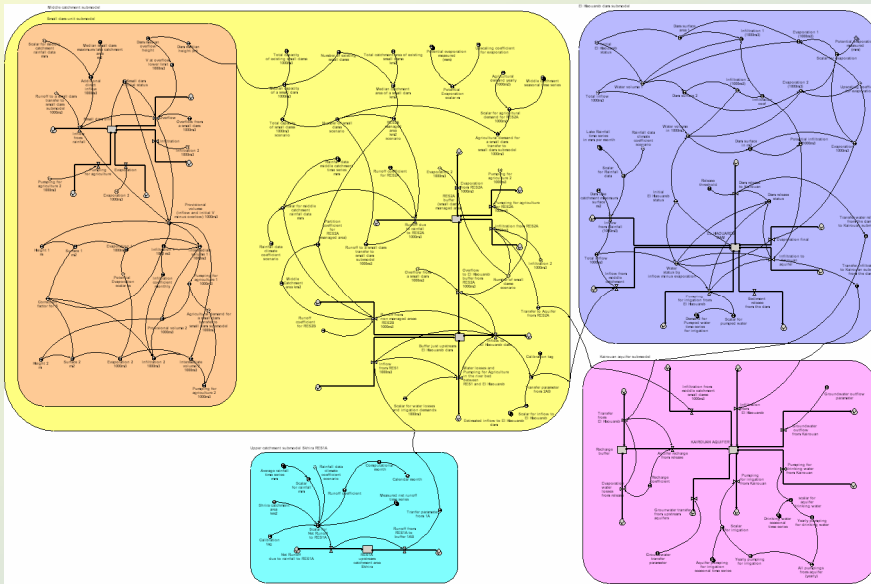


# WP3.1: System Dynamics Modelling for the Merguellil valley Water System

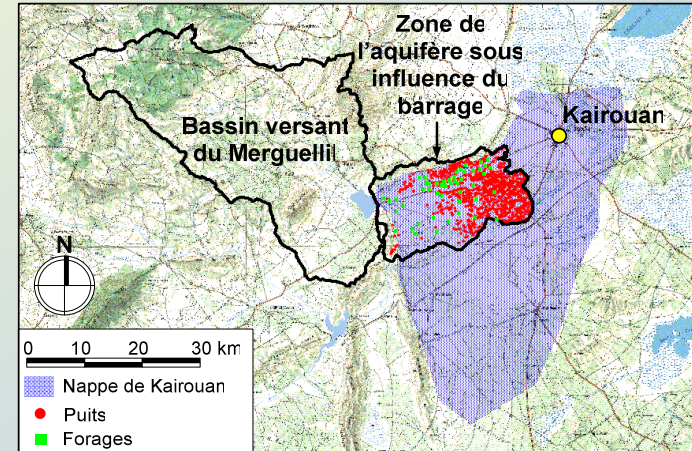


**Lydia Vamvakeridou-Lyroudia**  
**Dragan Savic**  
*Centre for Water Systems*  
*University of Exeter, United Kingdom*

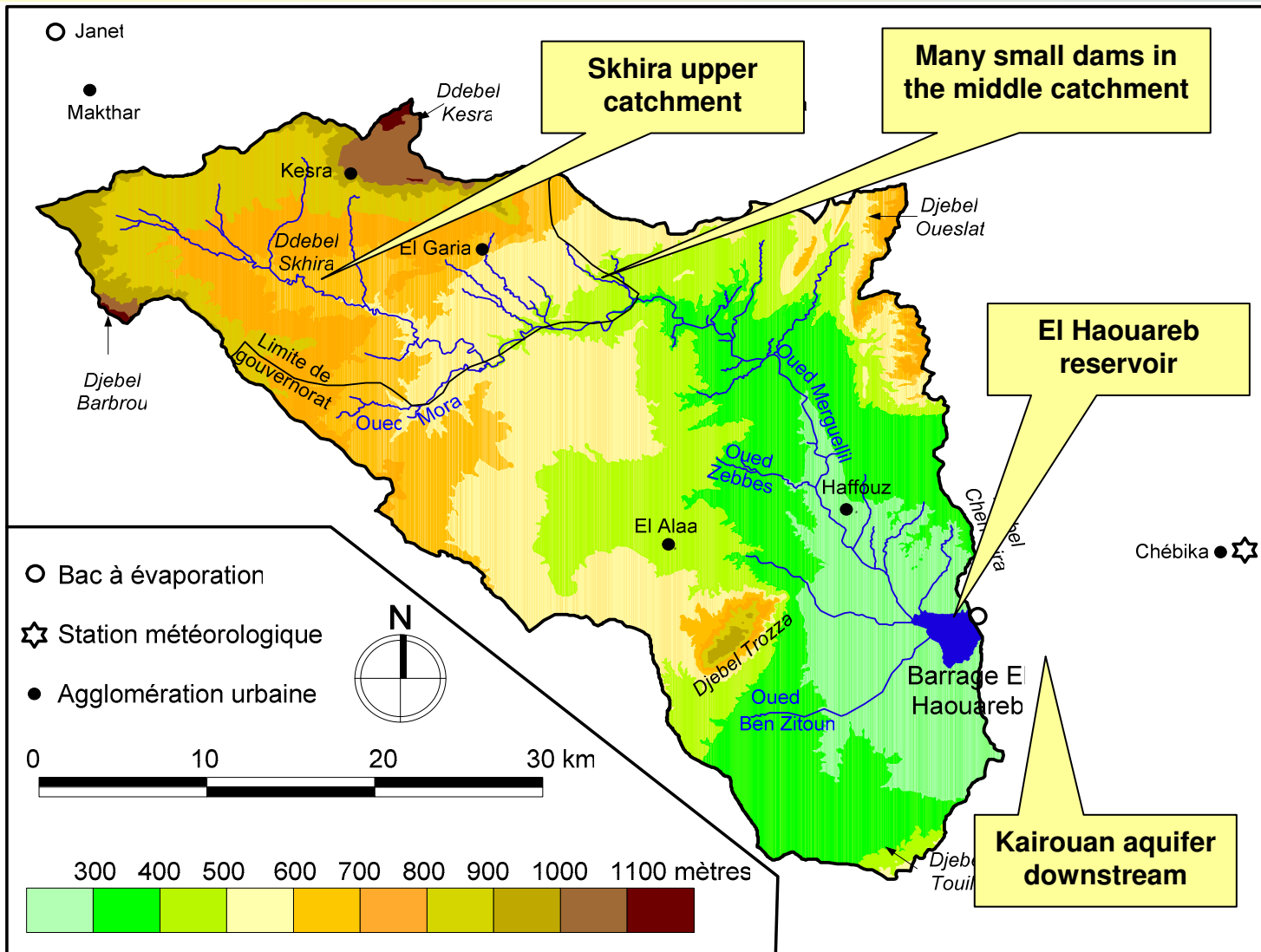
**Christian Leduc**  
*IRD, France*

## Case study : Rainfall harvesting for aquifer recharge in Merquellil

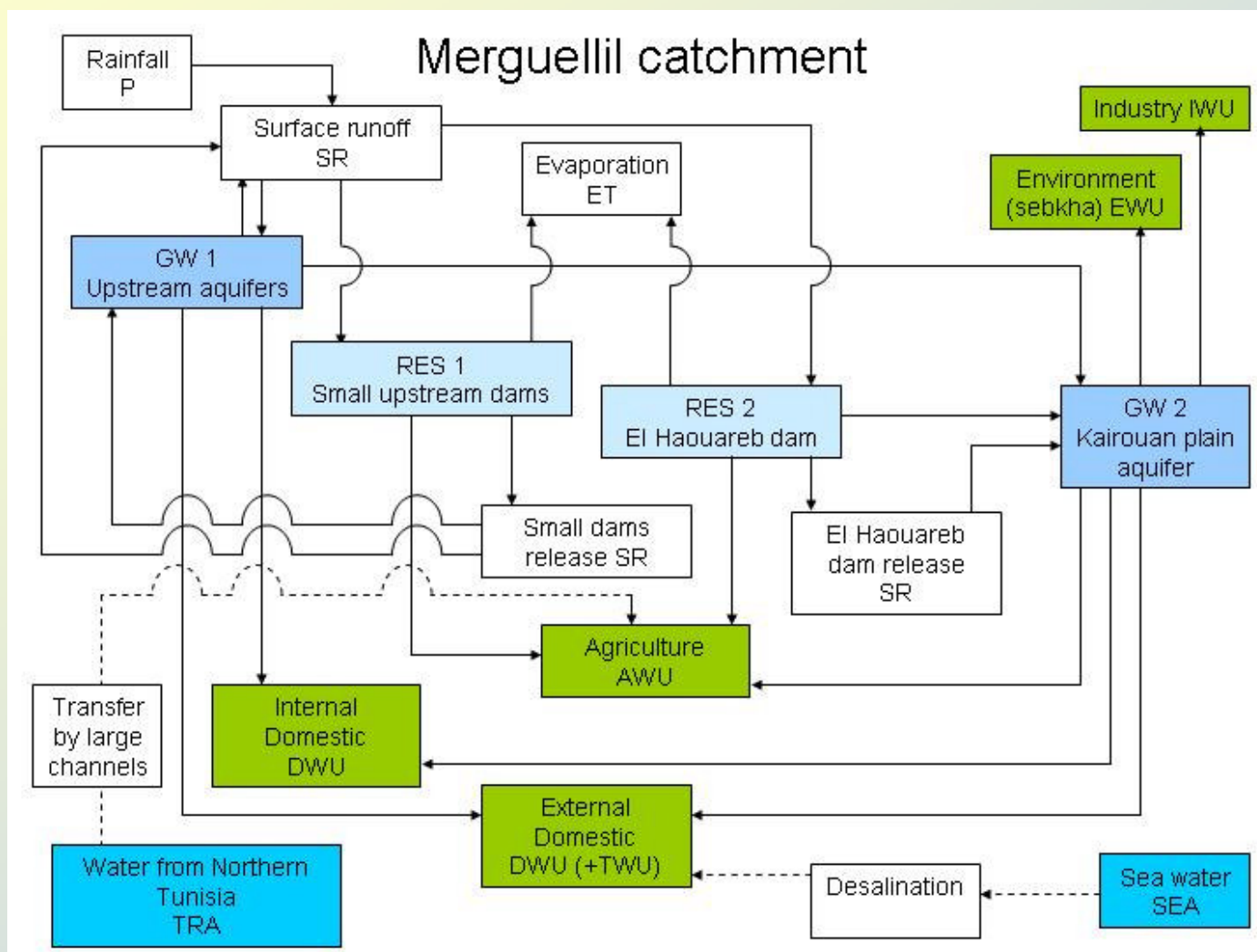
- Case study in Tunisia: **Merguellil valley**
- Semi-arid region, water shortages
- Downstream: **Kairouan aquifer**
- Many (35 **small dams**) and one large reservoir (**El Haouareb**)
- Water used for irrigation (and drinking)
  
- Small dams: **Rainfall harvesting**
- **Aquifer recharge** through:
  - Infiltration (from El Haouareb and the small dams)
  - Water released from El Haouareb
- **System Dynamics Modelling** for the simulation of
  - Small dams and water release **impact** on aquifer recharge
  - Various **scenarios** with different water policies and rainfall



## Merguellil valley

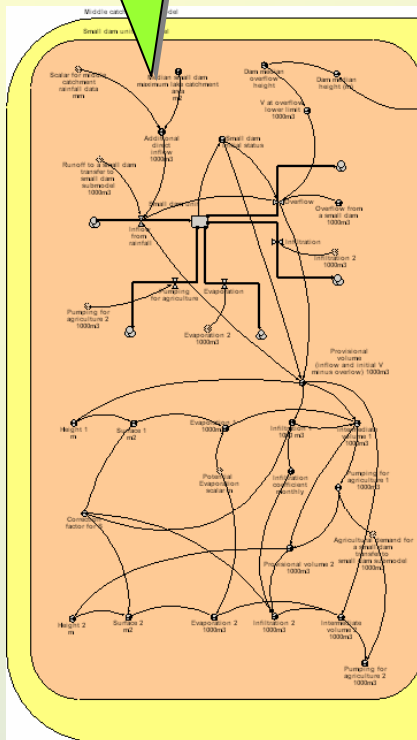


## Merguellil valley: From Conceptual Model (2006)....

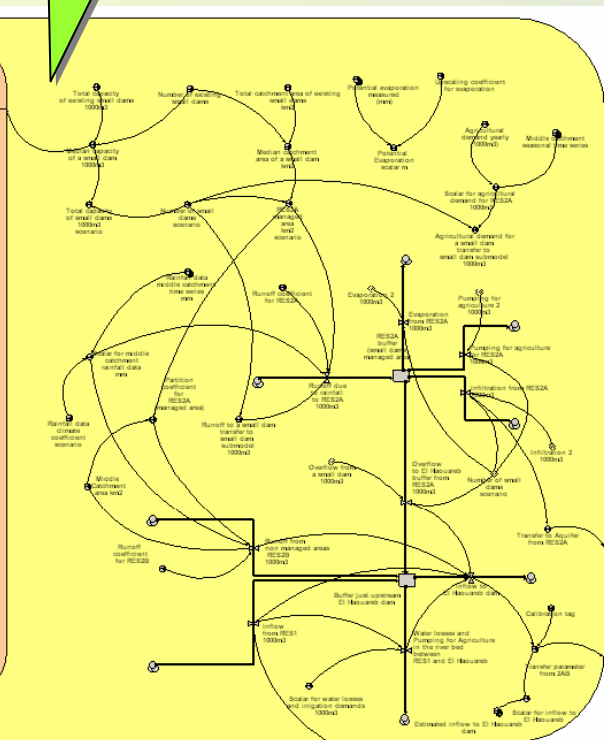


# ... to System Dynamics Model (2008)

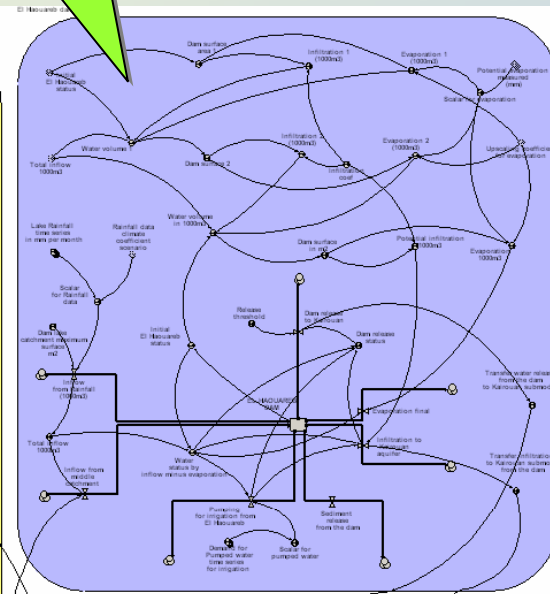
Small dam unit submodel



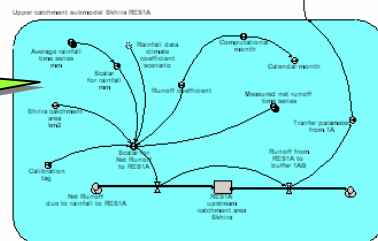
Middle catchment submodel



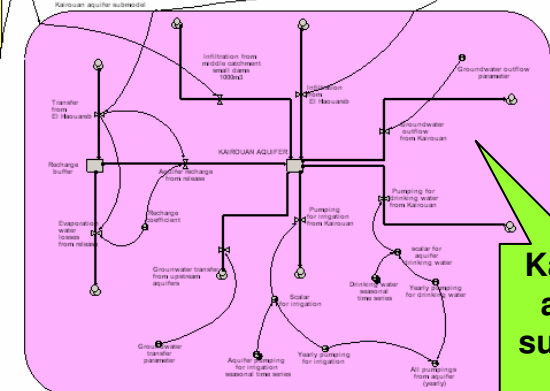
El Haouareb dam submodel



Upper catchment Skhira submodel



Kairouan aquifer submodel



## SDM for Merquellil

- **Numerical** data provided by IRD:
- Measured **time series** for:  
*Rainfall, evaporation, surface flow, irrigation demands, water releases*
- Additional **data** for:  
*Characteristics of Small Dams, El Haouareb, Kairouan aquifer*
- **Monthly** simulation time step
- **Calibration** with measured data
- Setting up and running different **scenarios** for system simulation
- Full results for **5** different scenarios published
- **More** scenarios can be simulated by the end users...

→ Download the SDM model at : [www.ex.ac.uk/cws](http://www.ex.ac.uk/cws)

## Results

- **El Kairouan: Maximum water available from Merguellil 14Mm<sup>3</sup>/year for current conditions - water release threshold from El Haouareb at 20Mm<sup>3</sup>.**
- **El Kairouan: Water available increased (↑) to 16Mm<sup>3</sup>/year, if the water release threshold at El Haouareb lower (↓) (15Mm<sup>3</sup>).**
- **Increasing (↑) the small dams by 14% → water release threshold (↓) (10Mm<sup>3</sup>), to keep water availability at the Kairouan aquifer at current level (↔) .**
- **85% of normal rainfall (↓) → water release threshold (↓) (6.5Mm<sup>3</sup>), to maintain (↔) water availability at Kairouan, BUT water availability for irrigation from El Haouareb lower (↓) by 43%.**
- **85% of normal rainfall (↓) → water release threshold (↑) to 15Mm<sup>3</sup>, to maintain (↔) irrigation level BUT water available at Kairouan reduced (↓) by 29%.**