IWAS Brasil · Água DF

Water Resources in the Federal District: Groundwater Flow Model of the Pipiripau Watershed

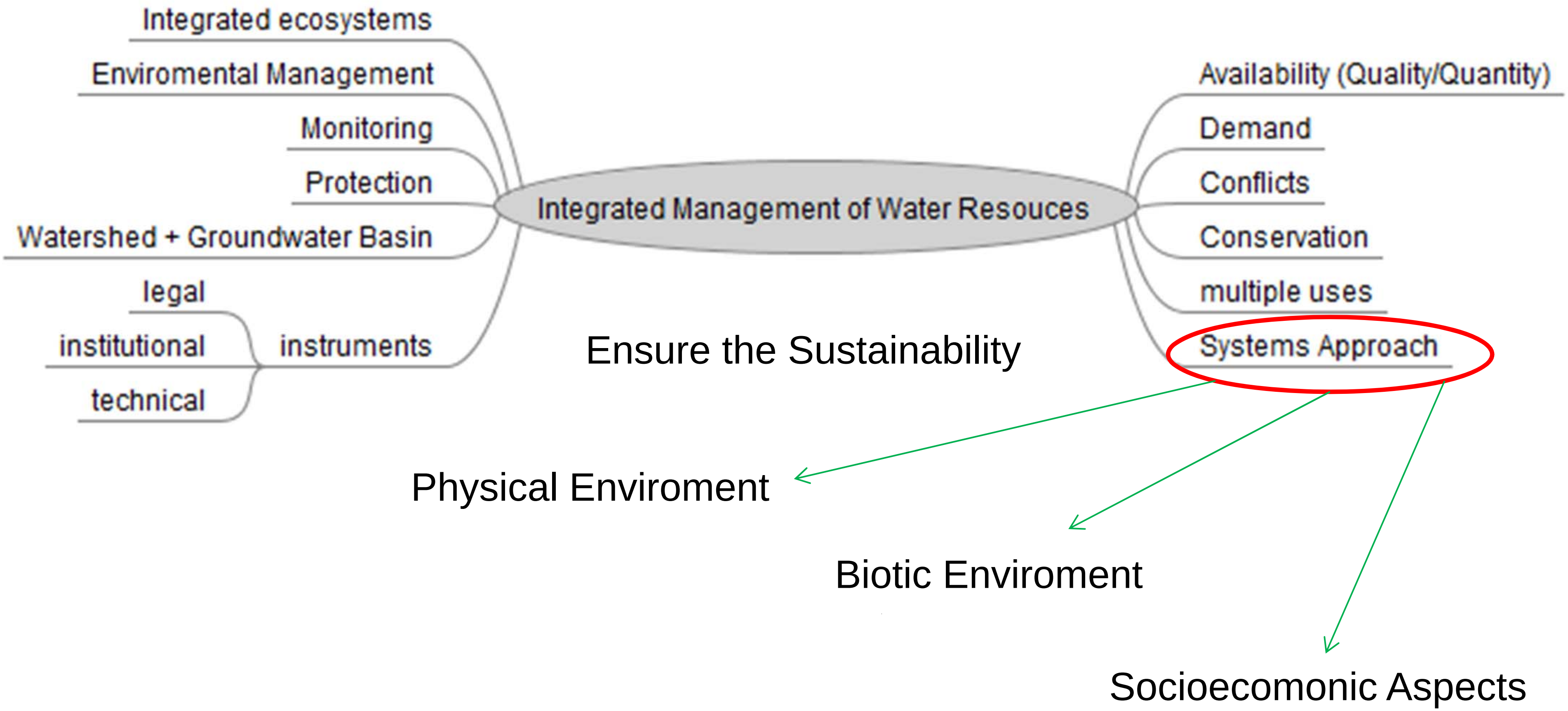
Tatiana Diniz Gonçalves[1], Agnes Gräbe[2], Thomas Fischer[2], Olaf Kolditz[2], Holger Weiss[2]

[1]Universidade de Brasília
[2]Helmholtz Centre for Environmental Research GmbH – UFZ

Patrocinado por

Motivation

- ✓ Scarcity of basic information to support water management

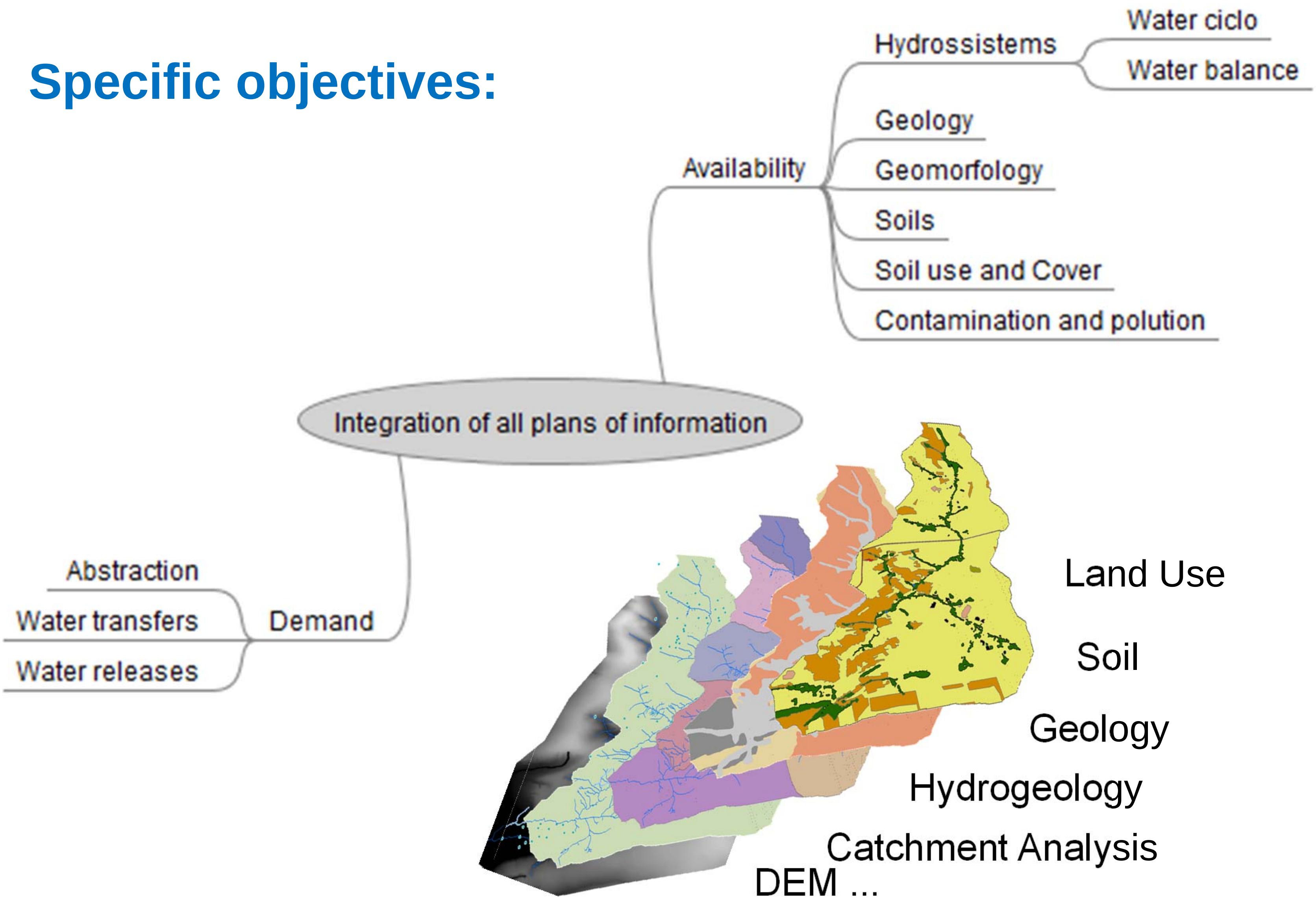


Objectives

- ✓To better serve the water demands of the population
- ✓Minimize impacts on ecosystems

The challenge is to manage the availability and demand

Specific objectives:



✓There is more data from surface water resources than groundwater in FD.

✓In order to understand the **groundwater dynamics** was necessary to provide a **3D groundwater model** representing the **groundwater level and flow system**

Tasks

Evaluation and discretisation of the data
(topography, hydrology, geology, hydraulic)

↓

Conceptional model

↓

Geological 3D model
(cross sections, boreholes and *virtual* boreholes)

↓

Groundwater flow model - OpenGeoSys

↓

Steady State
(gw recharge [mm/yr])

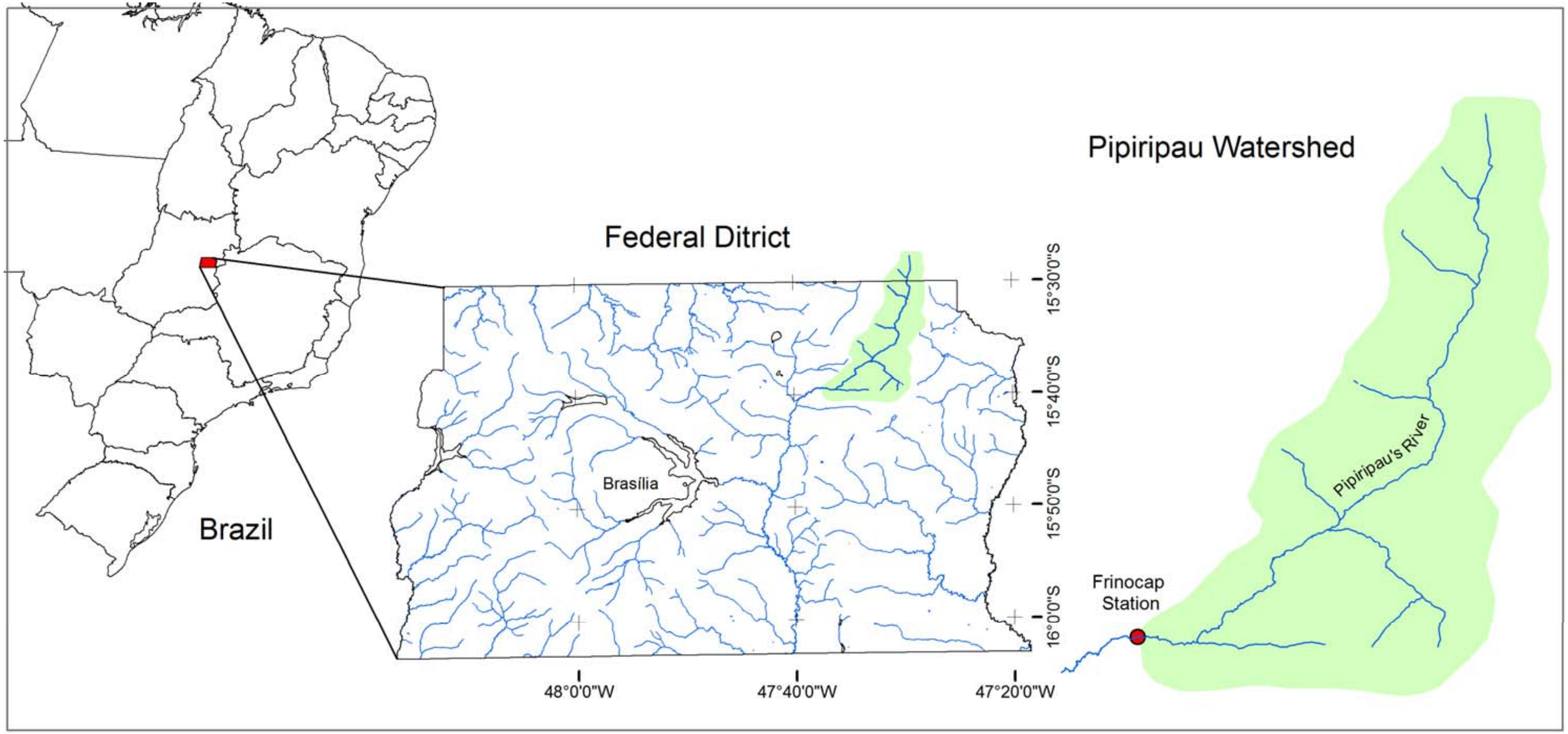
↓

Transient
(gw recharge for a time period)

↓

HYDROLOGICAL MODEL SYSTEM

Location of Pipiripau Watershed



✓Data and Model Set-Up

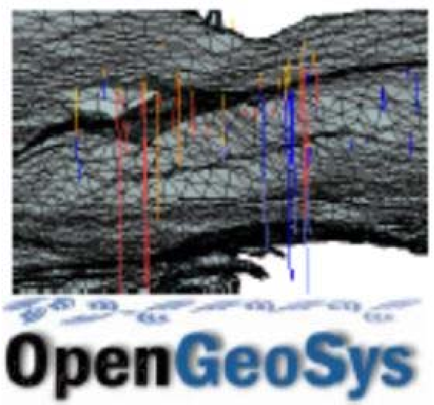
A comprehensive data set was collected and integrated into this study containing information about:

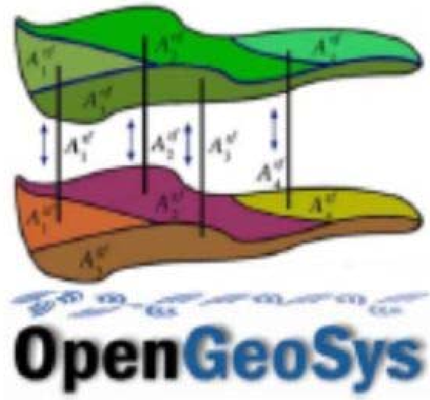
- **Climate:** strong seasonality, hot rainy season (about 80% of annual rainfall, between October and April) and cool and dry season from May to September; Average annual precipitation is 1.600 mm
- **Geology:** Pipiripau watershed is bounded on the northeast and southwest by faults from Paranã, which put tectonically the Paranoá Group on the Bambuí Group
- **Hydrogeology:** Campos and Freitas-Silva (1998) classified the groundwater systems reservoirs of the FD in two domains: porous (Upper Aquifers) and fractured (Lower Aquifers)
- **Hydrology:** stream hydrograph of the Pipiripau watershed, expected recharge areas

✓**Hydrodinamic parameters such as hydraulic conductivity (K) is a better parameters to better define the potential of aquifers**

Upper Aquifer Porous						
Aquifers Systems	K-values (m/s)	Average production (m^3/h)	Transmissivity (m^2/s)	Specific capacity (m^3/h/m)	Porosity ηe or Ifi (%)	Average thickness saturated (m)
P1 - aquifer	1,68 x 10^{-6}	0,8	4,20 x 10^{-5}	-	11	25
P4 - aquitard	3,11 x 10^{-7}	0,3	3,11 x 10^{-7}	-	3	1
Saprolite	1,68 x 10^{-6} - 3,11 x 10^{-7}	0,8 - 0,3	4,20 x 10^{-5} -3,11 x 10^{-7}	-	3-11	0-50
Lower Aquifer Fractured						
A - aquitard	2,06 x 10^{-6}	4,0	1,15 x 10^{-4}	3,32 x 10^{-1}	2,5	115
R3/Q3 - aquifer	8,43 x 10^{-7}	12	3,46 x 10^{-4}	1	2,5	140
R4 - aquifer	1,26 x 10^{-6}	6,0	1,24 x 10^{-4}	3,59 x 10^{-1}	2,5	100

✓ Conceptual Model, 3D Model and Groundwater flow model



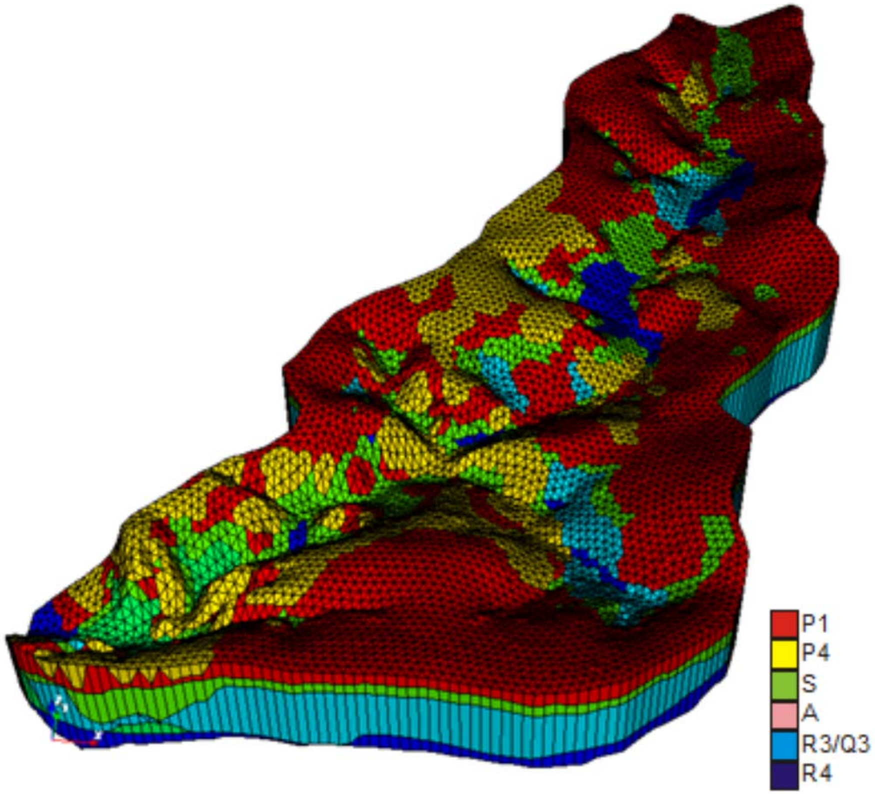


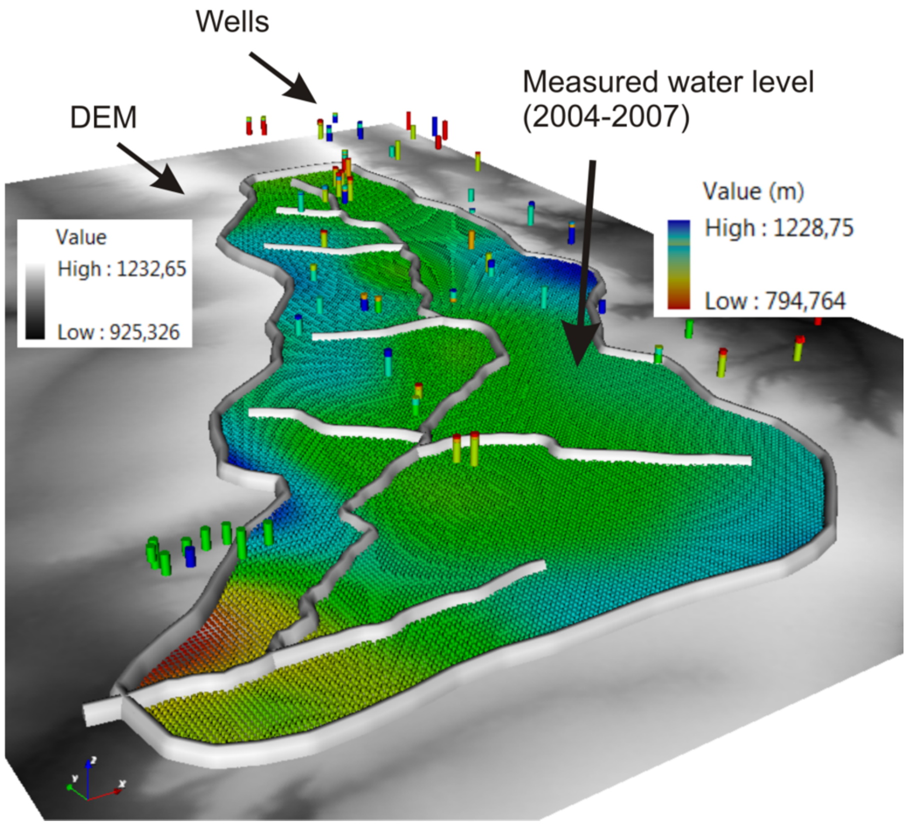
Pre-processing and data conversion

Structural 3D Model

Simulation Visualization and Calibration

Water Resources in the Federal District: Groundwater Flow Model of the Pipiripau Watershed



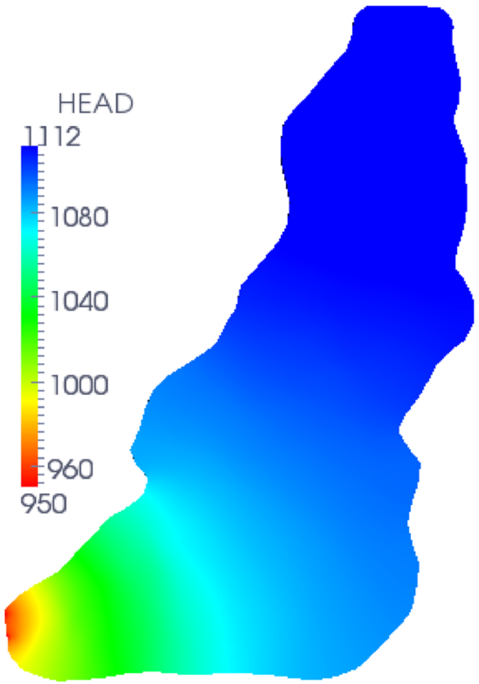


✓ ***3D mesh file generated into GMS*** **and displayed on OGS, showing the different materials.**

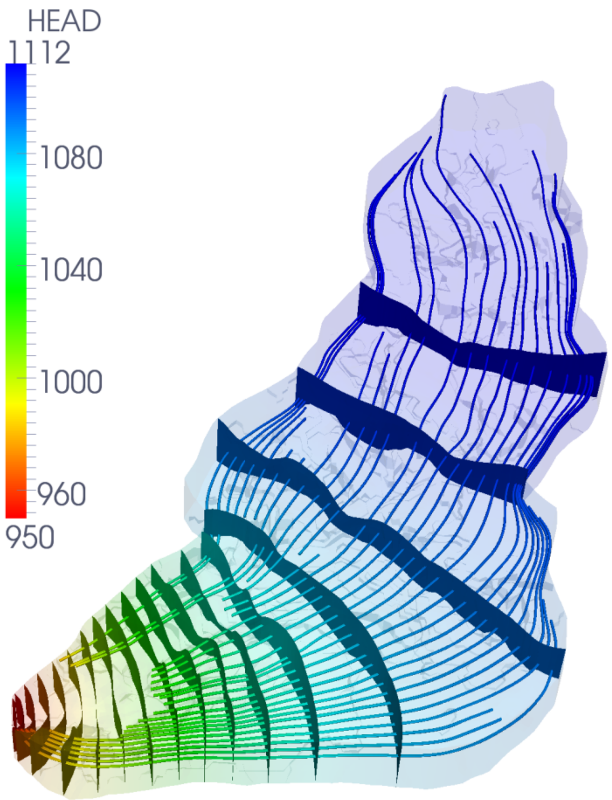
✓ **Borehole logs, DEM, distribution of the measured water level used to the spatial and temporal discretization.**

✓ Results – Steady State

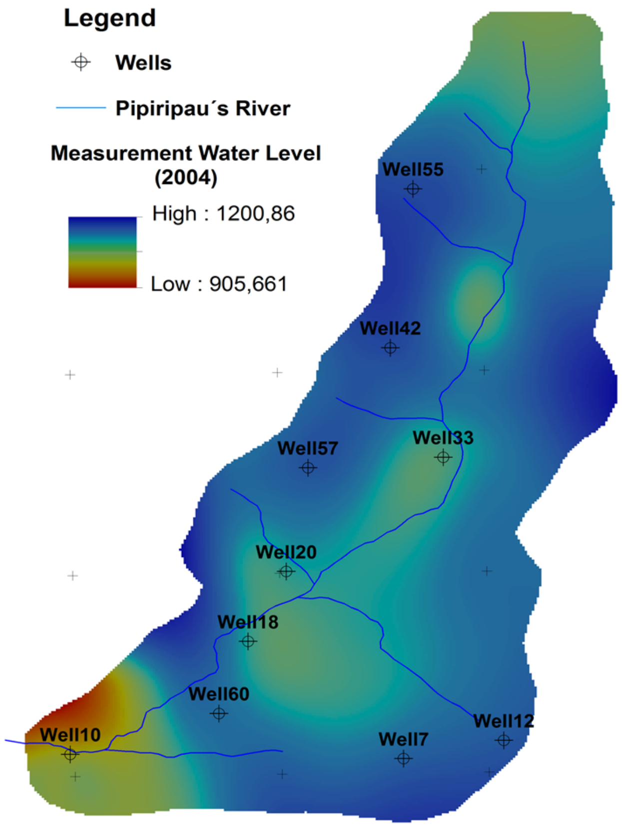
Visualization of Flow filed and comparison between simulated heads and measured heads in selected wells.



Simulation head

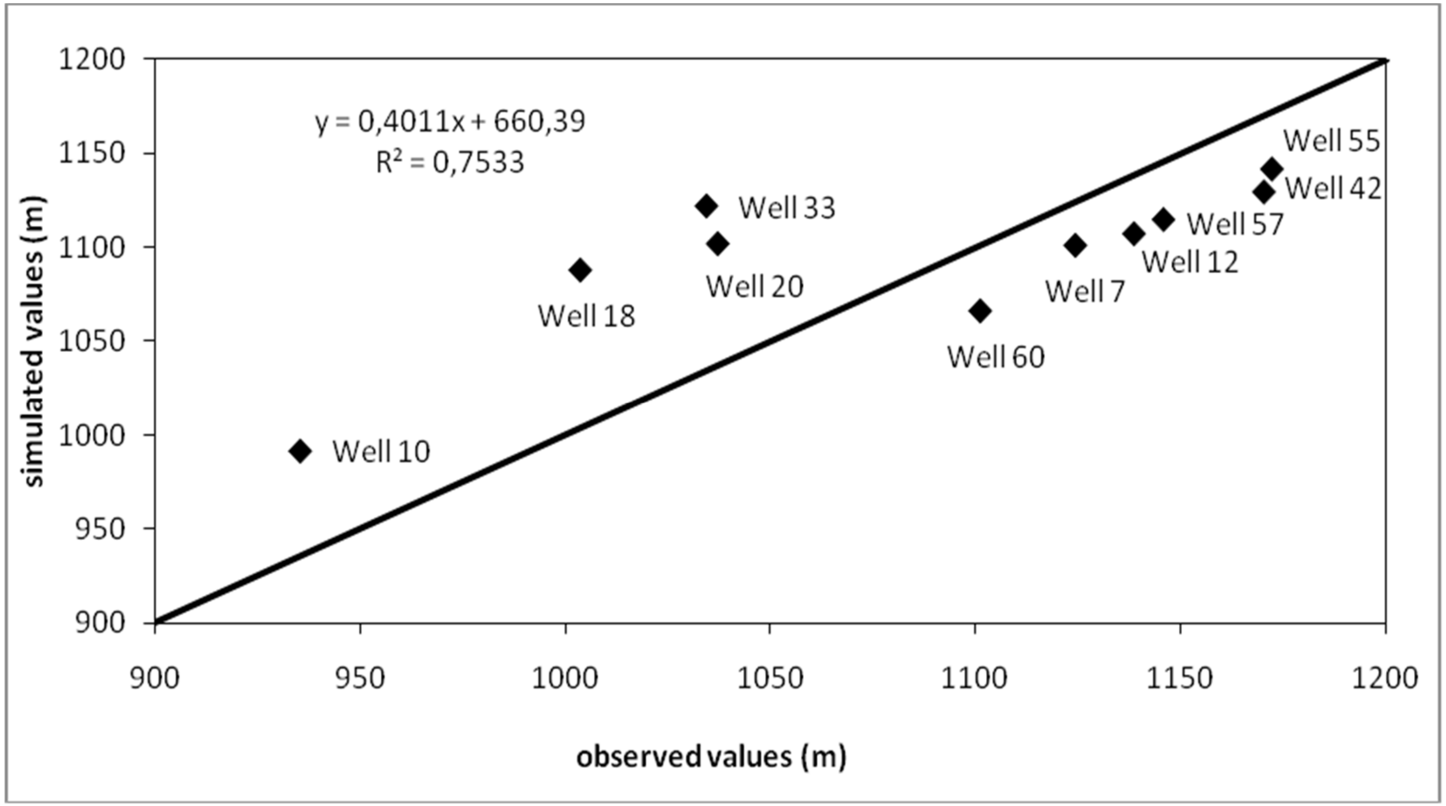


Head isosurface



Measured head

✓ Results – Steady State



Measured vs. simulated groundwater level in monitoring wells

Conclusions

- ✓ The current model represents only the **first step** toward a comprehensive effort to the scenario analysis for a sustainable water resources management in Pipiripau watershed.
- ✓ The **recharge rate** in the model was assumed (250mm/y) and this simplification cannot represent the natural behavior of the catchment. More realistic infiltration and recharge conditions based on observations is necessary to reach a water balance
- ✓ These results indicate that it is possible to have a **good representation** of the geological structure of the basin but the estimates of the hydrodynamic conditions of the study area should to be analyzed more intensively.

Recomendations:

✓Sensitivity Analysis of the hydrodynamics parameters
✓Transient model - water level time series and abstraction rates
✓Water Balance
✓Land use, irrigation
and socioeconomic characteristics must be considere, in order to improve the systemic management of water resources in Pipiripau Basin

Thank you for your attention!!