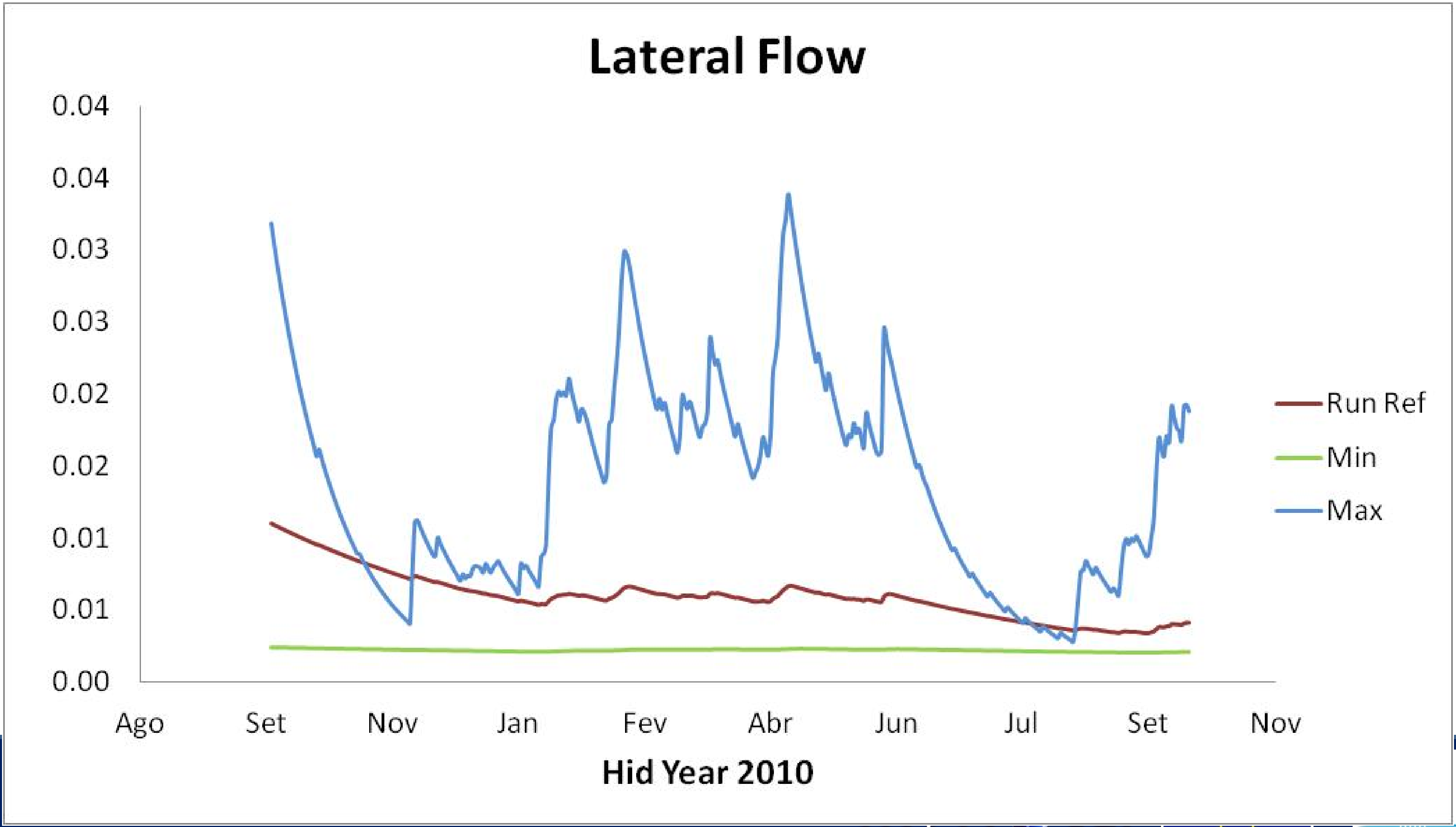
$$\phi_{soil} = 1 - \frac{\rho_b}{\rho_s}$$

K tests

Min	Max	Run Ref
0.94667	25	5.025

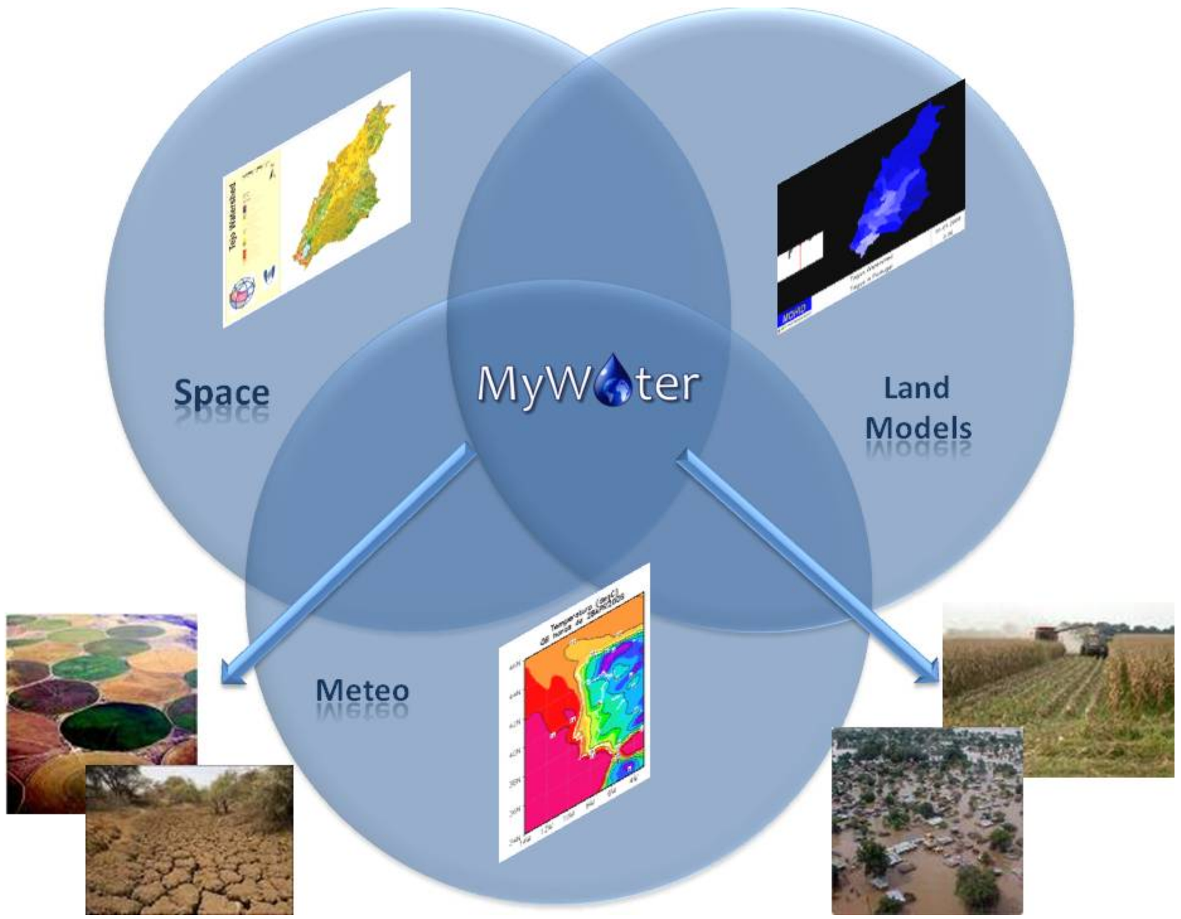


K tests



Lateral Flow
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
Ago
Set
Nov
Jan
Fev
Abr
Jun
Jul
Set
Nov
Hid Year 2010
Run Ref
Min
Max

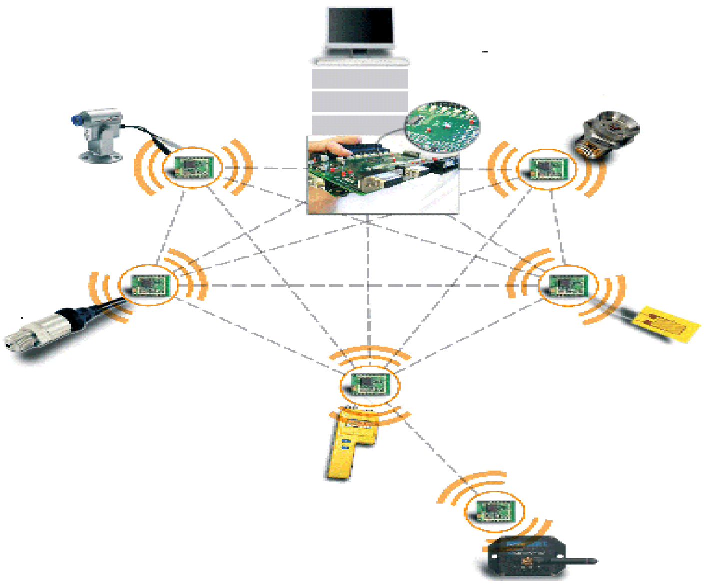
Whatis MyWater about



Background

- Nowadays there is an increased capability to measure and to forecast;

- There is a need for tools capable to extract useful information from the large amounts of data;



There is need to be able to act more promptly and adequately in case of an incident and to be able to improve the systems management;

Actions

- Focus on **prevention**, instead of the traditional **reactive** approach, making use of advanced **data mining** and **modelling**;

- Improvement of the systems intelligence in order to able them to **automatically** detect anomalies and provide support to proper actions.

- Provide tools capable to integrate **real time data** and **models** and, by this way, make available an increased capability of data analysis, malfunctions detection and anticipation and acting accordingly.

First step: data management

Most users already have high amounts of data that, most of times, have potentialities to produce added value information (e.g., pumping efficiency analysis, malfunctions identification, consumption profiles, etc.)

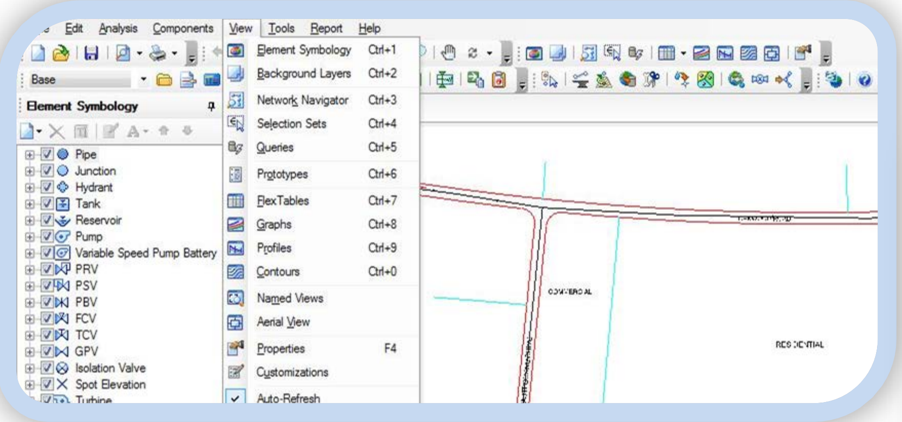
One of the prime reasons preventing a more common use of these data sets to help operation and management is that the importing and treatment process is often too complex to the “common” user.

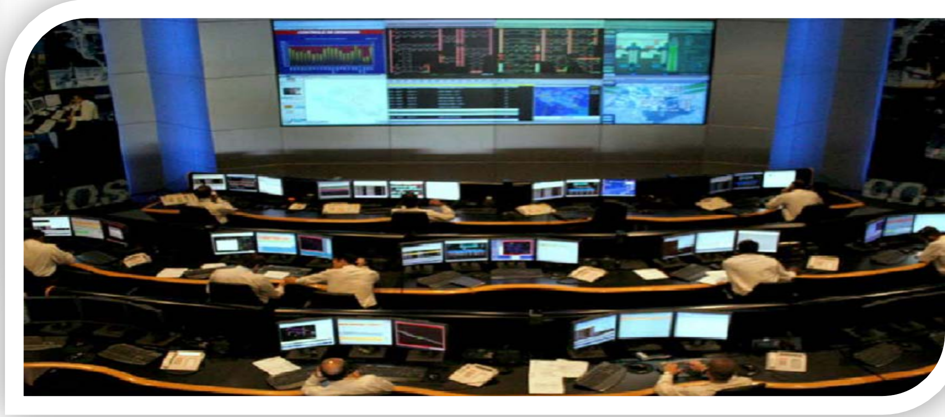
- **SOLUTION: provide proper tools that remove this complexity from the hands of the users.**

Second step: move the models to the operation room

Models are traditionally used for project and planning

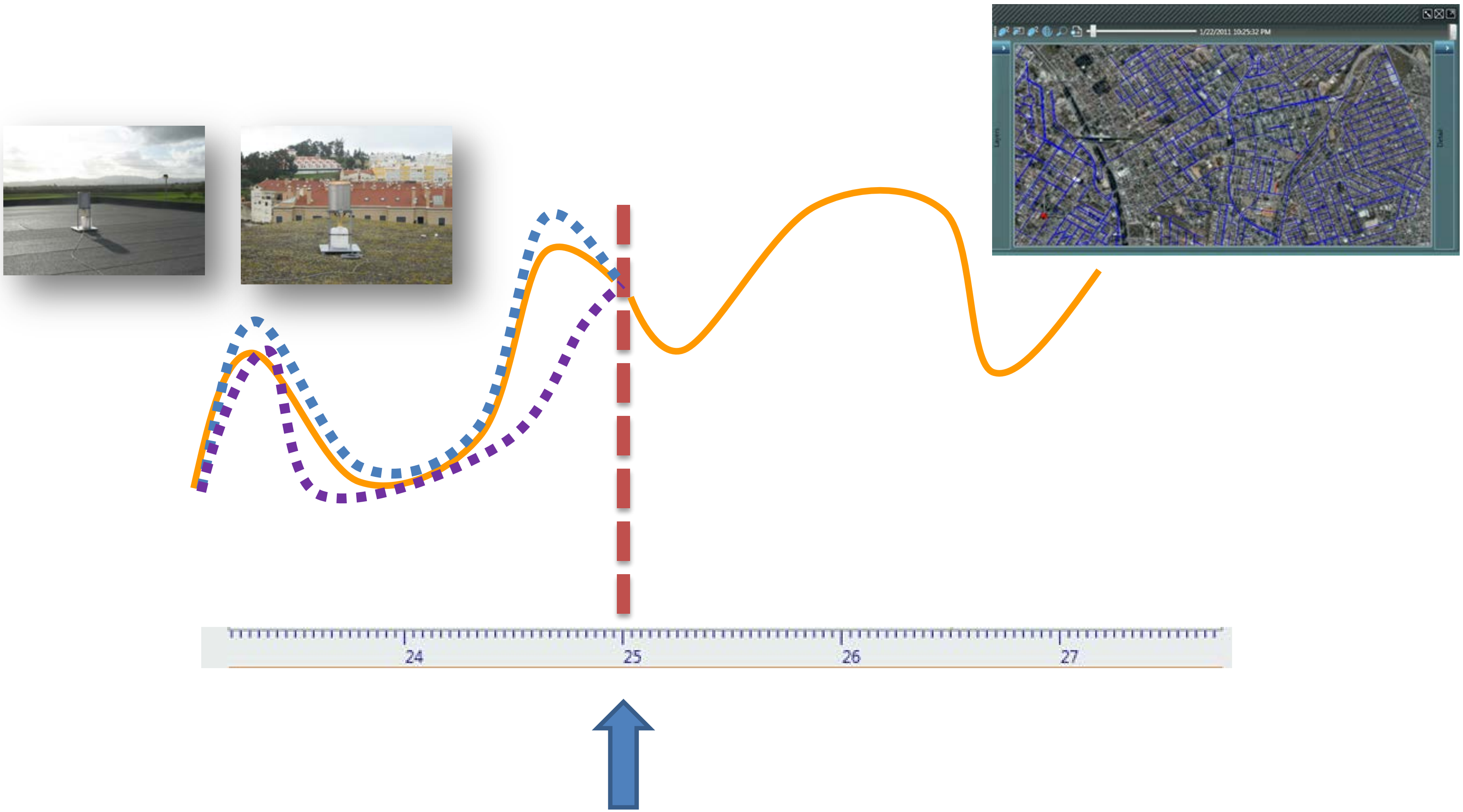
Usually they have complex interfaces that are not suitable for an operational use





➢ **SOLUTION: Provide proper operational working environments**

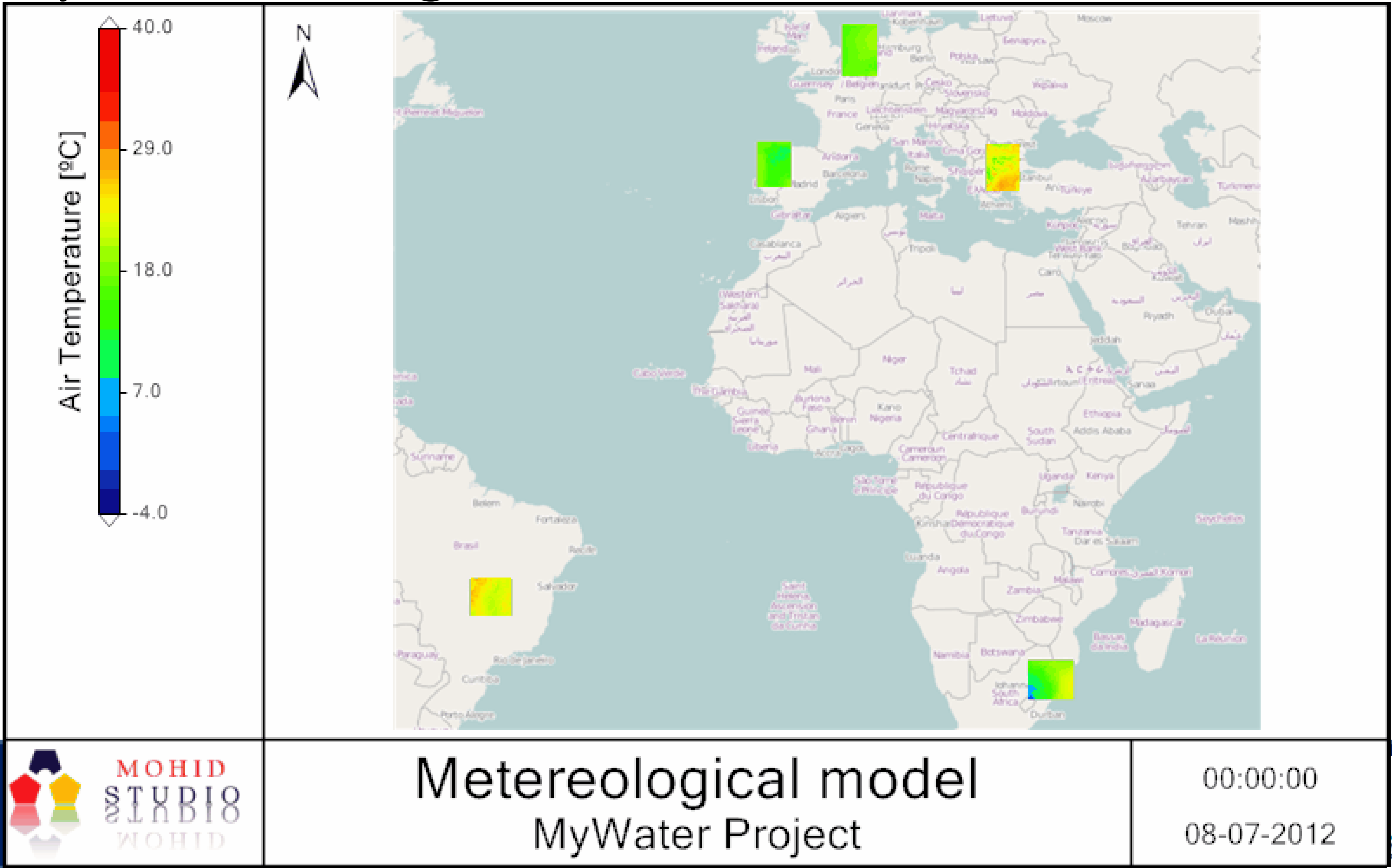
Models add forecast capabilities



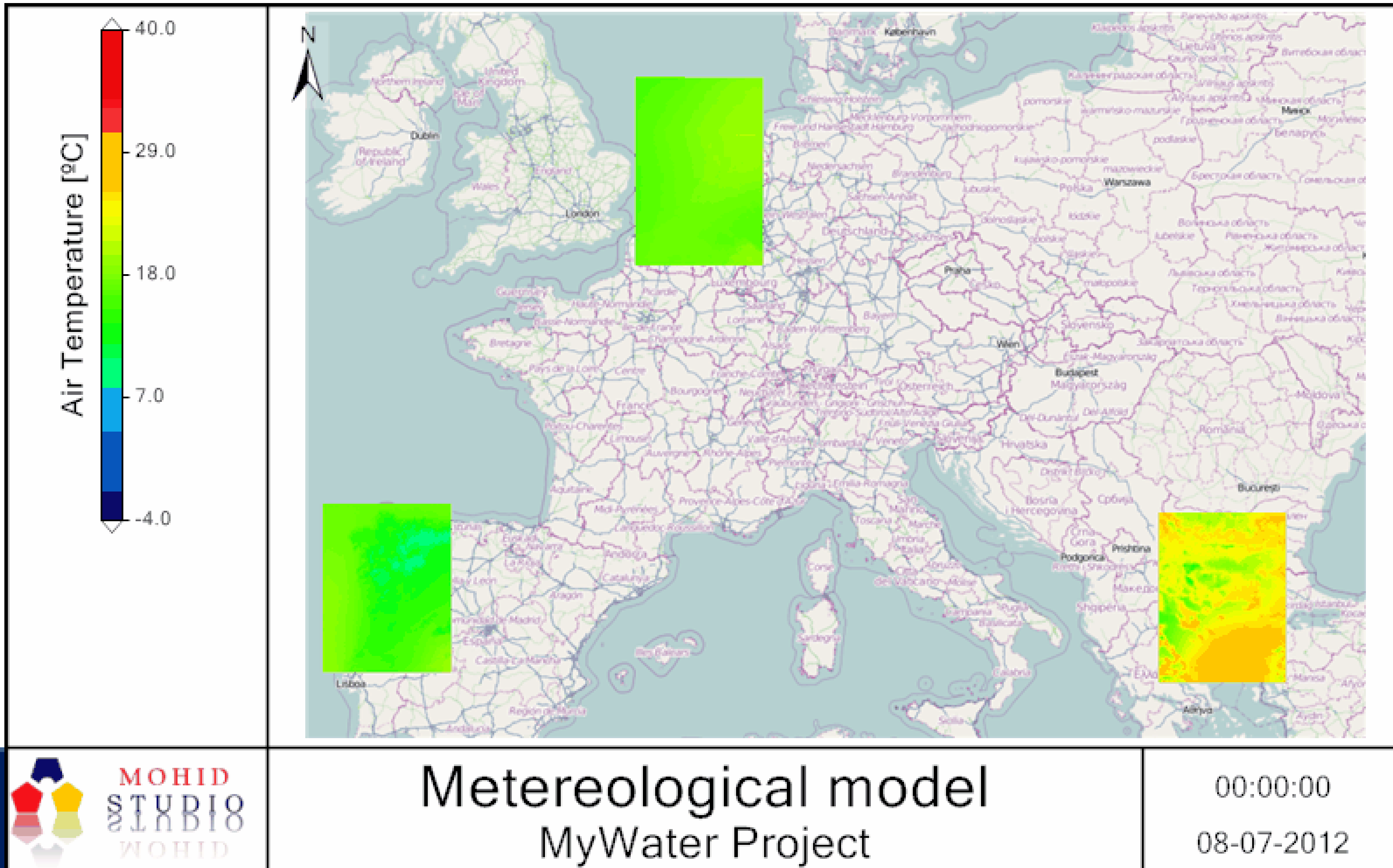
Current time

MyWater project

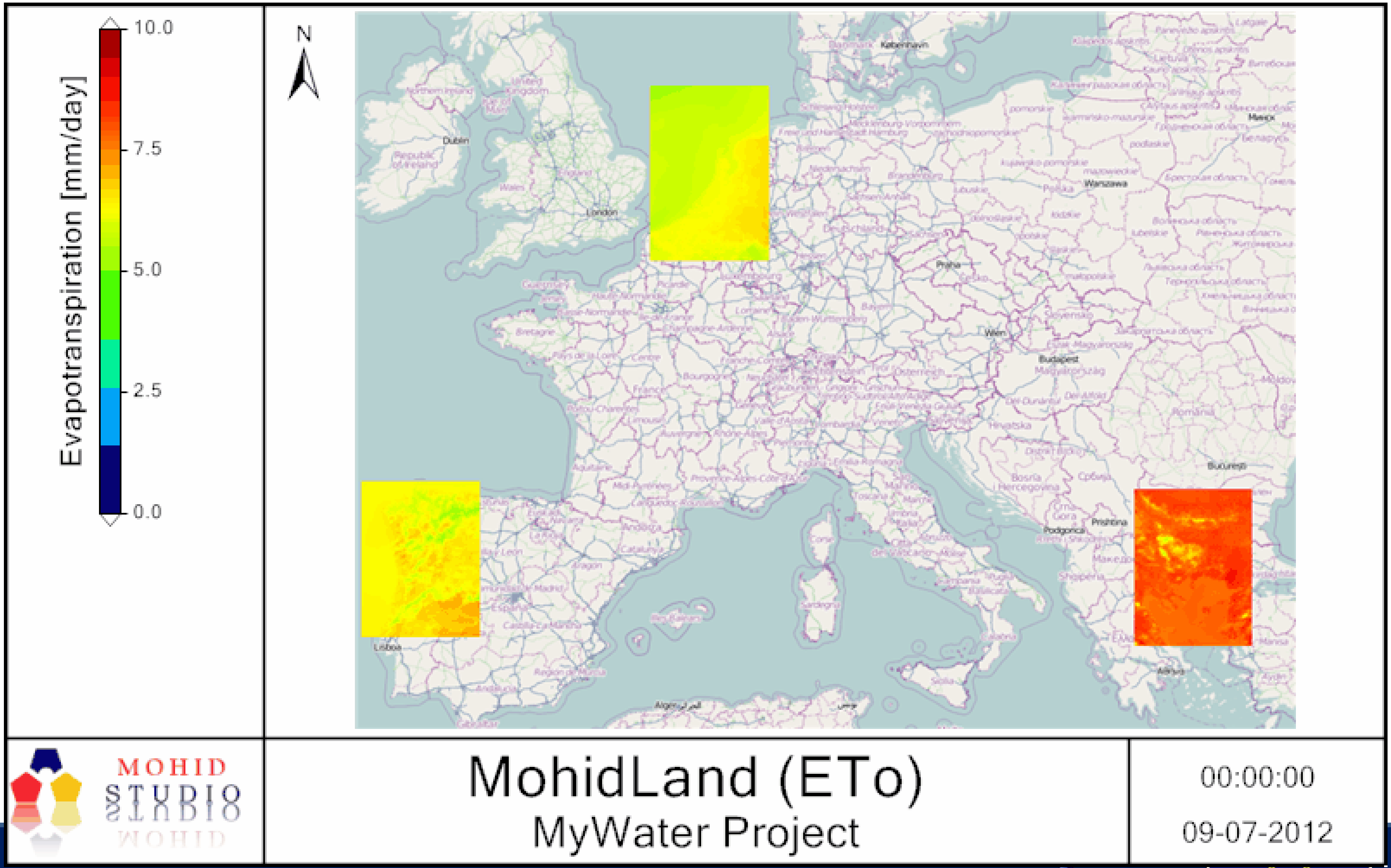
- MyWater at a glance



MyWater project

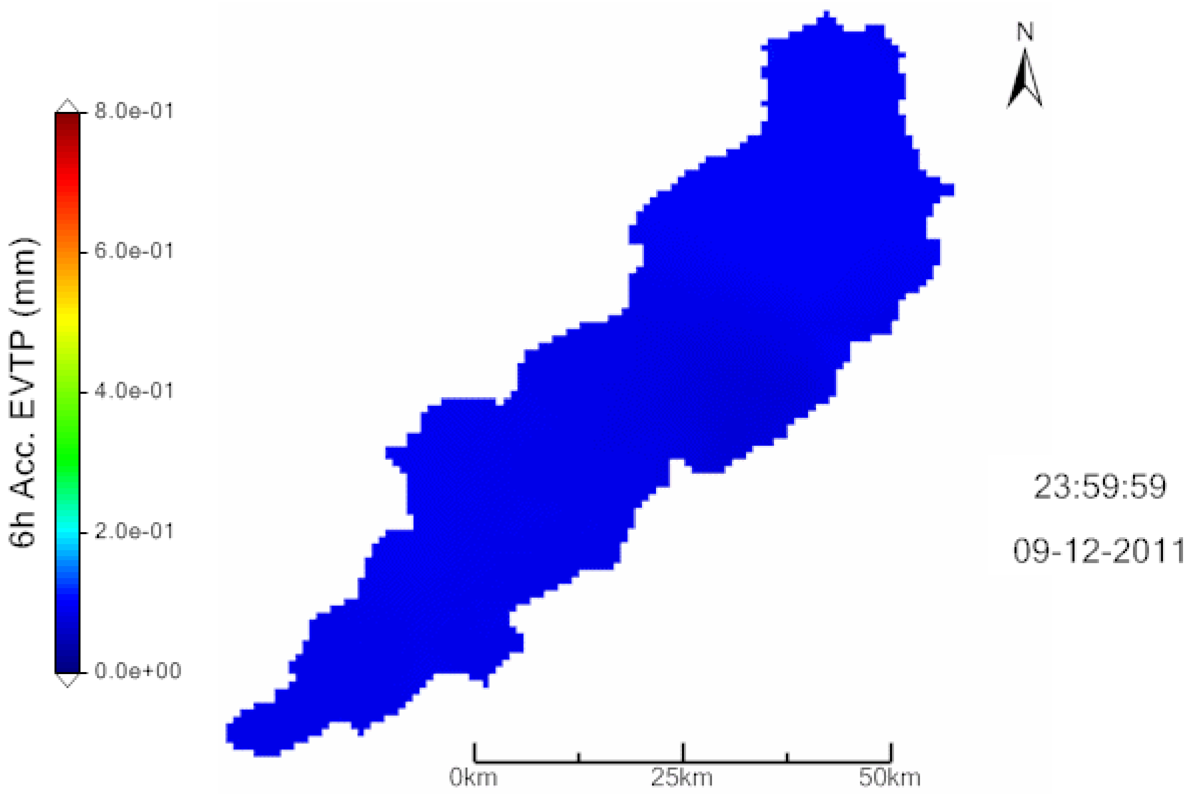


MyWater

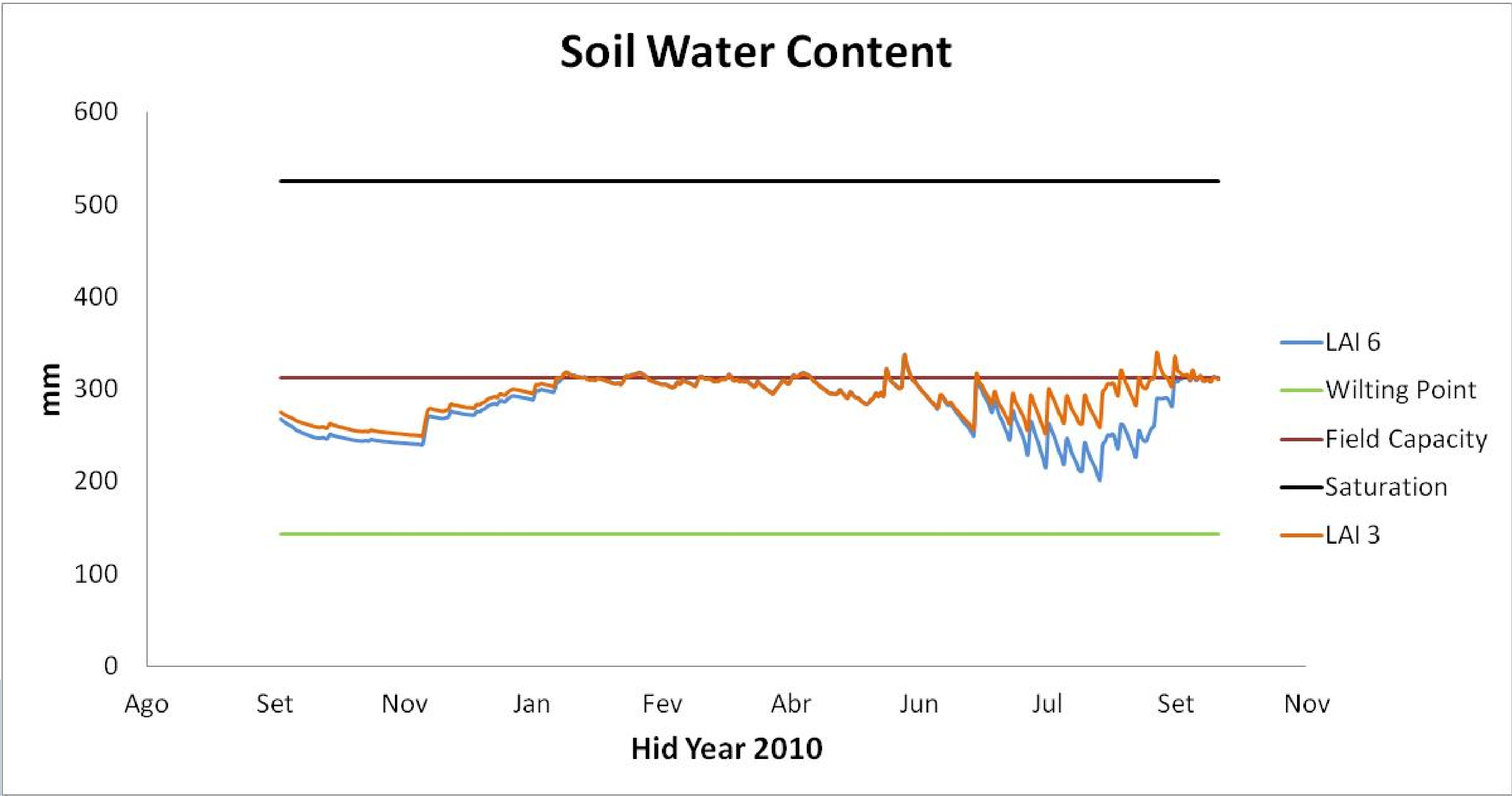


Evapotranspiration [mm/day]
10.0
7.5
5.0
2.5
0.0
N
MOHID STUDIO
MohidLand (ETo)
MyWater Project
00:00:00
09-07-2012

Acc EVTP each 6 hours



LAI tests


Soil Water Content
600
500
400
300
200
100
0
mm
Ago
Set
Nov
Jan
Fev
Abr
Jun
Jul
Set
Nov
Hid Year 2010
LAI 6
Wilting Point
Field Capacity
Saturation
LAI 3

Acknowledgments

- This work was financed by European Union FP7 program

MyWater

- http://mywater-fp7.eu/