IrrigaSys – a decision support system for irrigation management in the Sorraia Valley region, Portugal

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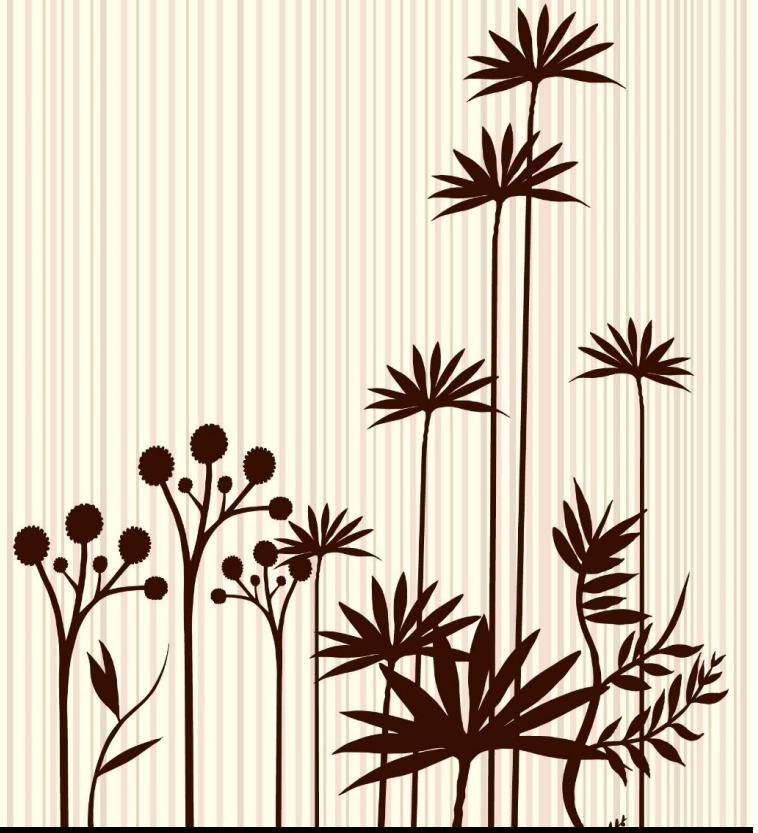


Introduction

- Decision support systems (SAD) seek to bring together various tools such as models, humidity sensors, remote sensing products
- There are currently several platforms (FIGARO, SAGRA, IRRISTRAT)
- This work presents the IrrigaSys decision support system that integrates a database, a model based on physical processes, satellite images and an online graphic interface
- IrrigaSys has been developed over the last 5 years (103 plots, 30 farmers)

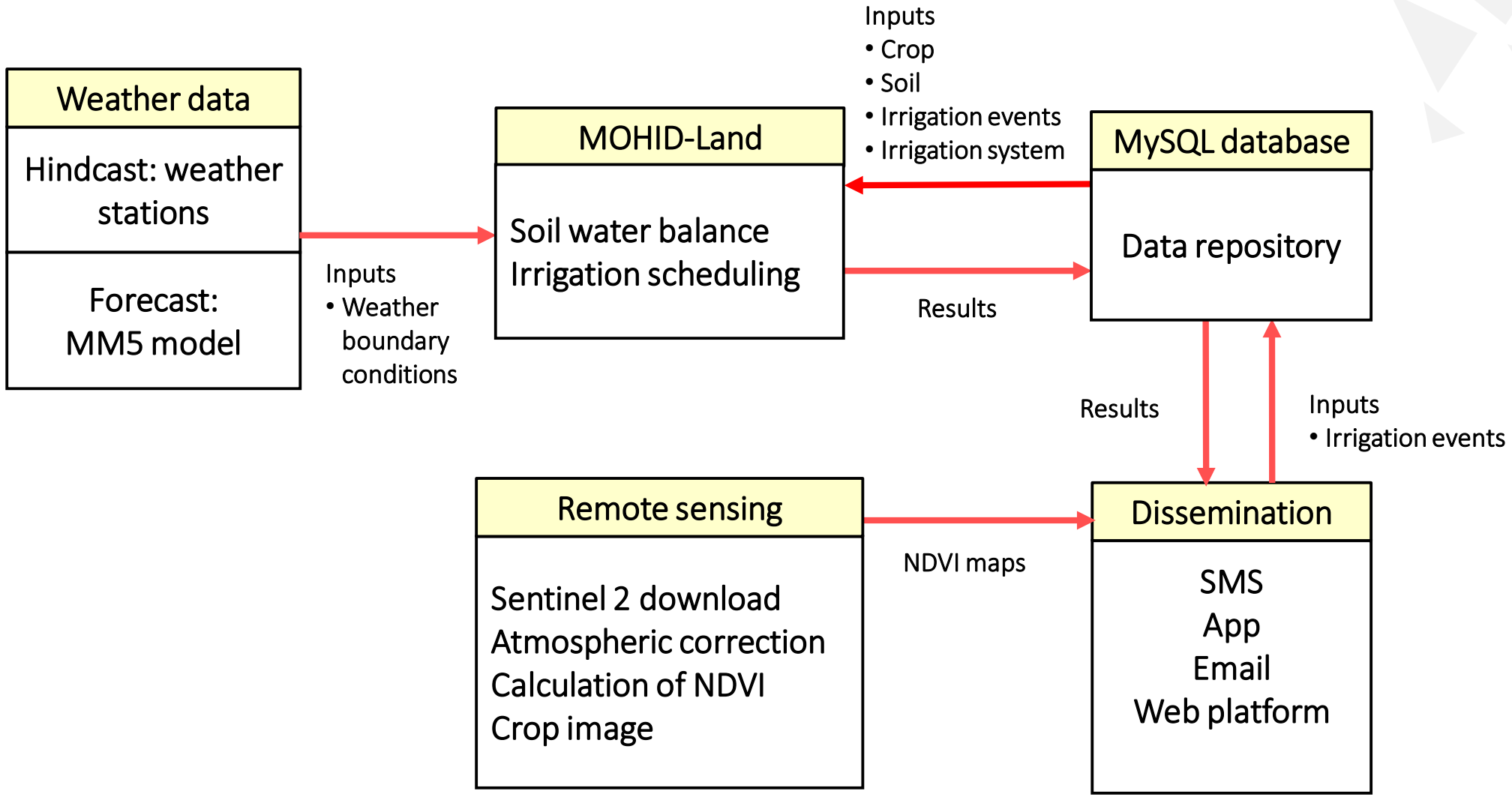
Objectives

- Promote the adoption of beneficial environmental practices
- Improve water management
- Improve water use efficiency

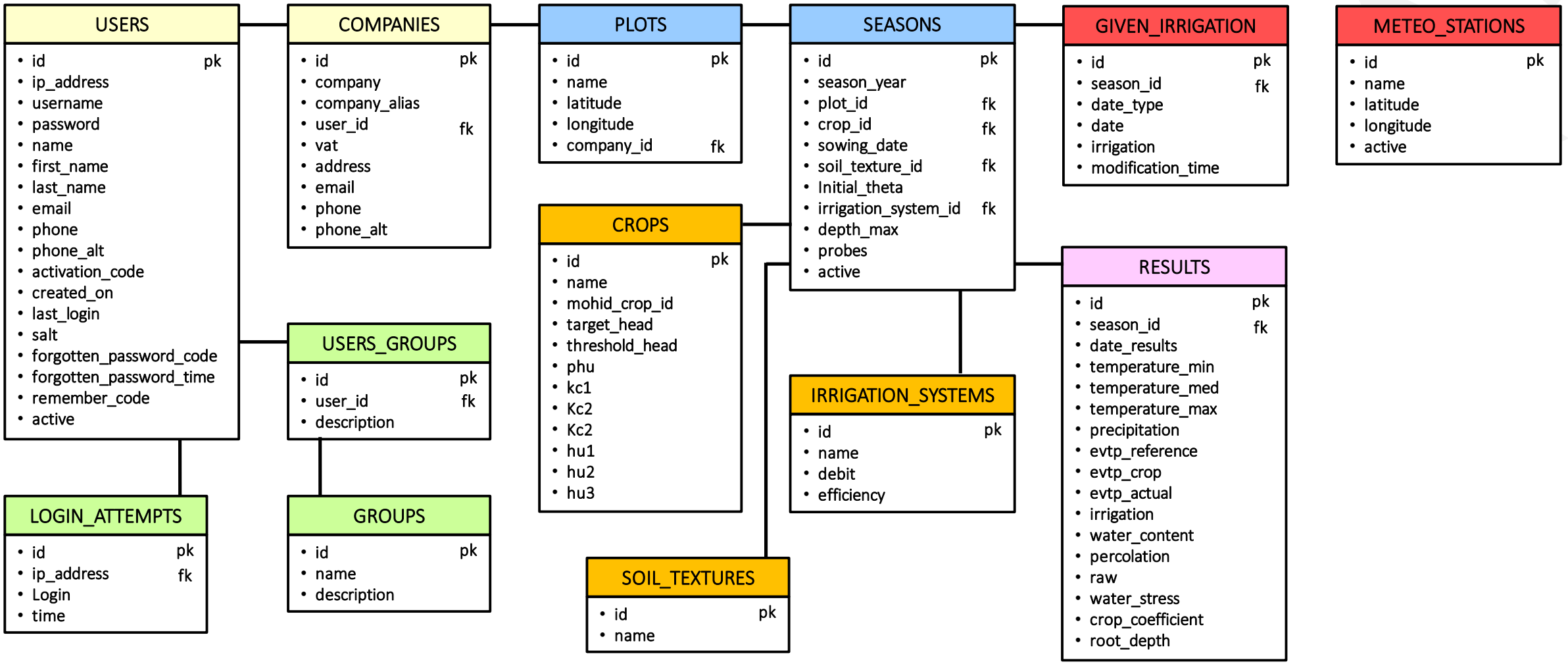
IrrigaSys system description

- General description
  - The database
  - The model
  - Remote sensing products
  - Results presentation
- System Implementation

General description

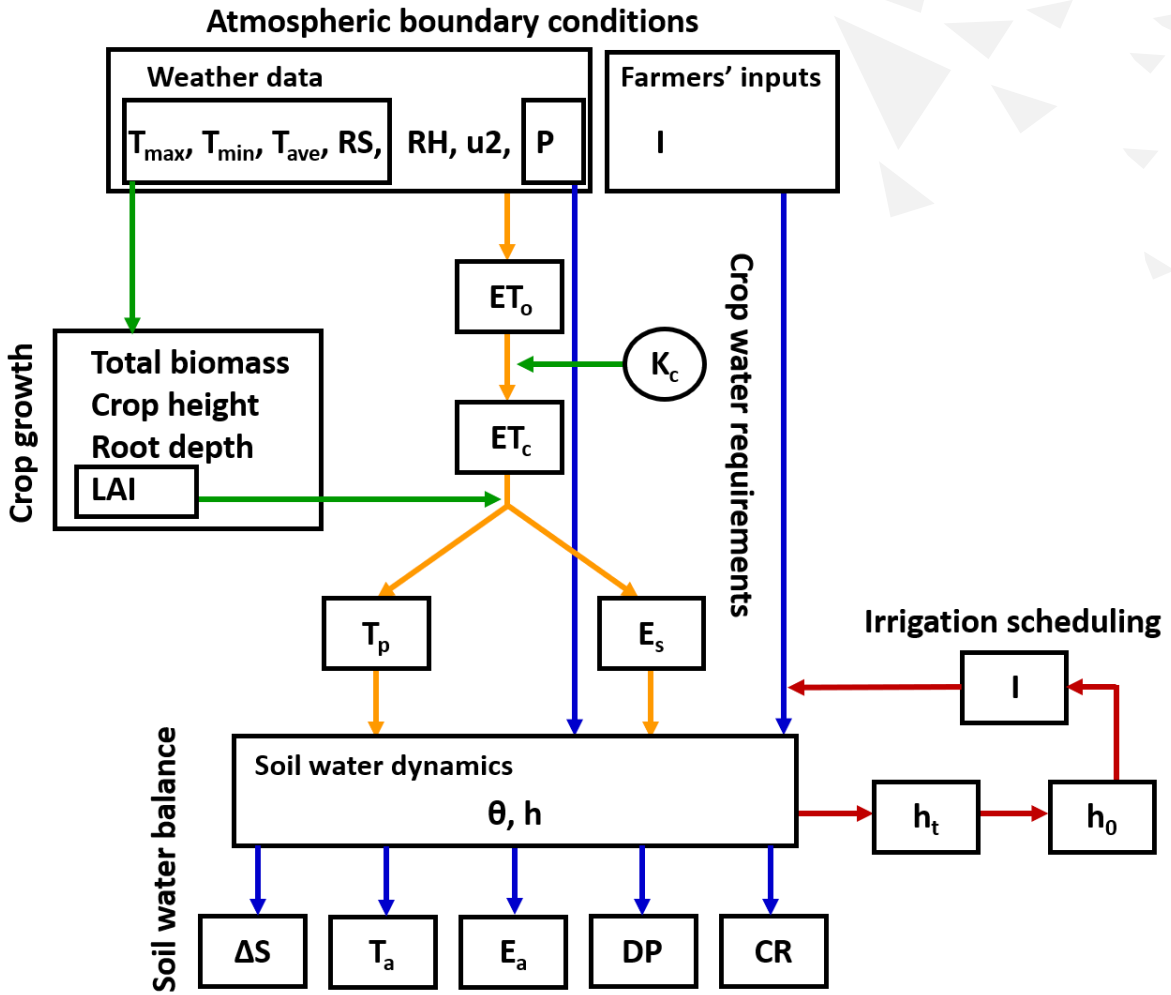


The database



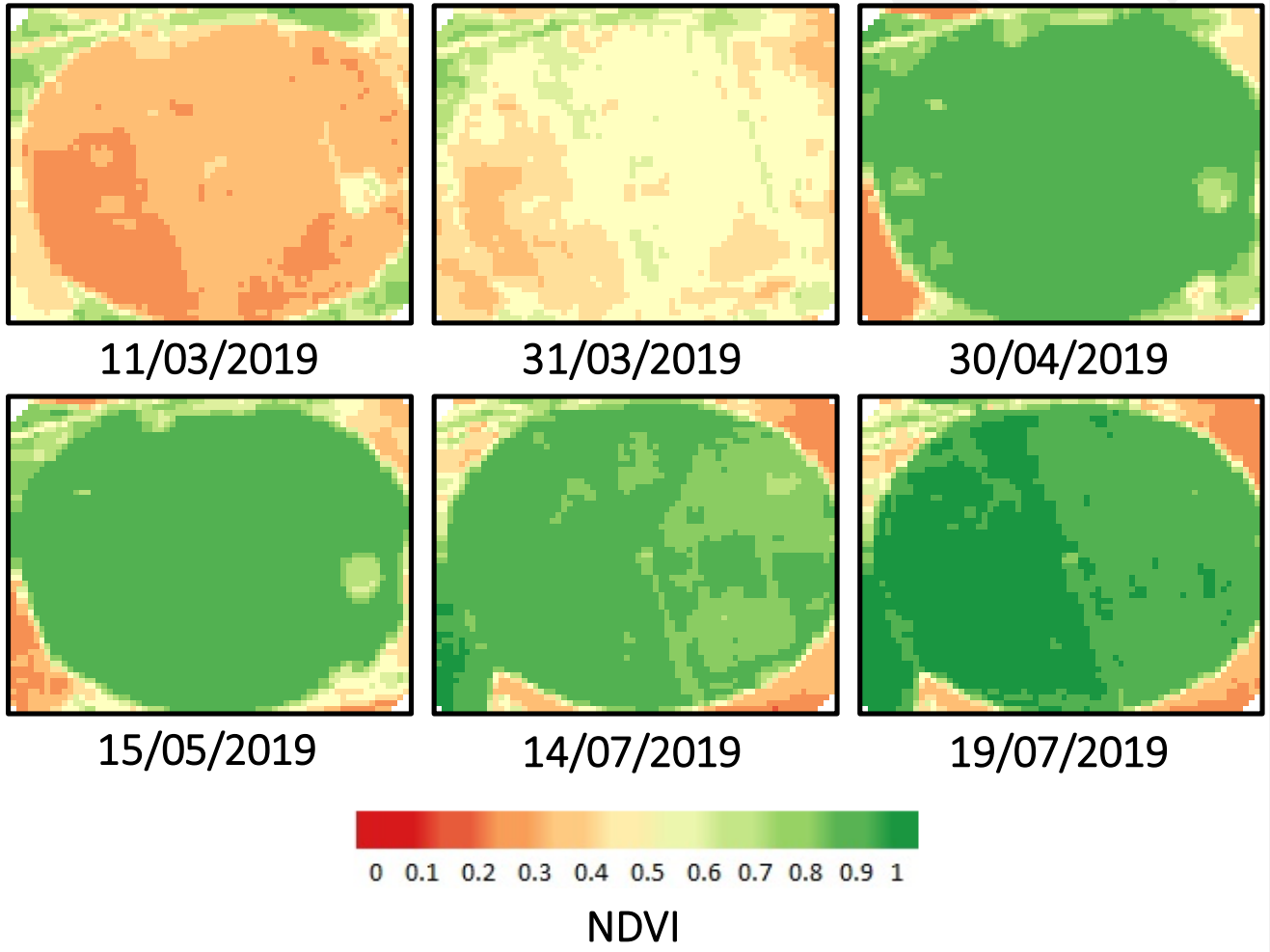
The model

- MOHID Land
- Physical model, distributed
- Vertical water flows in the soil calculated using the Richards equation
- Hydraulic properties of the soil described by the Mualem-van Genuchten model
- The extraction of water from the soil by plant roots is calculated according to Feddes
- Programmed irrigation according to the water needs of the crop and the effective pressure of the soil water



Remote sensing products

- Availability NDVI vegetative index (Normalized Difference Vegetation Index) maps
- The latest Sentinel 2 images with less than 10% cloud coverage
- Images are cropped for each plot



Results presentation

SMS

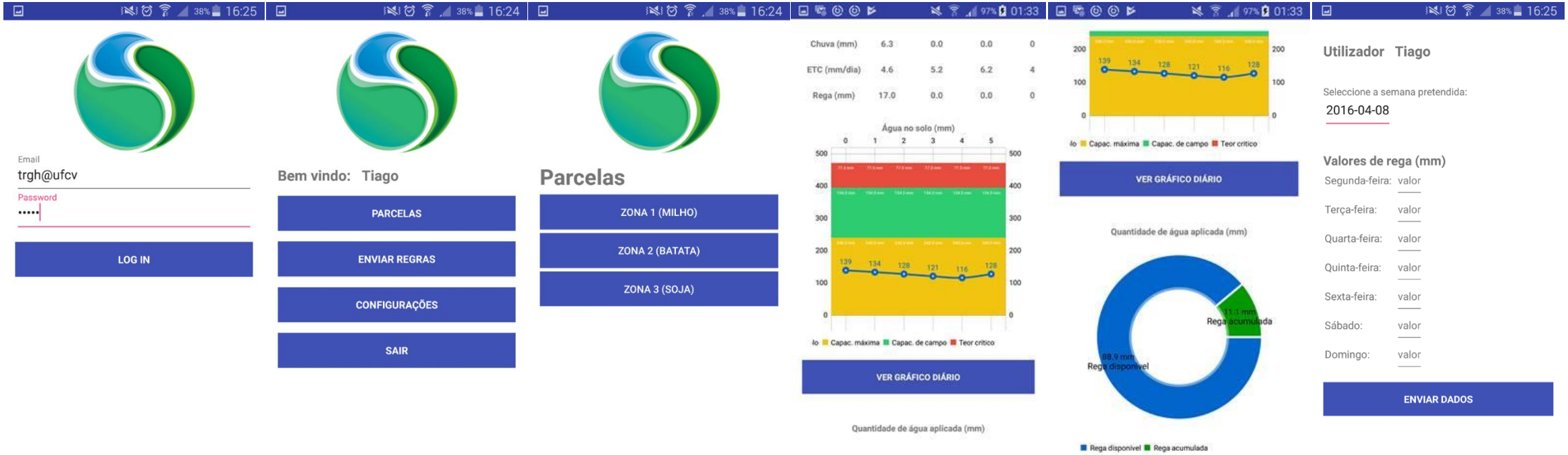
App

E-mail

PDF report

Online platform

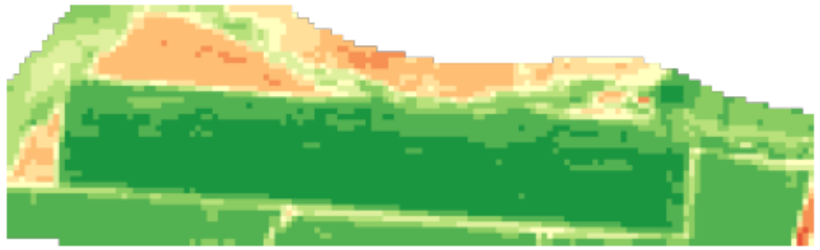
App


16:25
Email
trgh@ufcv
Password
LOG IN
16:24
Bem vindo: Tiago
PARCELAS
ENVIAR REGRAS
CONFIGURAÇÕES
SAIR
16:24
Parcelas
ZONA 1 (MILHO)
ZONA 2 (BATATA)
ZONA 3 (SOJA)
01:33
Chuva (mm) 6.3 0.0 0.0 0
ETC (mm/dia) 4.6 5.2 6.2 4
Rega (mm) 17.0 0.0 0.0 0
Água no solo (mm)
Capac. máxima
Capac. de campo
Teor crítico
VER GRÁFICO DIÁRIO
Quantidade de água aplicada (mm)
01:33
Capac. máxima
Capac. de campo
Teor crítico
VER GRÁFICO DIÁRIO
Quantidade de água aplicada (mm)
88.9 mm
Rega disponível
11.1 mm
Rega acumulada
Rega disponível
Rega acumulada
16:25
Utilizador Tiago
Seleccione a semana pretendida:
2016-04-08
Valores de rega (mm)
Segunda-feira: valor
Terça-feira: valor
Quarta-feira: valor
Quinta-feira: valor
Sexta-feira: valor
Sábado: valor
Domingo: valor
ENVIAR DADOS

PDF Report

Observações:

NDVI, 20180922

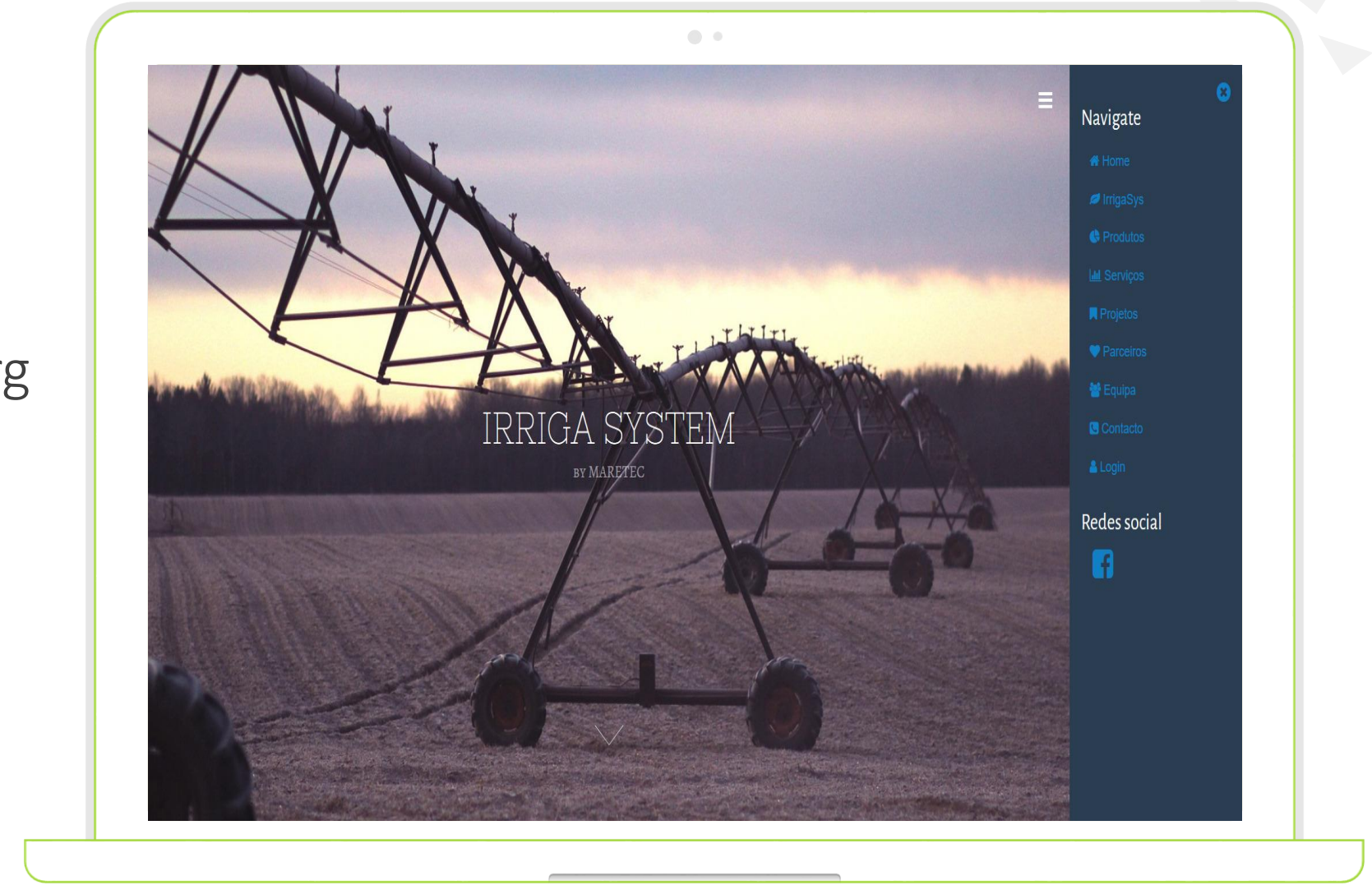


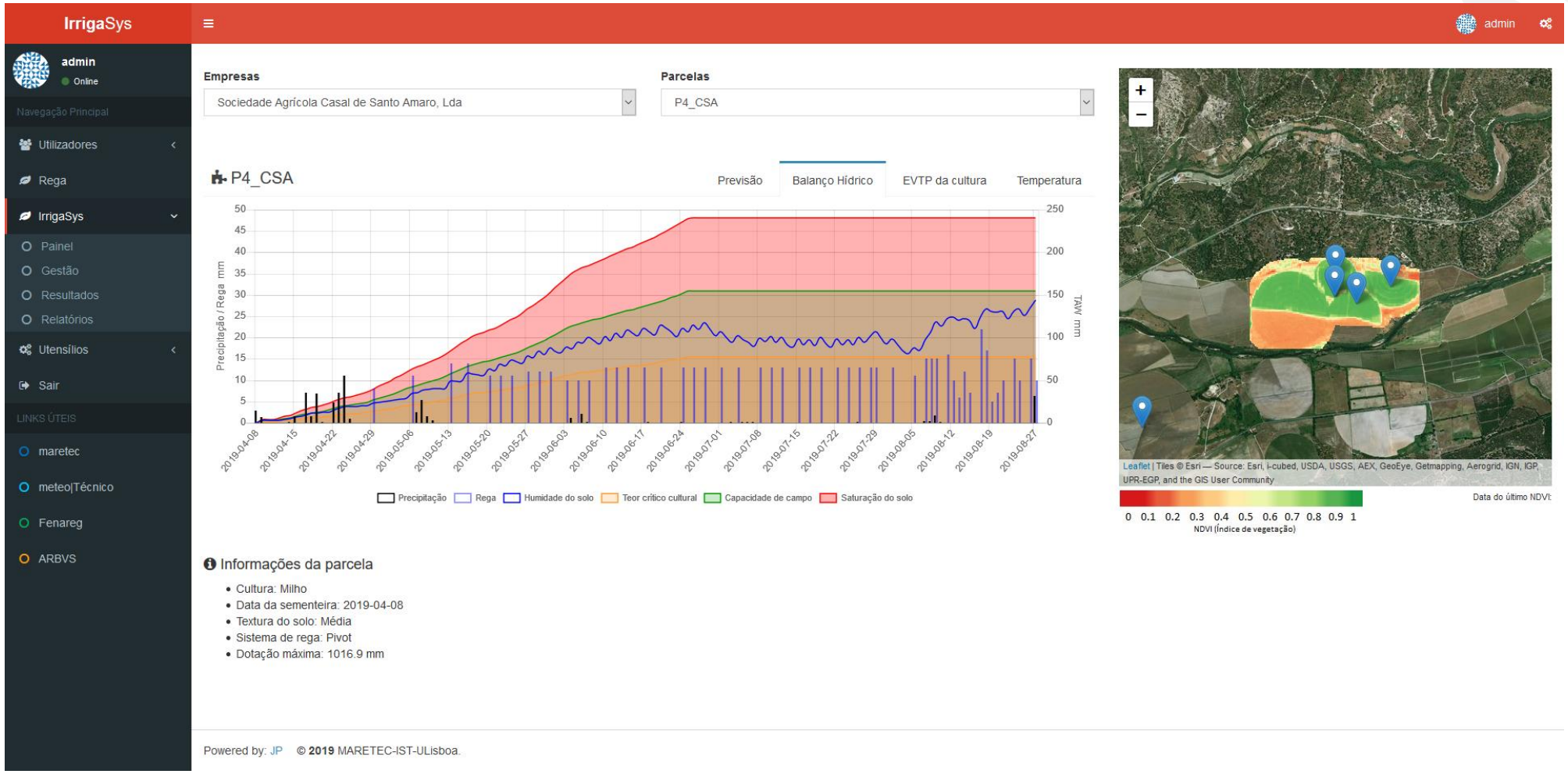
Legenda

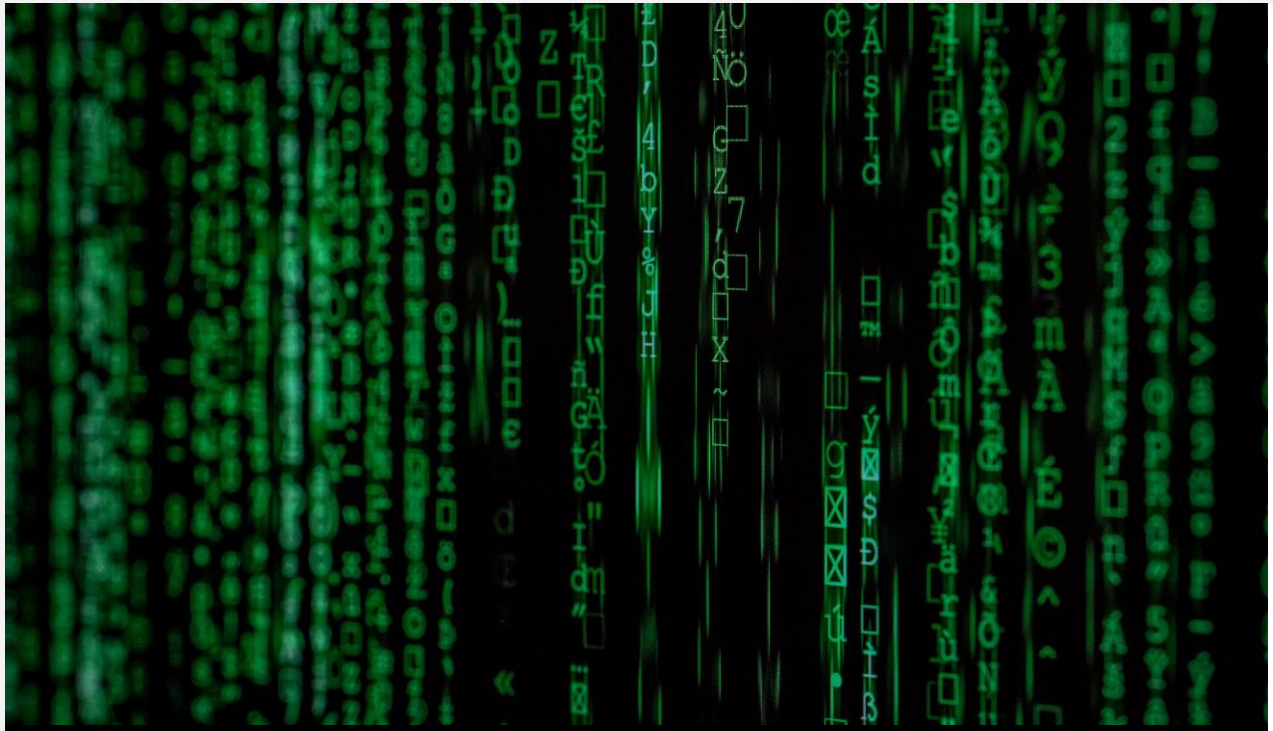
- 0
- 0 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1

Online platform

irrigasys.maretec.org



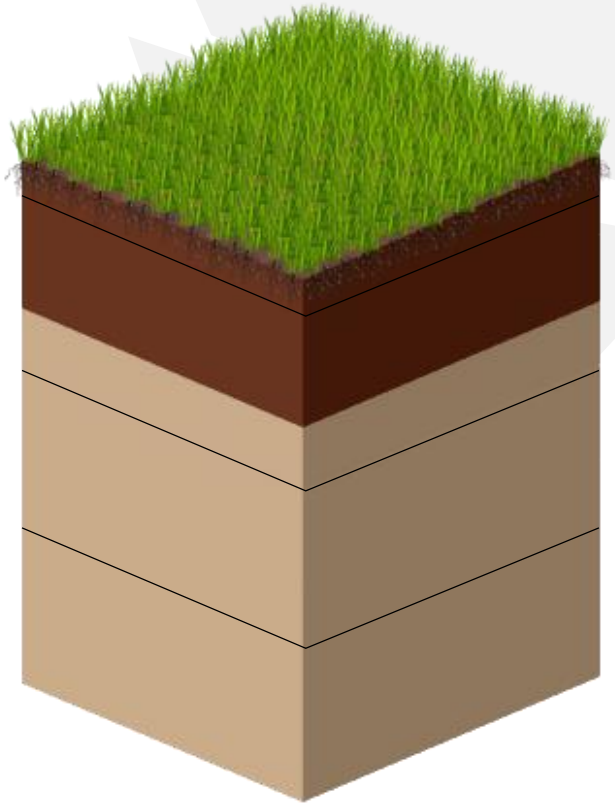

IrrigaSys
admin
admin
Online
Navegação Principal
Utilizadores
Rega
IrrigaSys
Painel
Gestão
Resultados
Relatórios
Utensílios
Sair
LINKS ÚTEIS
maretec
meteo|Técnico
Fenareg
ARBVS
Empresas
Sociedade Agrícola Casal de Santo Amaro, Lda
Parcelas
P4_CSA
P4_CSA
Previsão
Balanço Hídrico
EVTP da cultura
Temperatura
Precipitação / Rega mm
TAW mm
Precipitação
Rega
Humidade do solo
Teor crítico cultural
Capacidade de campo
Saturação do solo
Leaflet | Tiles © Esri — Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
NDVI (índice de vegetação)
Informações da parcela
Cultura: Milho
Data da sementeira: 2019-04-08
Textura do solo: Média
Sistema de rega: Pivot
Dotação máxima: 1016.9 mm
Powered by: JP © 2019 MARETEC-IST-ULisboa.



System implementation

- The script developed in Perl for the IrrigaSys system can select different input files of the MOHID-Land model, which are pre-defined according to the characteristics of the plots introduced in the database.
- The soil profile is always specified with depth of 2 m and divided into 3 horizons.
- The calculation domain, composed of the soil profile, is represented by a vertical column discretized in 11 cells 1 m wide, 1 m long and with variable thickness between 0.05 m at the top and 0.50 m at the bottom.

- Each cell in the column then defines a control volume where the state variables (for example, the water content in the soil) are calculated in the center of the cells and the flows (and related variables) in the faces (finite volume method).
- The upper boundary condition is always determined by the rates of Ta and Ea and by irrigation and precipitation flows. The lower limit condition is always specified as free drain.
- ETc = ETo x Kc values specific to the development phase of each culture
- The partition of ETc into its Tp and Ep components is based on the LAI simulation, and the parameterization of the model for vegetative growth is based on the result of the calibration in some case studies in the region or the values given by default
- The initial conditions of the water content in the soil are always defined for field capacity.
- The hydraulic parameters of the soil are defined for three classes of soil texture (fine, medium, coarse) based also on the results of the calibration of the model in some case studies implemented in the region



Limitation and future developments

- The parameterization related to the hydraulic properties of the soil has to be enriched so that the system can take into account the great variability of these properties across the landscape
- The database related to crop development parameters should be extended to better describe local plant growth patterns.
- The system should also start to automatically identify the state of development of the crop based on the information obtained by satellite, thus allowing better accuracy in calculating the water balance in the soil.

Conclusions

- IrrigaSys is a system under development that tries to take advantage of the experience acquired in various research projects, becoming a practical tool to support irrigation in the Sorraia basin.
- The system has the great capacity to provide a significant amount of information to the farmer in an easy and automatic way.

Funding

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water4ever

Thank you!

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