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Junior Research Group „Global Change 4+1“



Web-based decision support system for planning and management of MAR sites

Jana Sallwey,

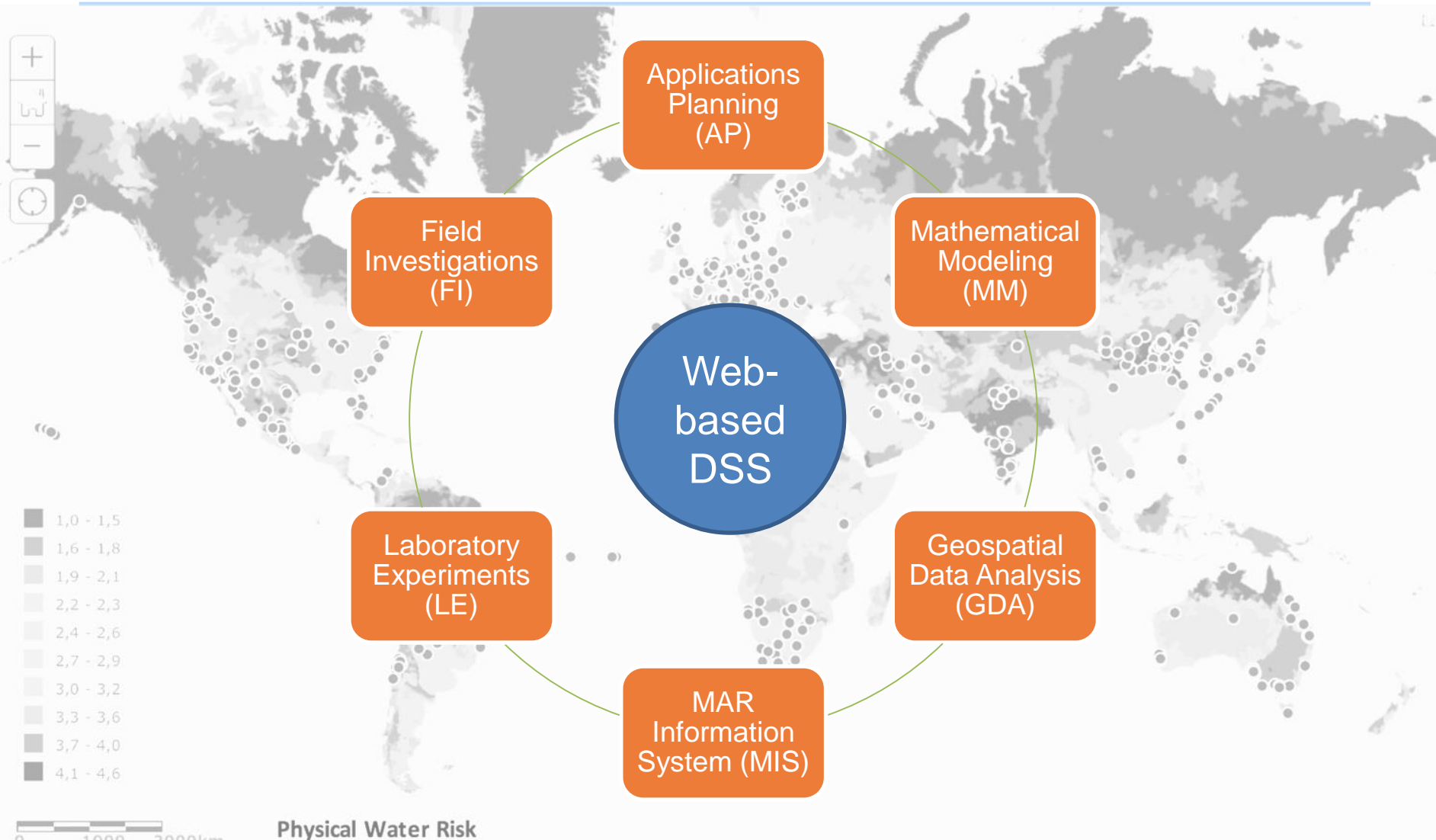
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Department of Hydrosociences, Technische Universität Dresden, Germany



Montpellier, September 2016

INOWAS Decision Support System



Application Planning (AP)

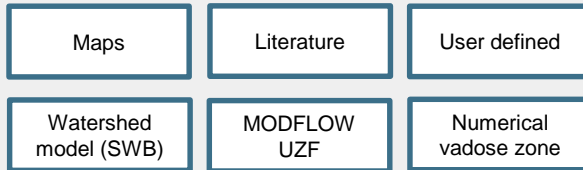
List of applications provided by the INOWAS DSS platform

Approach	Application
PLANNING	Restoration of groundwater levels
	Maximization of natural storage capacity
	Sustainability of groundwater resources
	Improvement of water quality
	Prevention of seawater intrusion
OPTIMIZATION	Design optimization of MAR schemes
	Optimization of MAR operational charts
	Assessment of recovery efficiency
	Assessment of geochemical processes during MAR
	Clogging development assessment
	Evaluation of interactions with other groundwater users
	Sustaining environmental flow in water systems

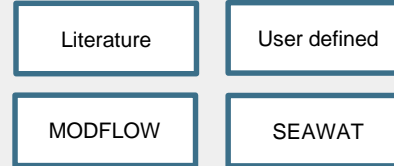
Mathematical Modeling (MM) Toolbox

1. Water balance assessment

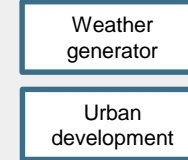
1.1 Natural Groundwater Recharge



1.2 Water demand



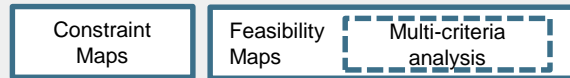
1.3 Future scenarios



Interface – GW deficit [L/T]

2. Spatial Multi Criteria Decision Analysis

2.1 Site selection



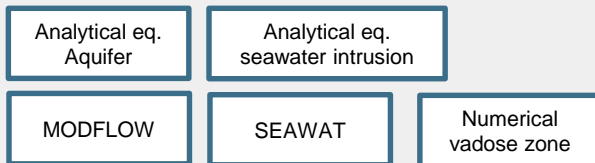
2.2 Method selection



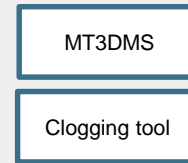
Interface – MAR method/site

3. Efficiency assessment

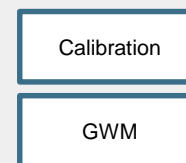
3.1 Quantity aspects



3.2 Quality aspects



3.3 Sensitivity & uncertainty analysis, calibration, optimization



Interface – efficiency index

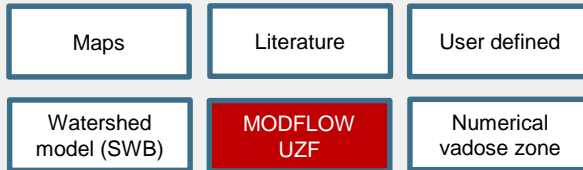
4. MAR operation design



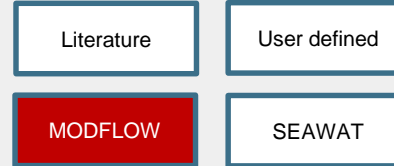
Mathematical Modeling (MM) Toolbox

1. Water balance assessment

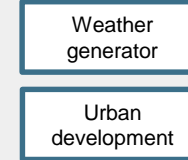
1. 1 Natural Groundwater Recharge



1. 2 Water demand



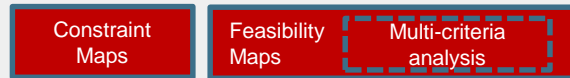
1. 3 Future scenarios



Interface – GW deficit [L/T]

2. Spatial Multi Criteria Decision Analysis

2. 1 Site selection



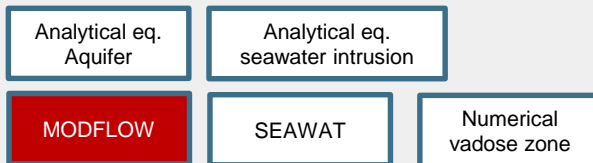
2. 2 Method selection



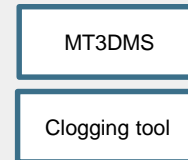
Interface – MAR method/site

3. Efficiency assessment

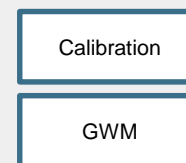
3. 1 Quantity aspects



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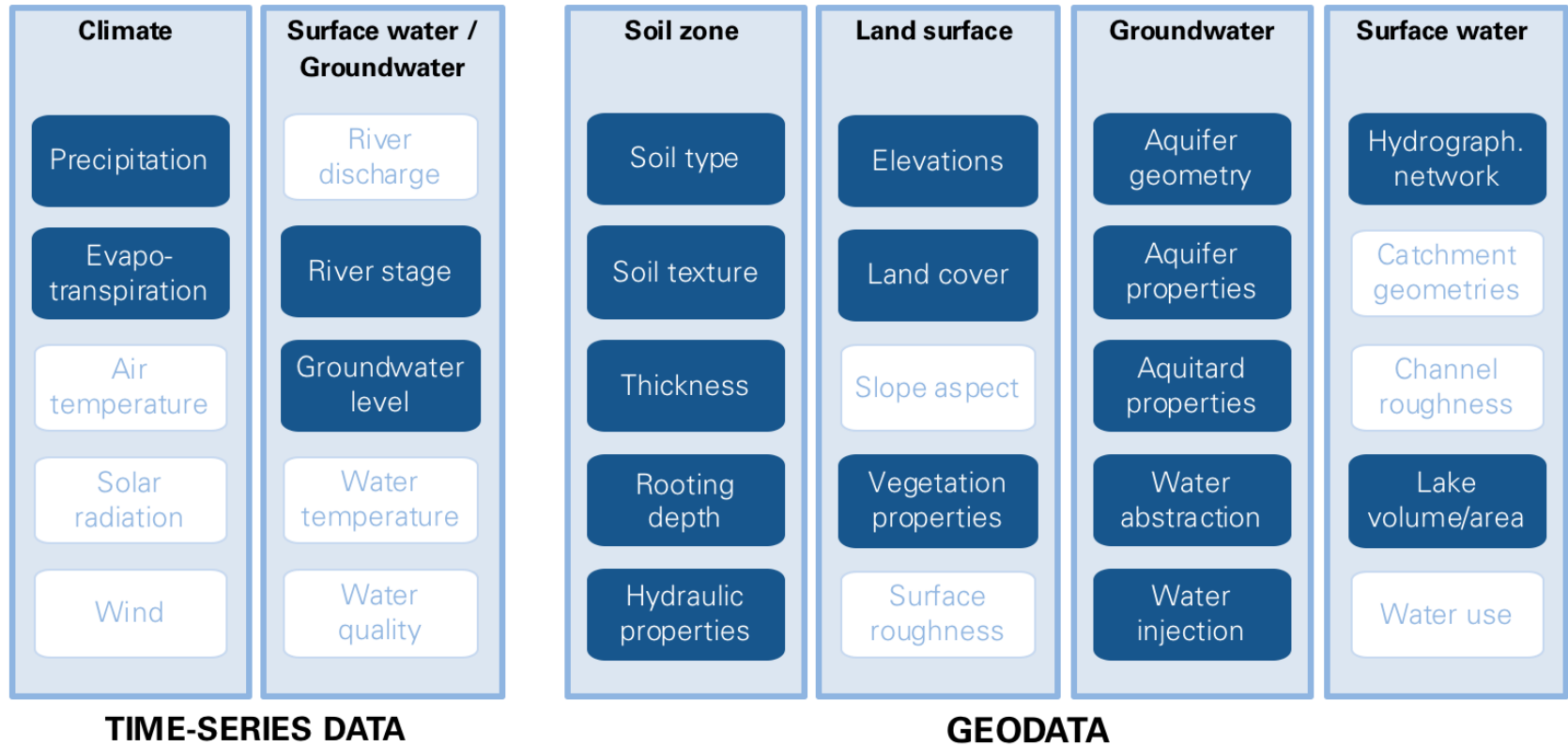


Interface – efficiency index

4. MAR operation design



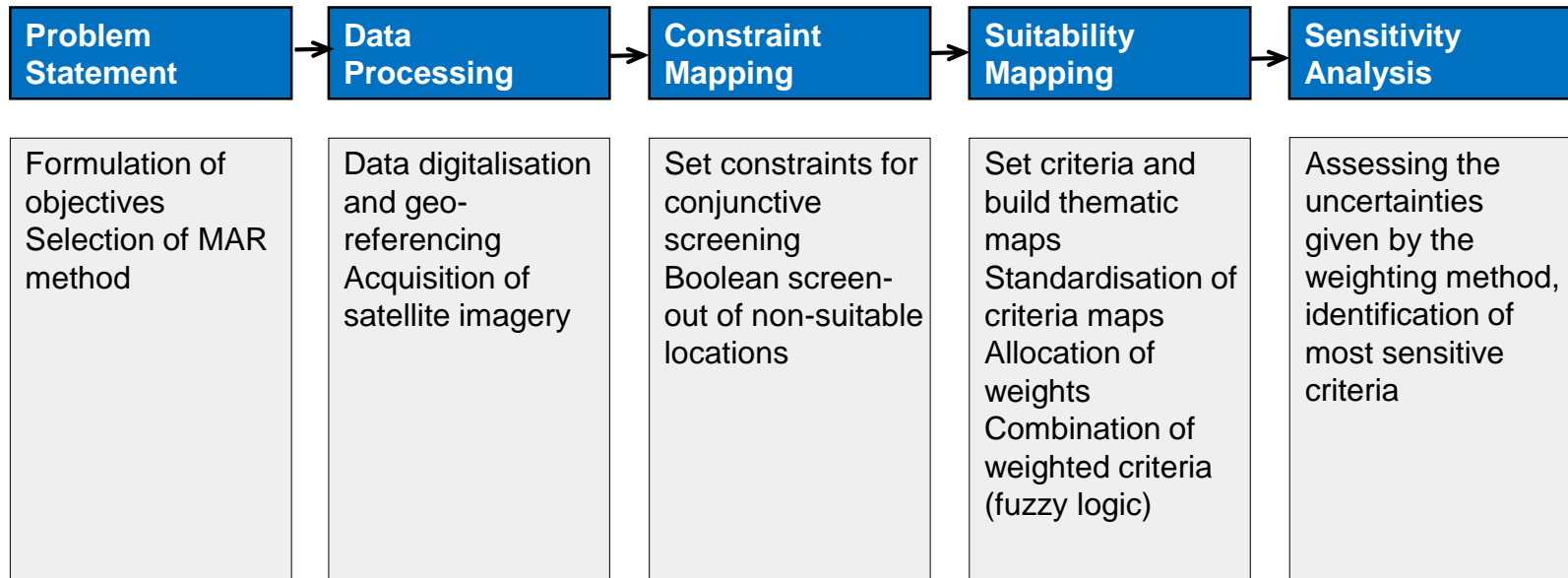
MAR Information System (MIS)



Management, analysis, visualization and presentation of time-series data, geodata, documents and any data required by the simulation models. *Example: Environmental data blocks and their required composition for a hypothetical groundwater recharge model*

Geospatial Data Analysis (GDA)

Multi-criteria decision analysis (MCDA): integration of technical information and expert judgement, consideration of physiographic and socio-economic features

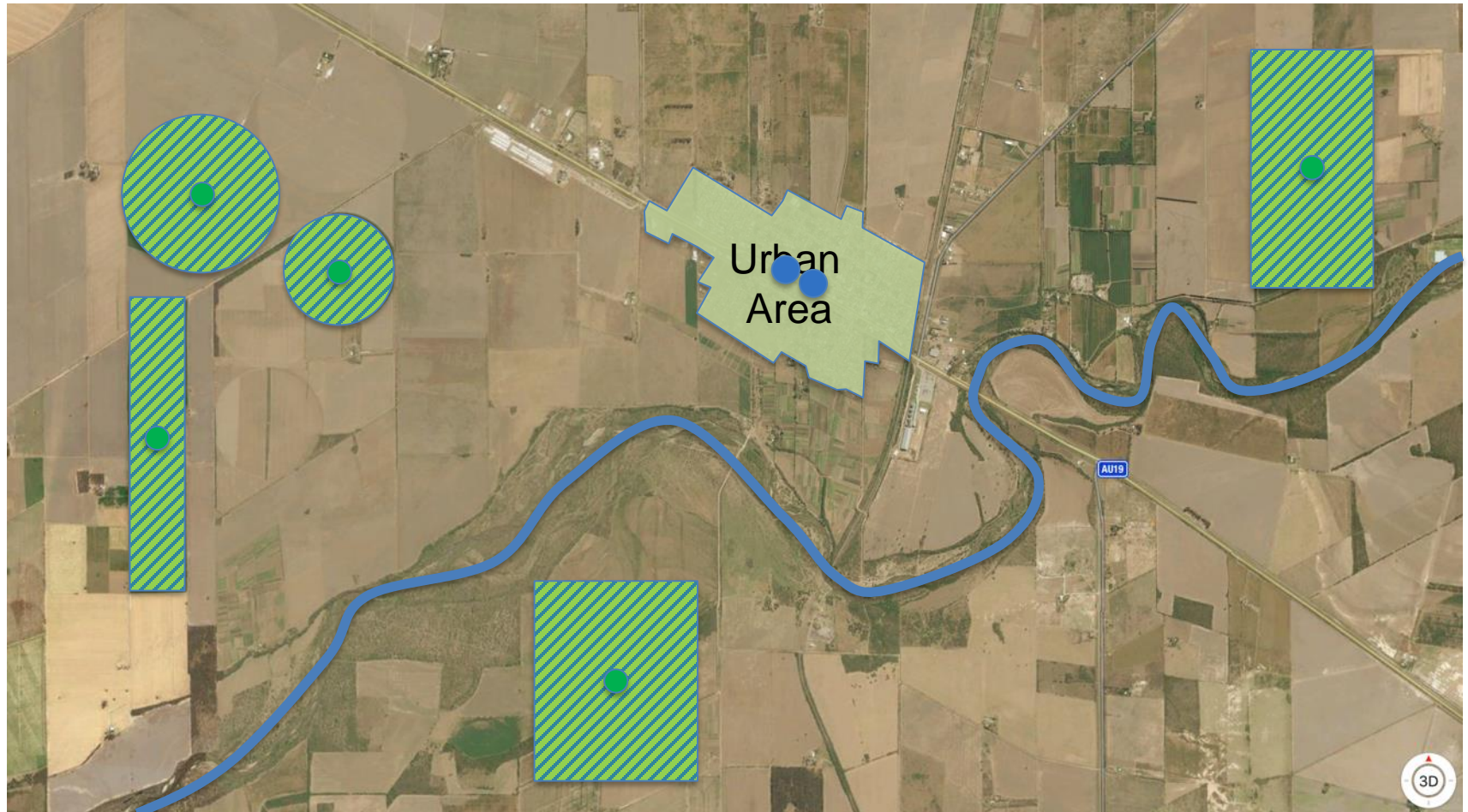


Workflow in mapping of MAR suitability mapping -
GDA module of INOWAS DSS, adapted from Rahman et al. [5]

Case study

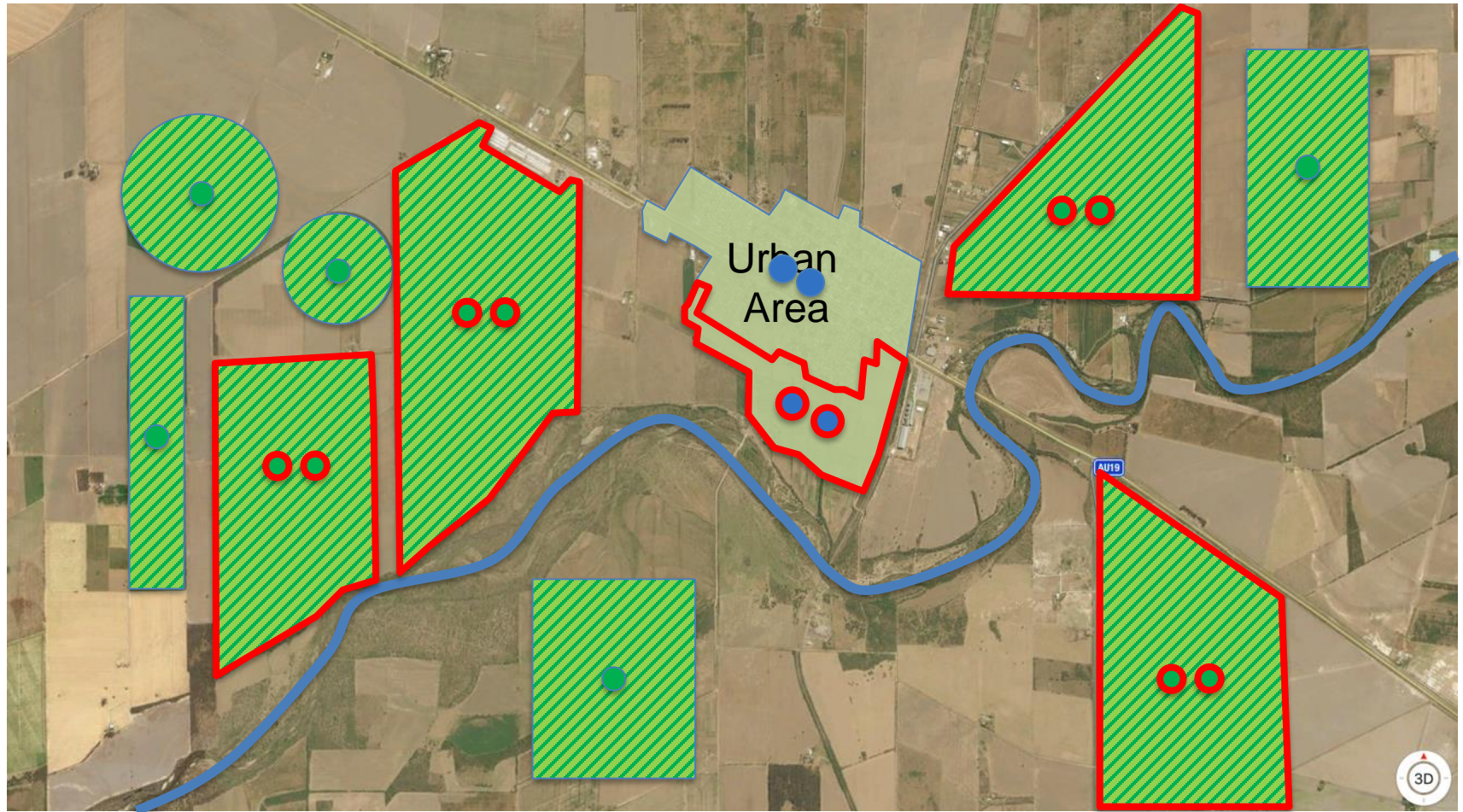


Case study – current state (2015)



● municipal wells ● wells for irrigation ▨ agricultural area ■ urban area

Case study – future prediction (2020)



- new municipal wells
- new wells for irrigation
- ▨ new agricultural area
- ▭ new urban area

Case study – WebGIS

wording : Wörterbuch / Di... x ModelMate—A GUI for Mo... x Modflow-Model Inowas Ri... x +

inowas.hydro.tu-dresden.de/models/modflow/f72d474f-8f82-446b-8932-67c3550e0d8e


Suchen

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Applications Tools Models

Models / Modflow / Inowas Rio Primero

 Inowas Rio Primero
Groundwater Model: 40 Rows, 75 Columns, 1 Layers, Last modified: 07-09-2016 (State)

Scenarios: 4

Summary

Model area
Soil properties
Boundaries
Calculation
Results
History
Delete

Summary

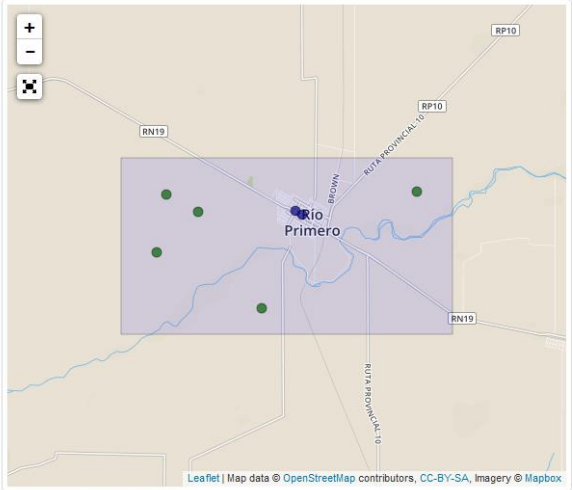
Description

Area
Surface: 92.2 sqkm
dx: 11233 m
dy: 5969 m

Soilmodel
Layers: 1
Rows: 40
Columns: 75

Stressperiods(1)

- 01/01/2015 - 31/12/2015 - steady state -
Timesteps: 1



Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

DE 13:20 15.09.2016

Case study – WebGIS

The screenshot displays the INOWAS WebGIS interface for the 'Inowas Rio Primero' groundwater model. The top navigation bar includes the INOWAS logo, 'Applications', 'Tools', and 'Models' menus, along with a settings icon. Below this, a breadcrumb trail shows 'Models / Modflow / Inowas Rio Primero'. The main header area features a map icon, the title 'Inowas Rio Primero', and metadata: 'Groundwater Model: 40 Rows, 75 Columns, 1 Layers, Last modified: 07-09-2016'. A 'Scenarios: 4' link is also present. On the left, a vertical menu lists various model components: Summary, Model area, Soil properties, Boundaries (highlighted), Wells (highlighted), Rivers, Recharge, Constant Head, General Head, Calculation, Results, History, and Delete. The central map area shows a purple-shaded model boundary over a geographic map of Rio Primero. A tooltip is active over a well feature, displaying the text: 'Click cancel to undo changes. Drag handles, or marker to edit feature.' The map includes various roads (RN19, RP10, PASO COSTANERA, BROWNS, RUTA PROVINCIAL 10) and the Rio Primero river. A 'Save Cancel' dialog box is partially visible on the left side of the map. The bottom right corner of the map area contains the text: 'Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, imagery © Mapbox'.

Case study – WebGIS

INOWAS Applications Tools Models
MAR Junior Research Group

Models / Modflow / Inowas Rio Primero / Scenarios / Scenario 3: Infiltration wells and river bank filtration

Scenario 3: Infiltration wells and river bank filtration

Groundwater Model: 40 Rows, 75 Columns, 1 Layers, Last modified: 07-09-2016 [State]

Base Scenario: [Inowas Rio Primero](#)

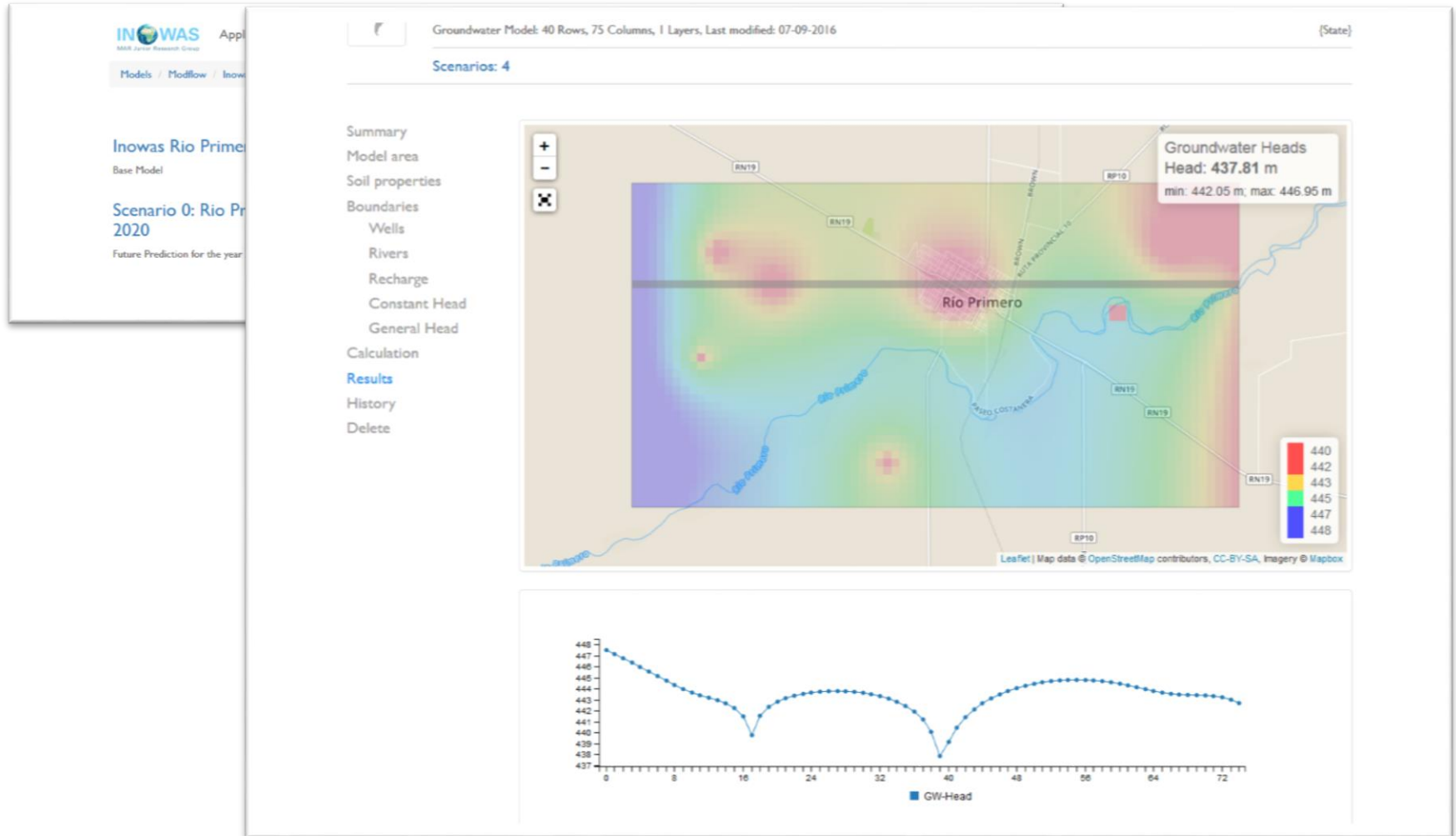
- Summary
- Model area
- Soil properties
- Boundaries
- Wells
- Rivers
- Recharge
- Constant Head
- General Head
- Calculation
- Results
- History
- Delete

Infiltration Well 4
Flux: 2000 m³/day

Rio Primero

Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Case study – WebGIS



Contact



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