Agua flash
INTERREG SUDOE

Contamination
Crues
Rivières
Risque

Bassins versants
Modélisation
Prototype

SUDOE
Interreg IV B

UE / EU - FEDER / ERDF

RÉGION
MIDI-PYRÉNÉES

Modélisation sur Enxoé

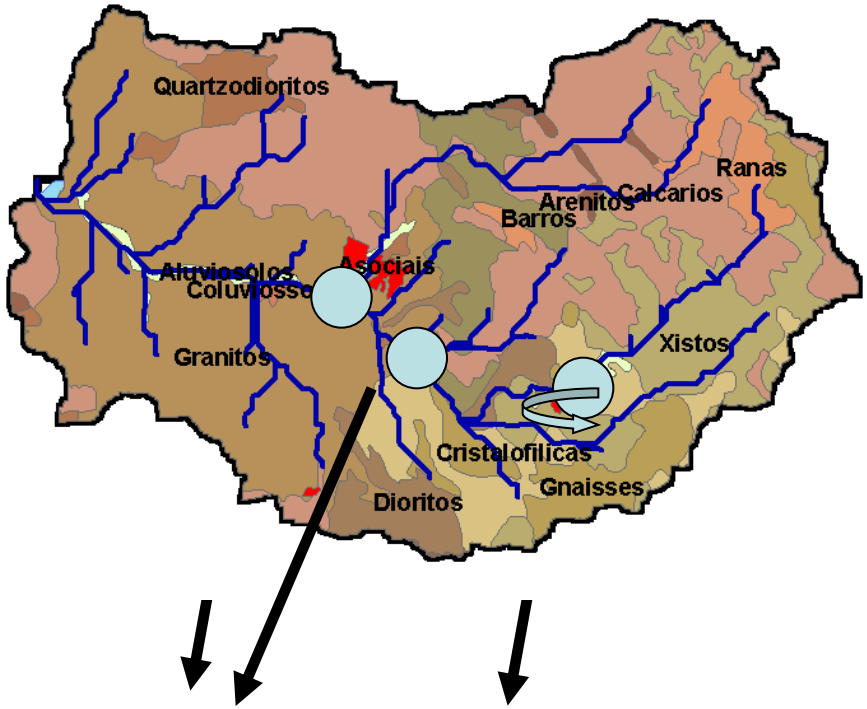
-

Lisbonne, 9-11 mars 2011

cnrs
UPV EHU
CSIC
Cemagref
Science, water & land management
INP ENSAT
Ministério da Agricultura, do Desenvolvimento Rural e das Pescas
INRB, I.P.
Instituto Nacional dos Recursos Biológicos, I.P.

Enxoé watershed

- Description
  - Area : 60km2
  - River Length: 9km
  - Altitude Range: 160 – 350m
  - Annual Precipitation: 500mm
  - Pressures: 50% NoIrrigAgriculture/Pasture; 35% Olive Trees; High animal presence (cattle, sheeps) low urban presence
  -



Pasture/agric.

Olive tree

Permanent pools

Water retained in reservoirs

Land Uses

Montado

Land Uses

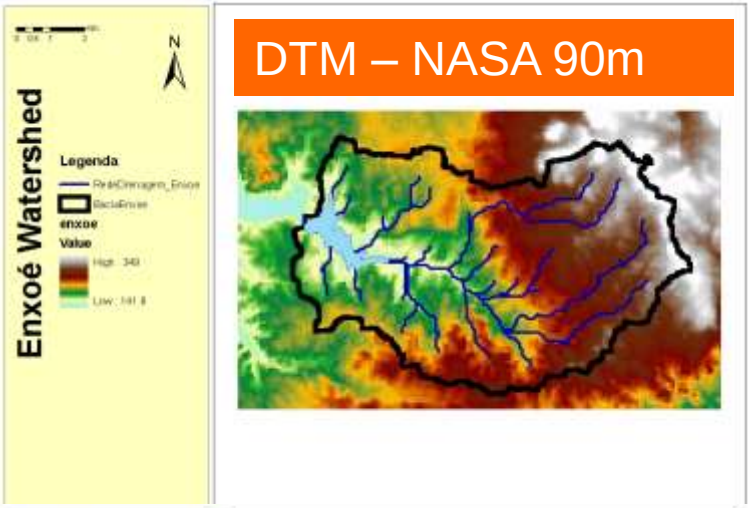
Irrigation

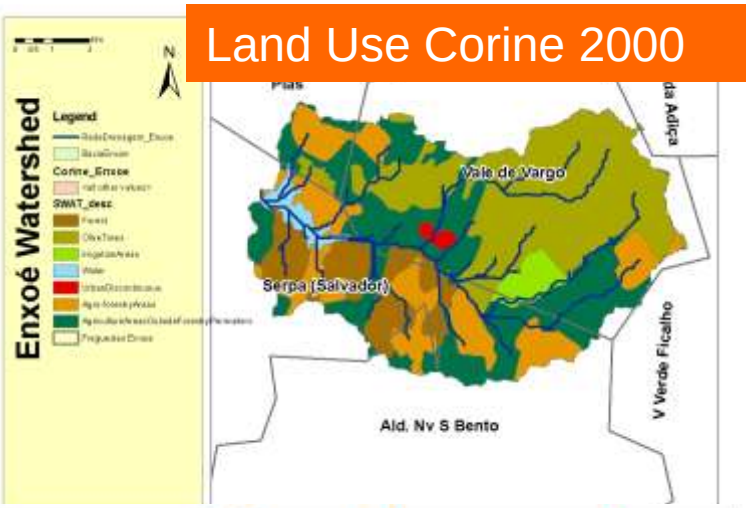
Olive

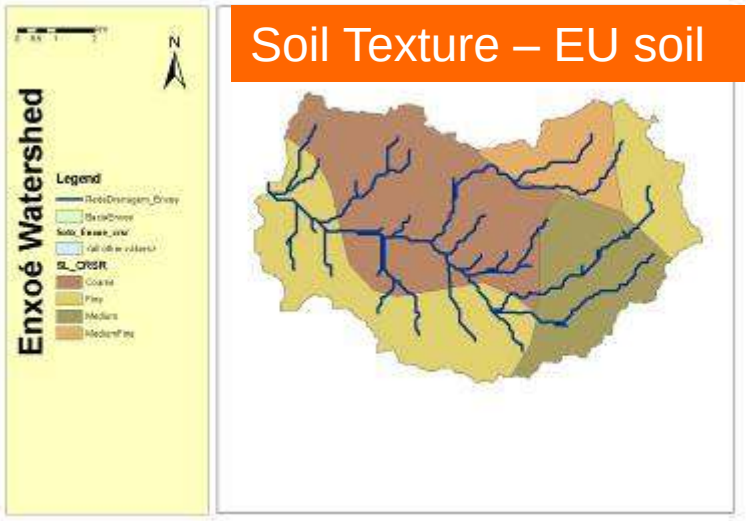
Small Farms

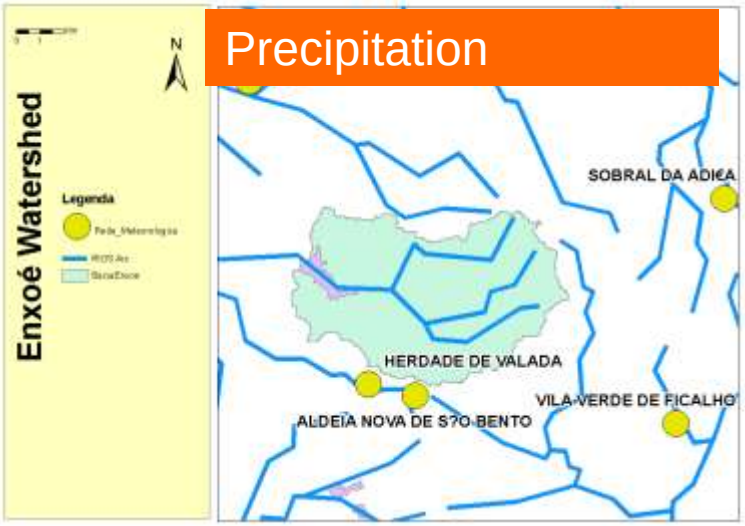
Data

- Data for model implementation







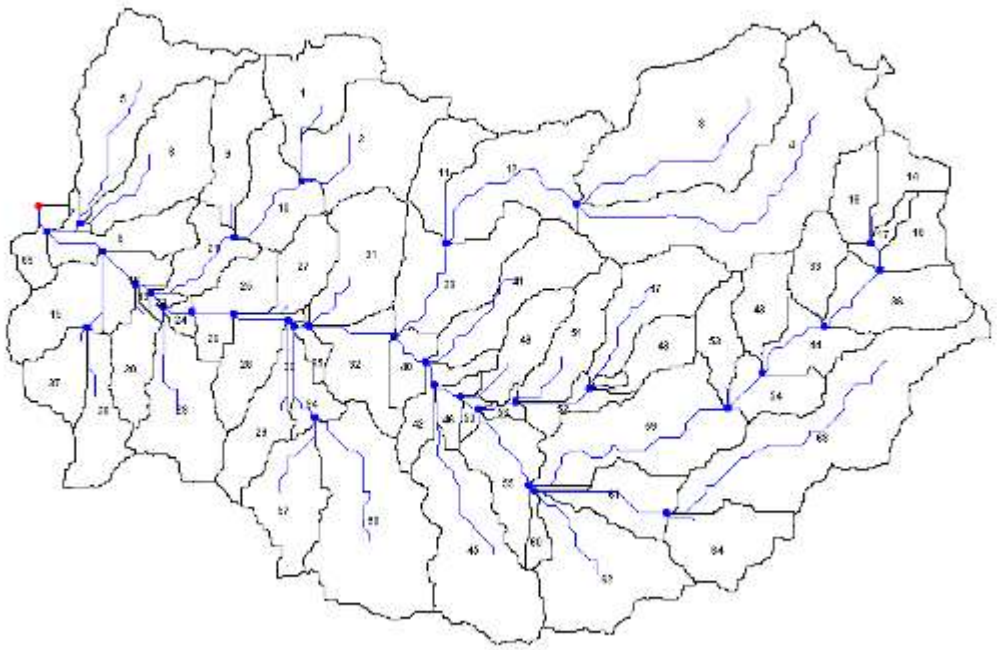


Data

- Data for validation
  - Collected during the project
  - Neighbour watersheds (flow)
  - Reservoir volumes and discharges

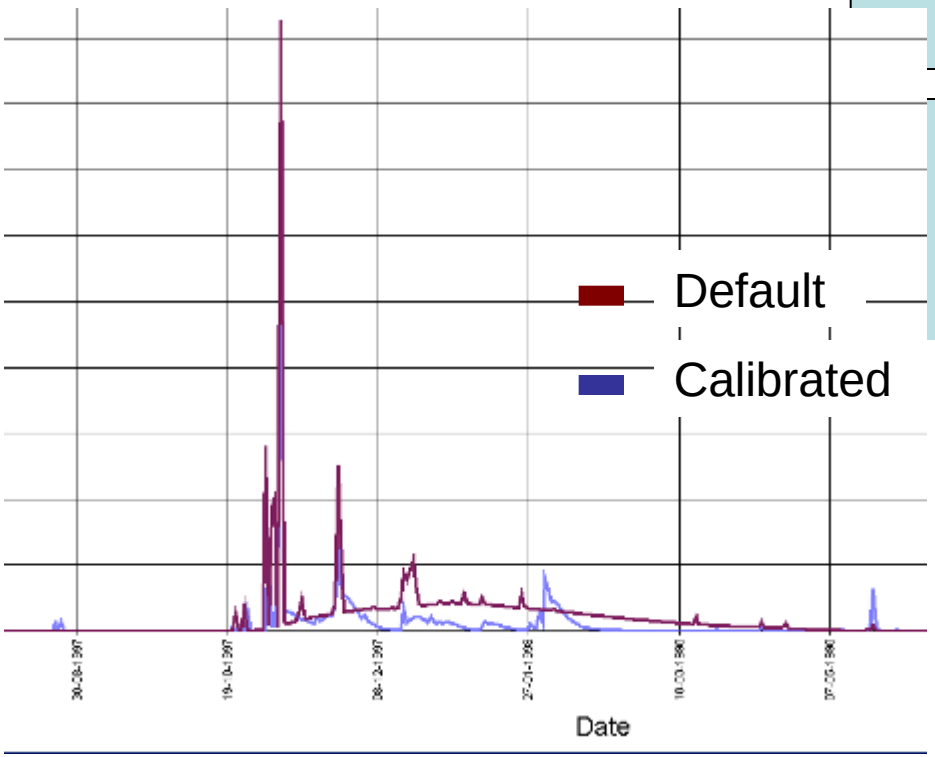
Watershed

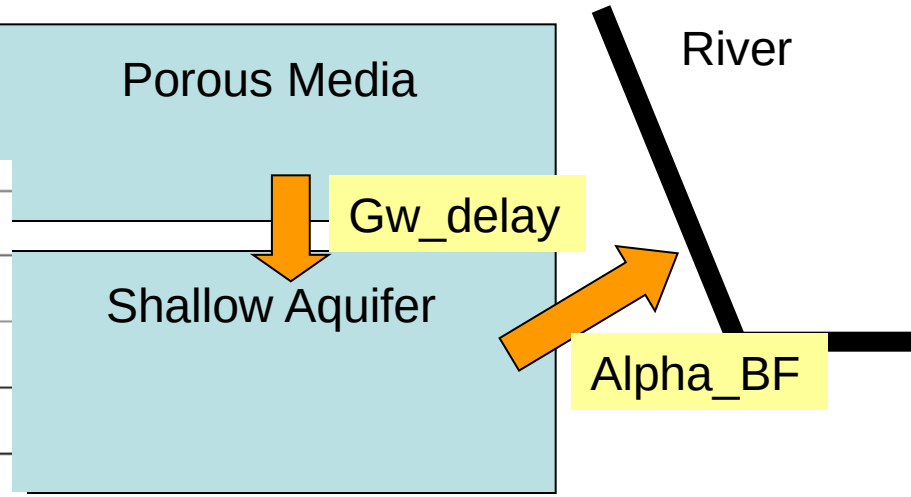
- 65 basins
- 161 hru
- Auto fertilization (maximum 200kgN/ha.year)



SWAT - Calibration

- Ground water behaviour
  - Impact on daily hydrogram



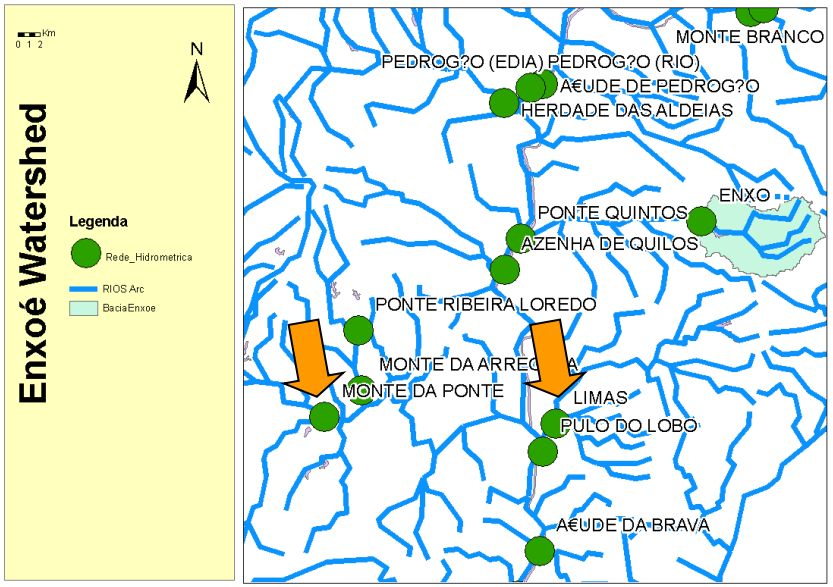


- Soil depth
  - Impact on monthly flow

Comparison with long term historic flow data outside Enxoe

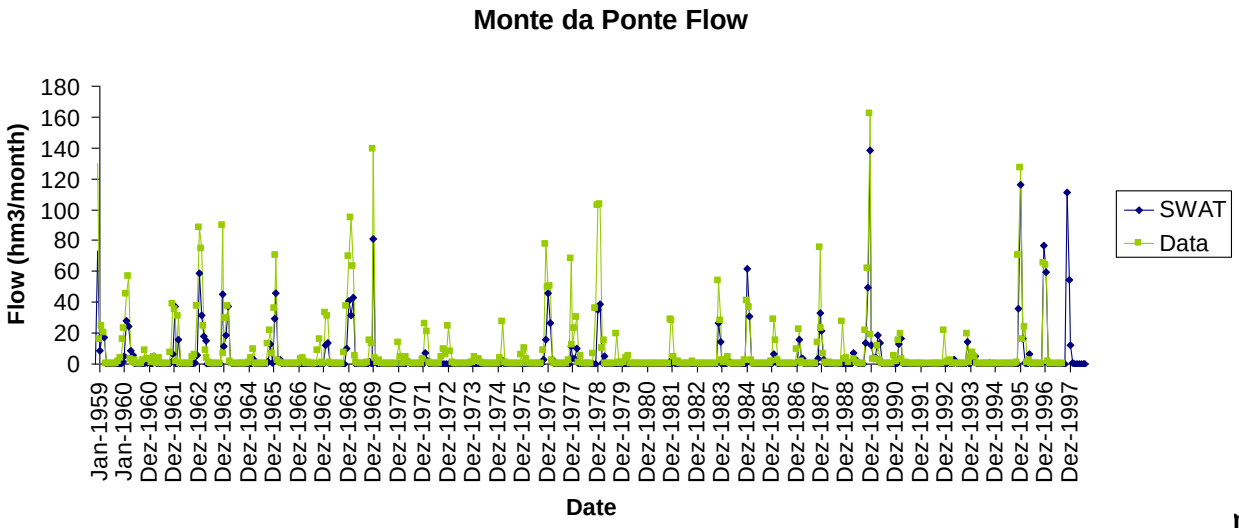
- Lack of historic in enxoé river basin
- 1 month data Aguaflash December 2009 and from October 2010.
- For checking long term trends and temporarility
- Run SWAT to neighbour watersheds and cal/validate to long term data

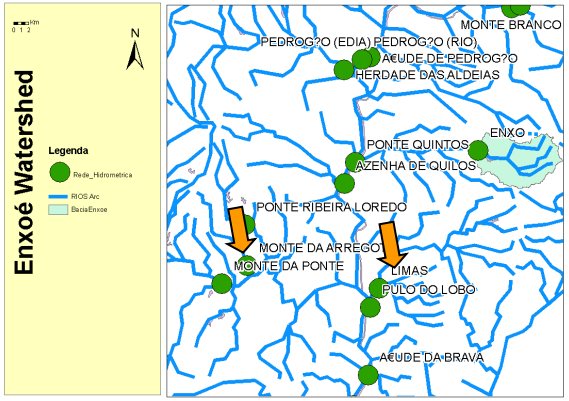
  - Monte da Ponte with 455 km^2; 100-300m alt.; 45km river
  - Limas with 97 Km^2; 100-250m al 25km river
  - Enxoé is 60 Km^2; 180-300m alt.; 9km river



Comparison with long term historic flow data outside Enxoe

- Monthly Flow





1958-1990

R2: 0.80

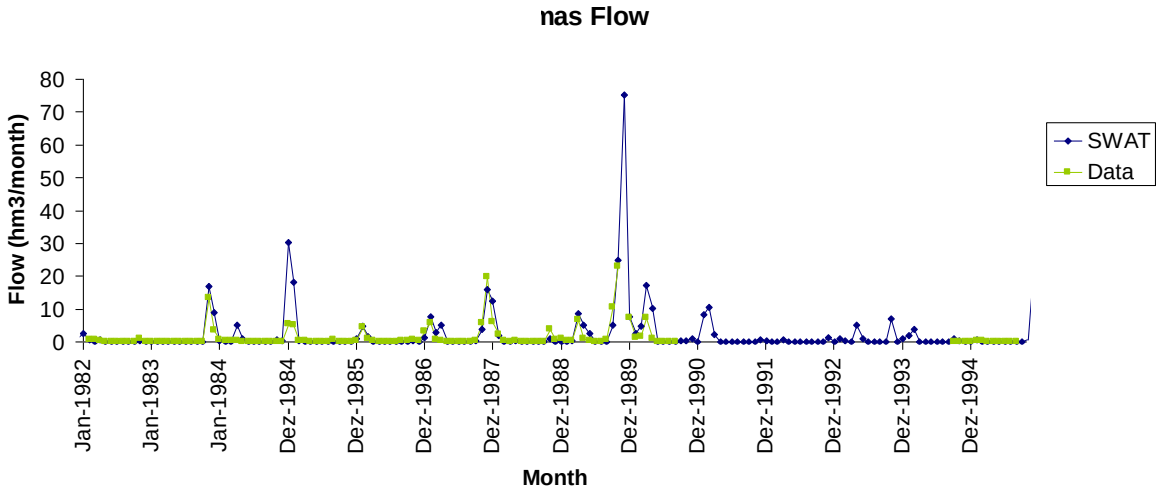
Nash: 0.68

Data SWAT

1984-1989

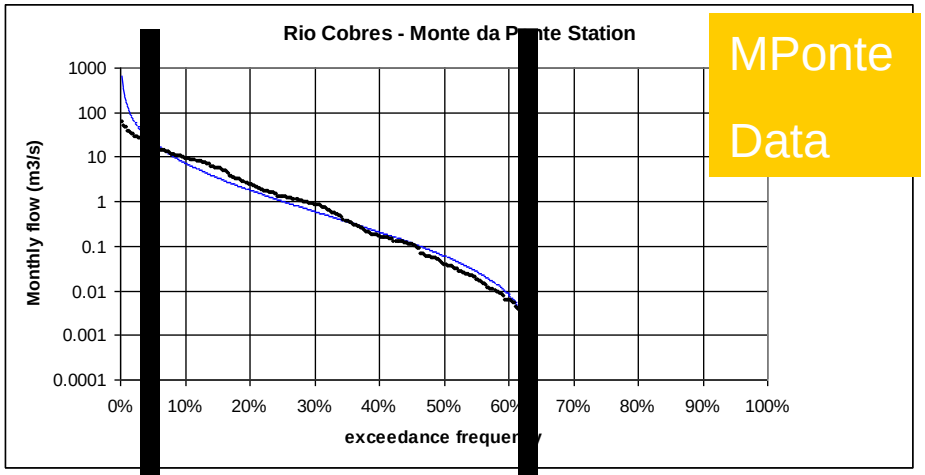
R2: 0.77

Nash: 0.74

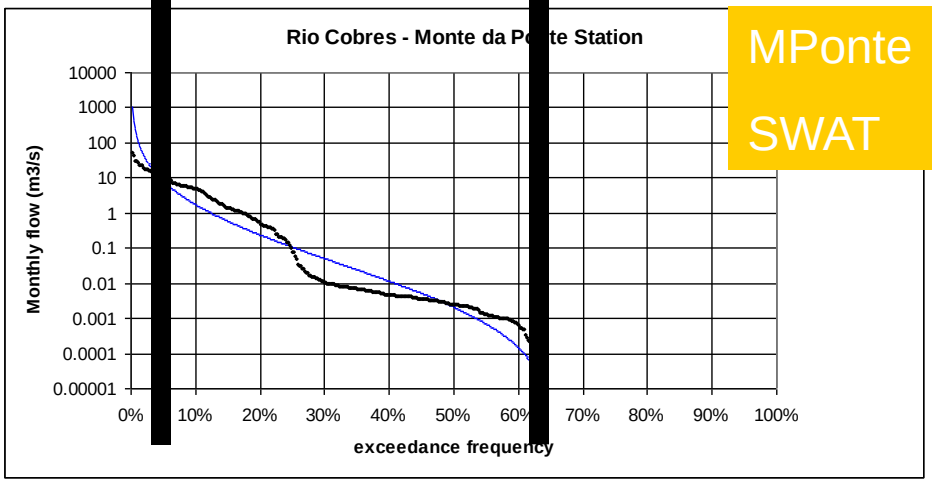


Comparison with long term historic flow data outside Enxoe

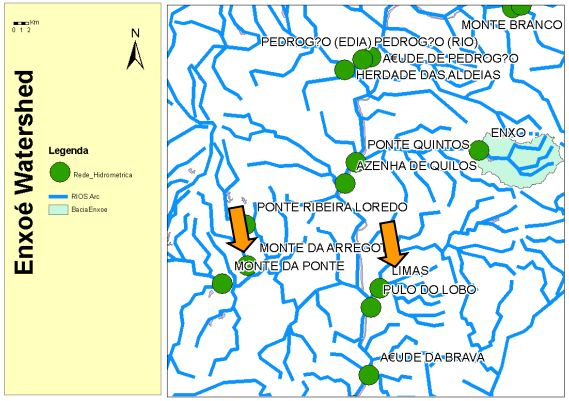
- Flow Frequency



MPonte Data



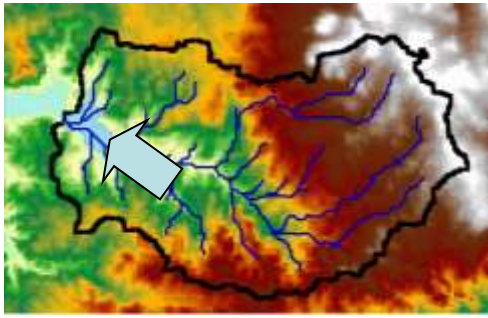
MPonte SWAT

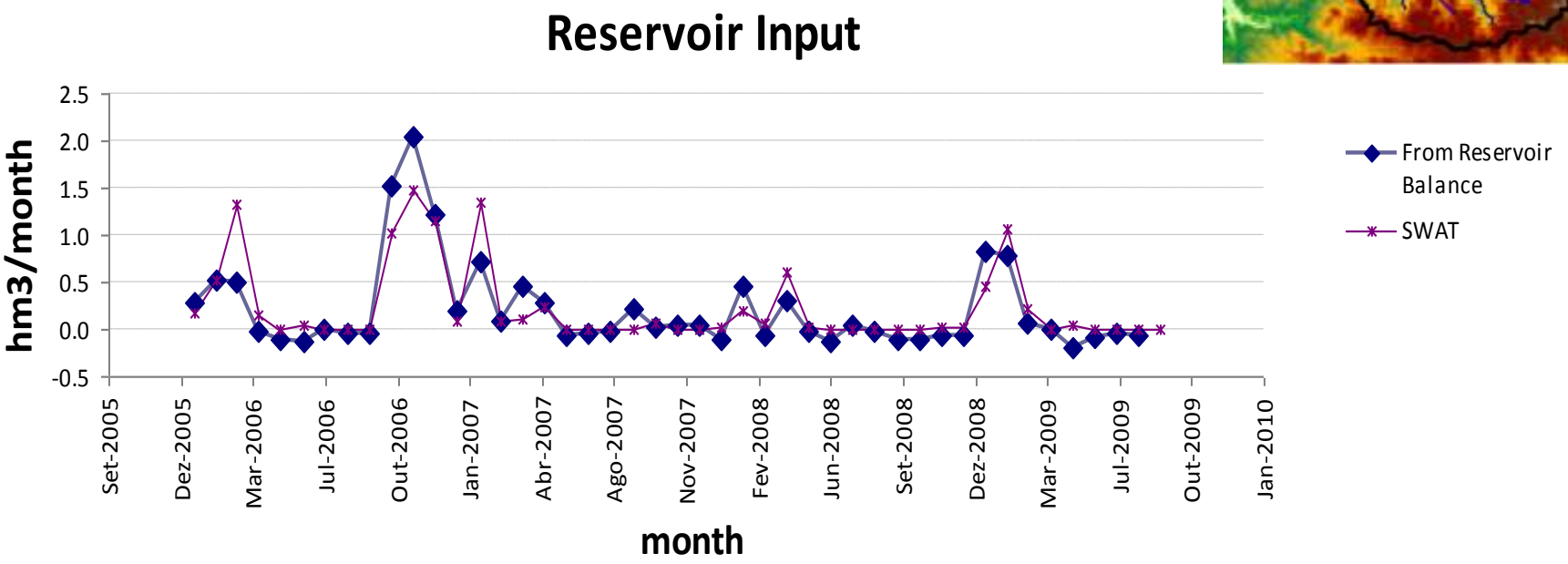


Comparison with indirect data inside Enxoe

- Enxoe Reservoir balance 13 years data
  - Discharges
  - Water abstraction
  - Volume change
- Meteorology
  - Evaporation
  - Precipitation
- Compare to SWAT model Inflow and Mohid Model inflow

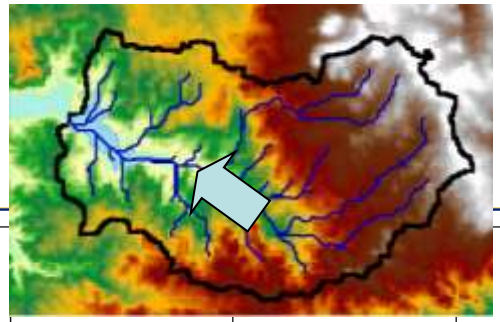
Comparison with indirect data inside Enxoe





Water Quality Simulation - SWAT

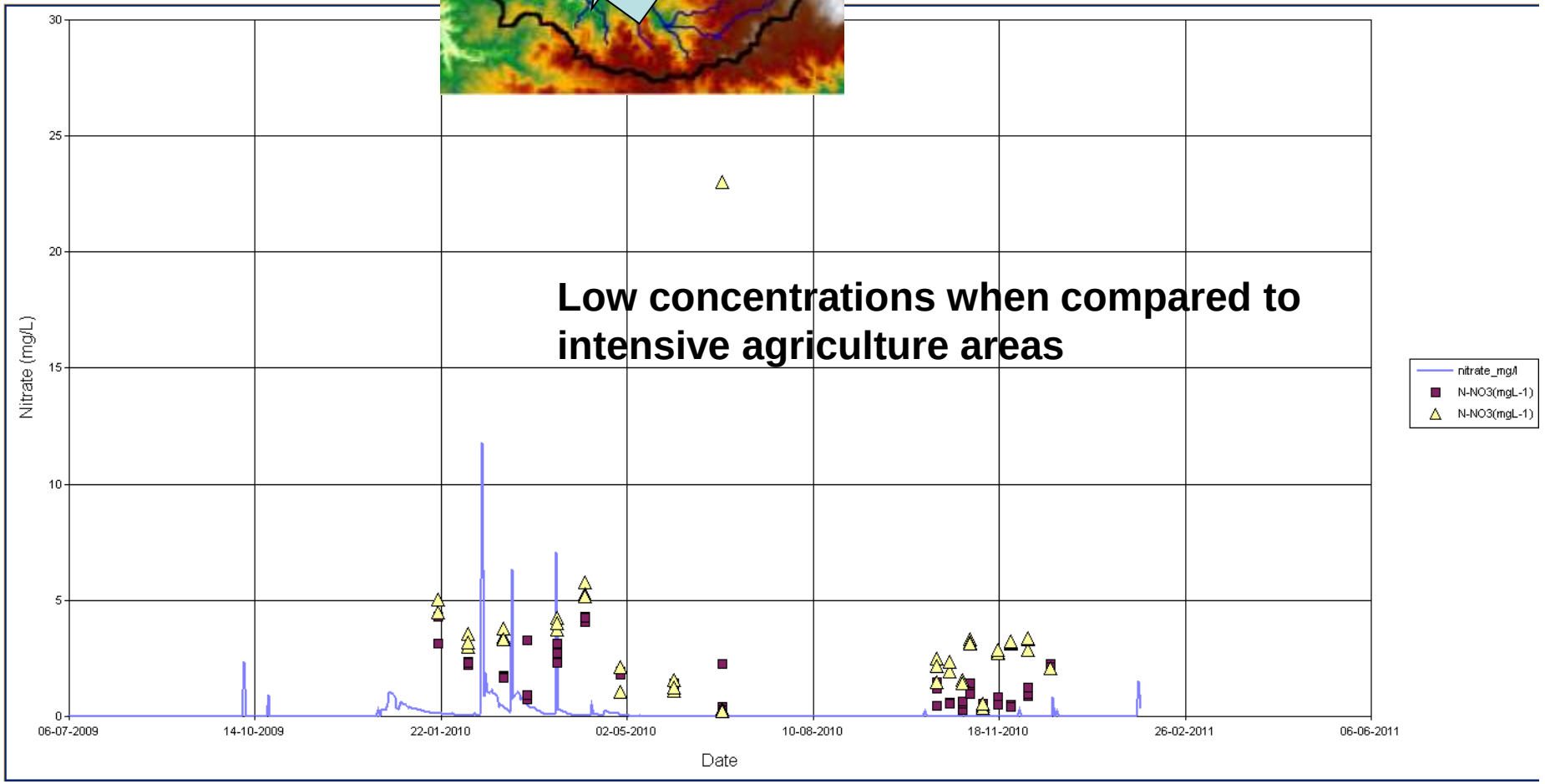
Nitrate (mgN/L)



SWAT

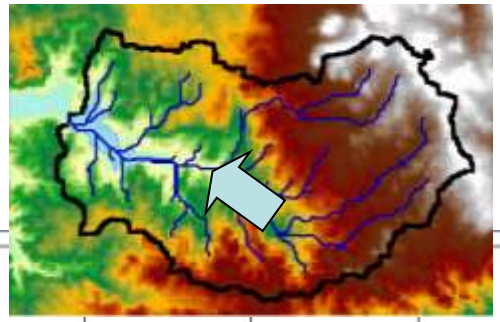
Data

Data



Water Quality Simulation - SWAT

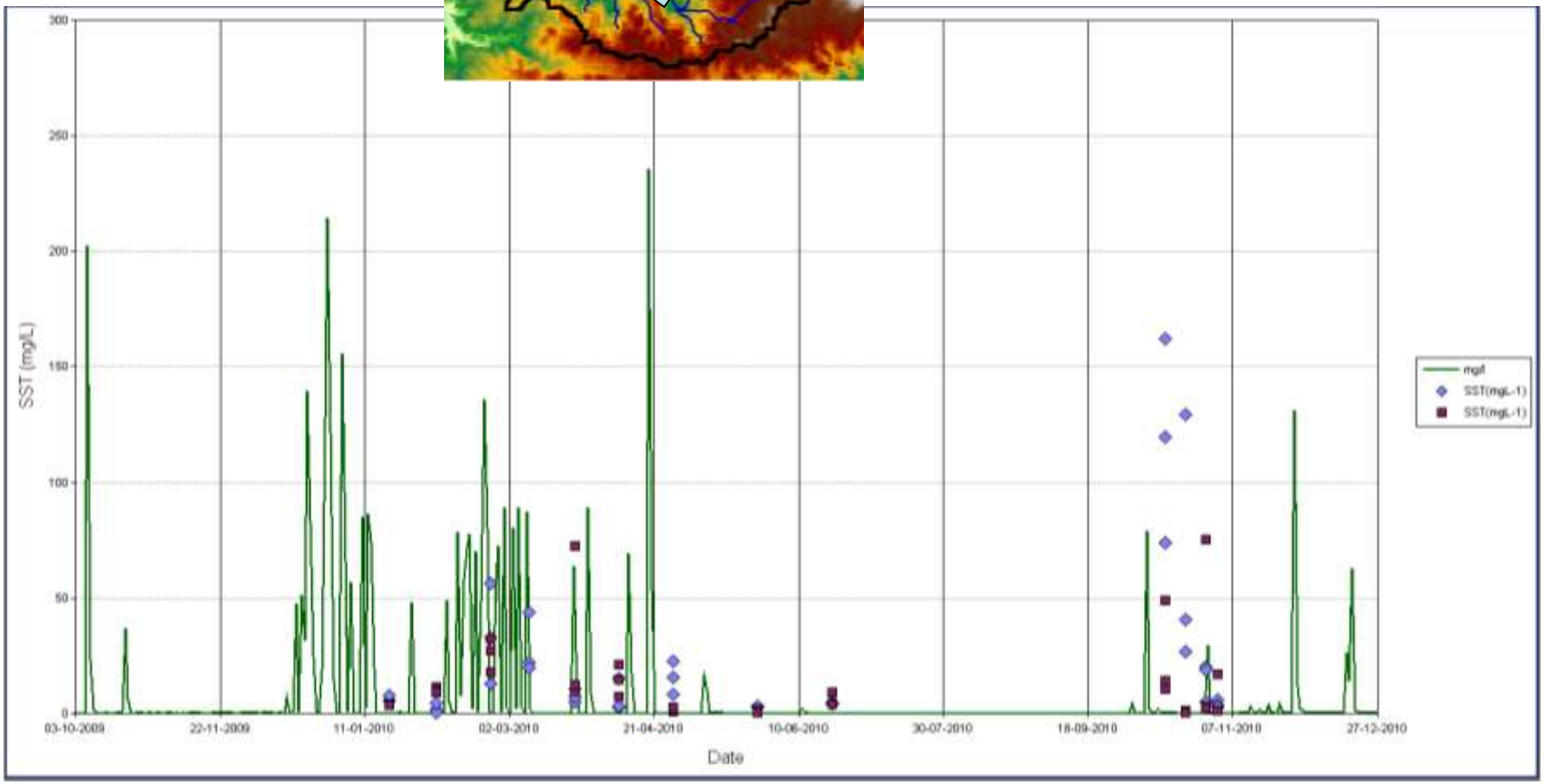
- SST (mg/L)



SWAT

Data

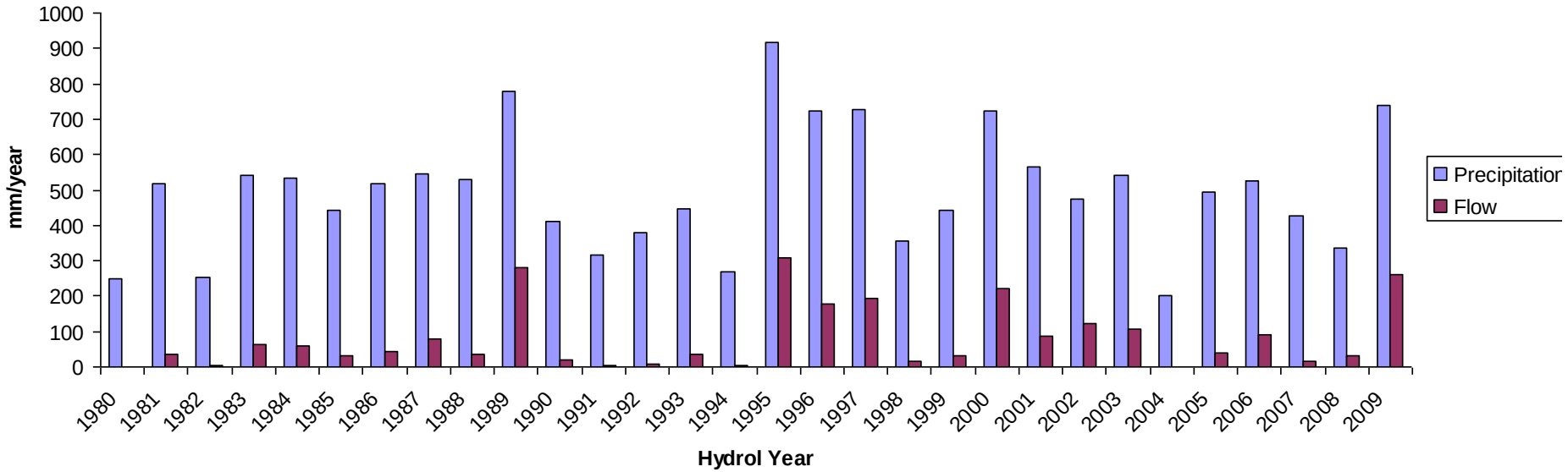
Data



- Validation in long term hydrodinamics and qualitatively water quality

- Balances

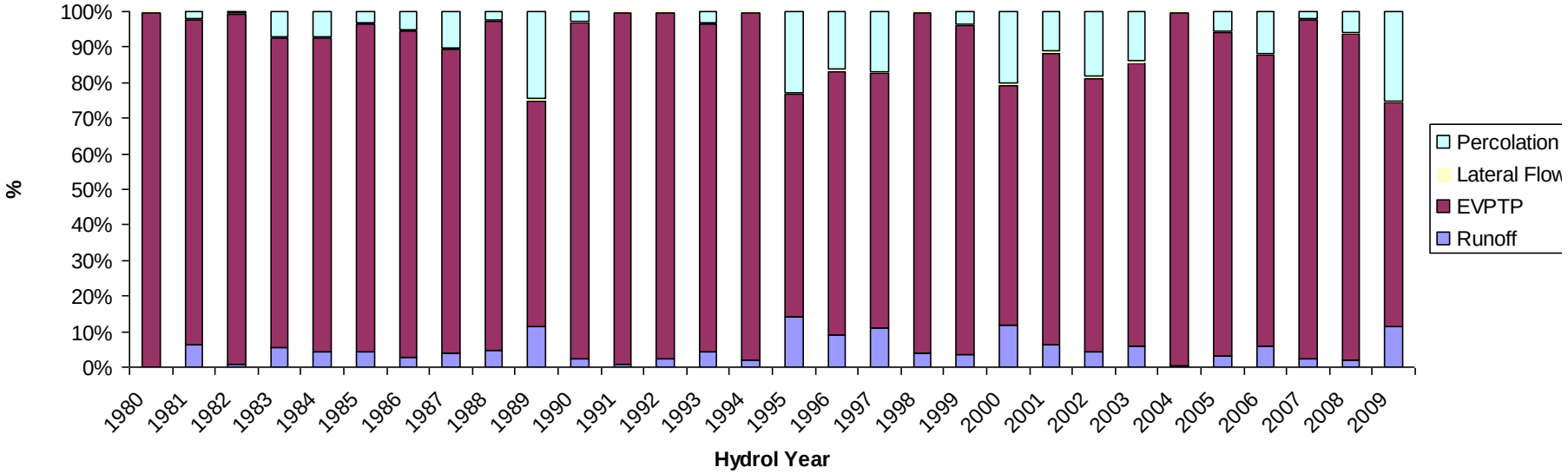
Water Balance 1980-2009

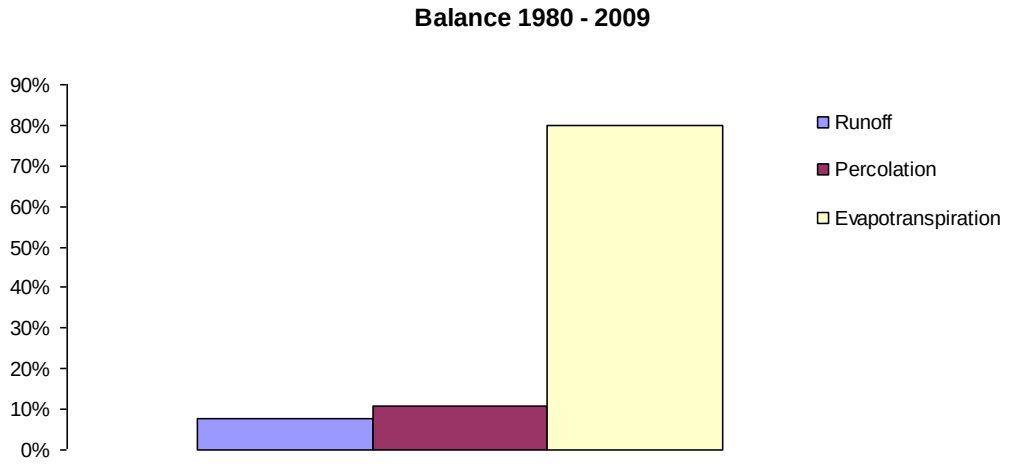


20% goes in river

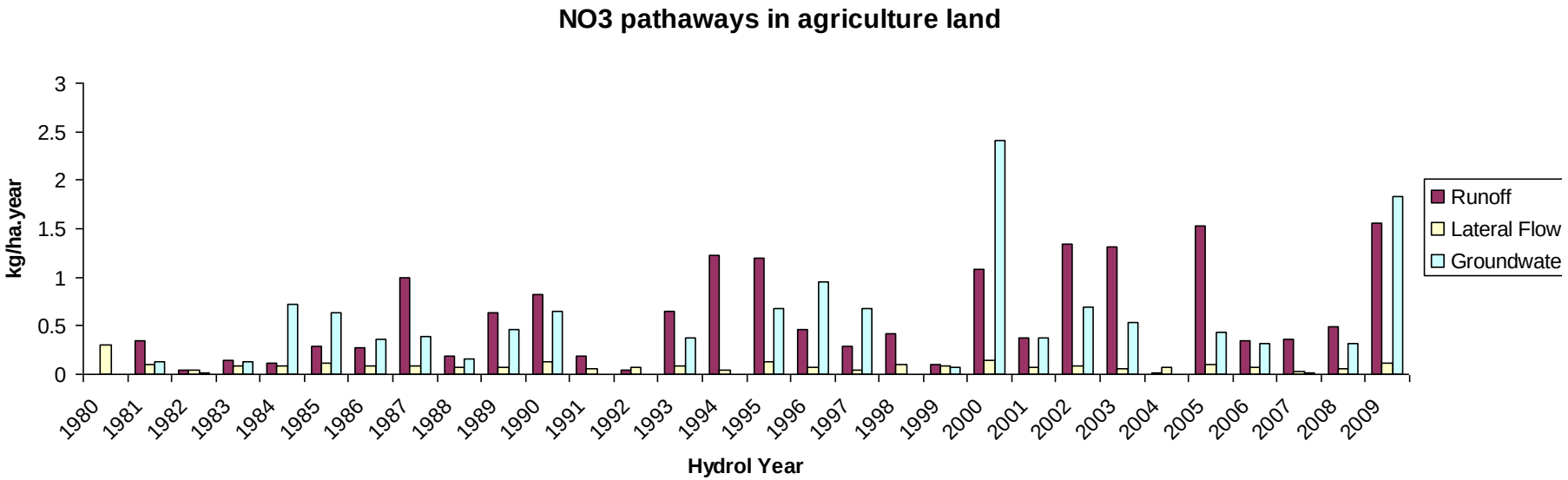
Water Balance 1980 - 2009

Precipitation – 500 mm



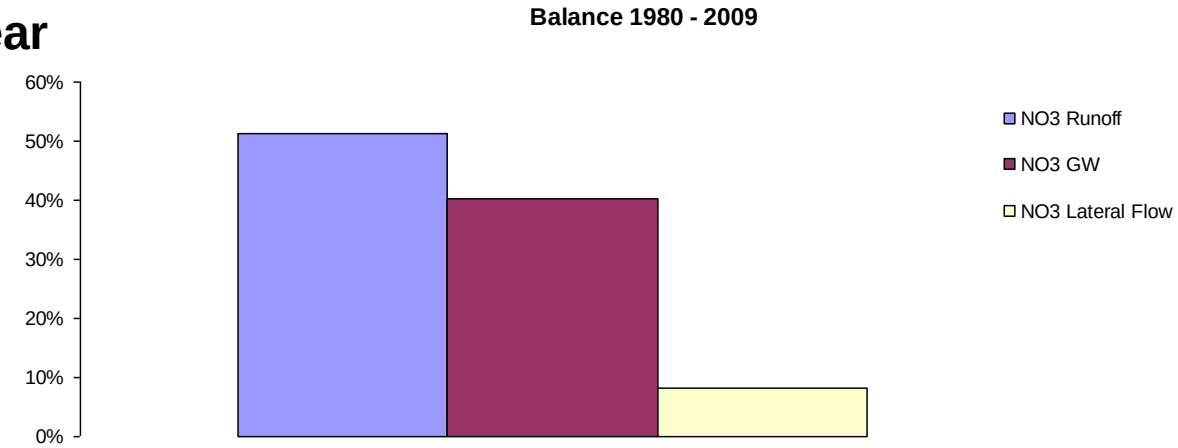


Nitrate Balance 1980 - 2009



->2 kg/ha.year

->10 kg/ha.year



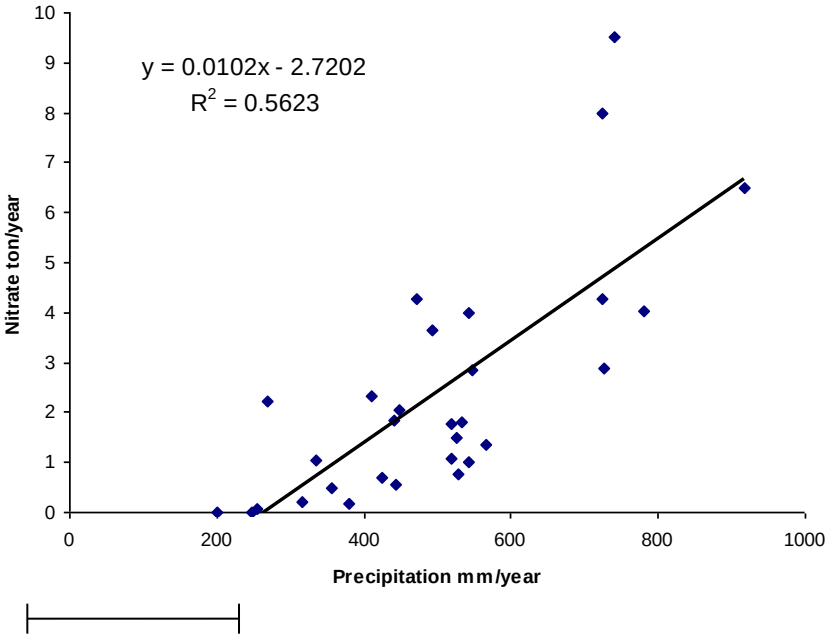
Montado

Irrigation

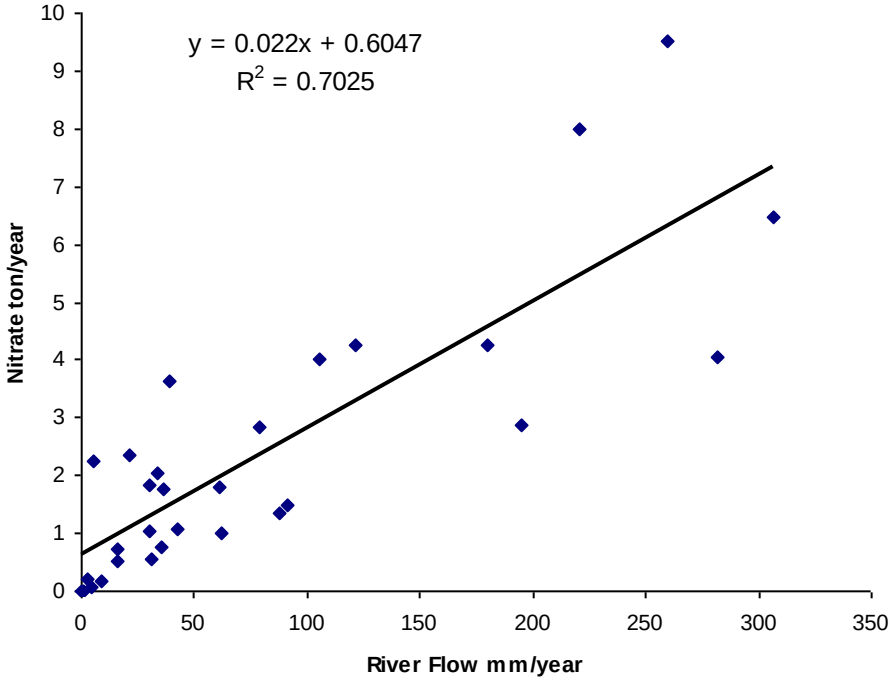
Olive

Small Farms

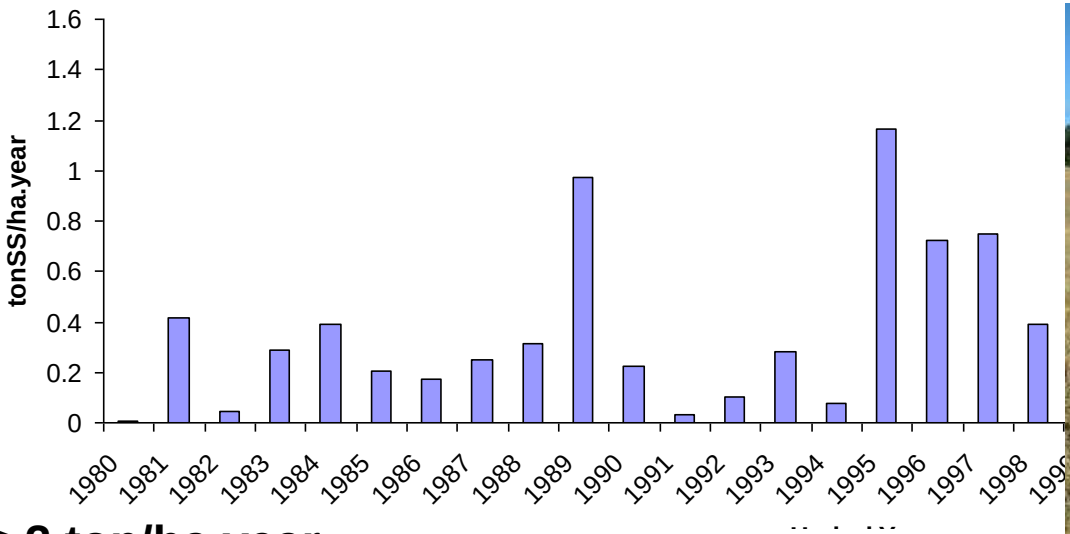
Nitrates vs. Water yield et Précipitations



Precipitation that does not get to river and not transport nitrate



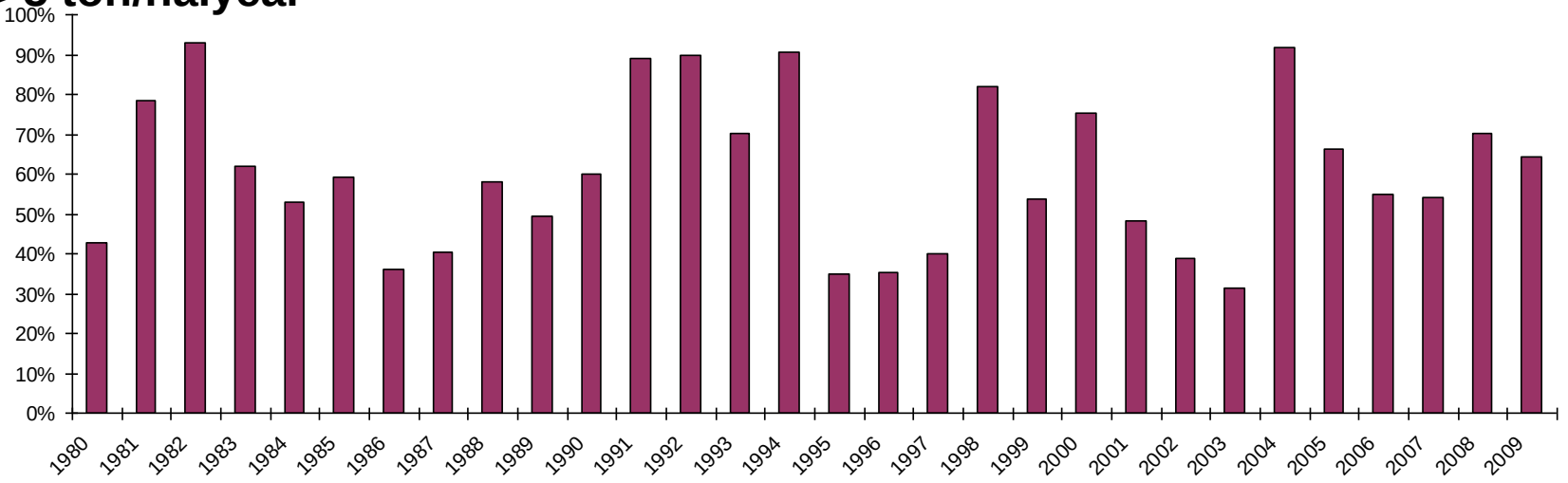
Soil Loss



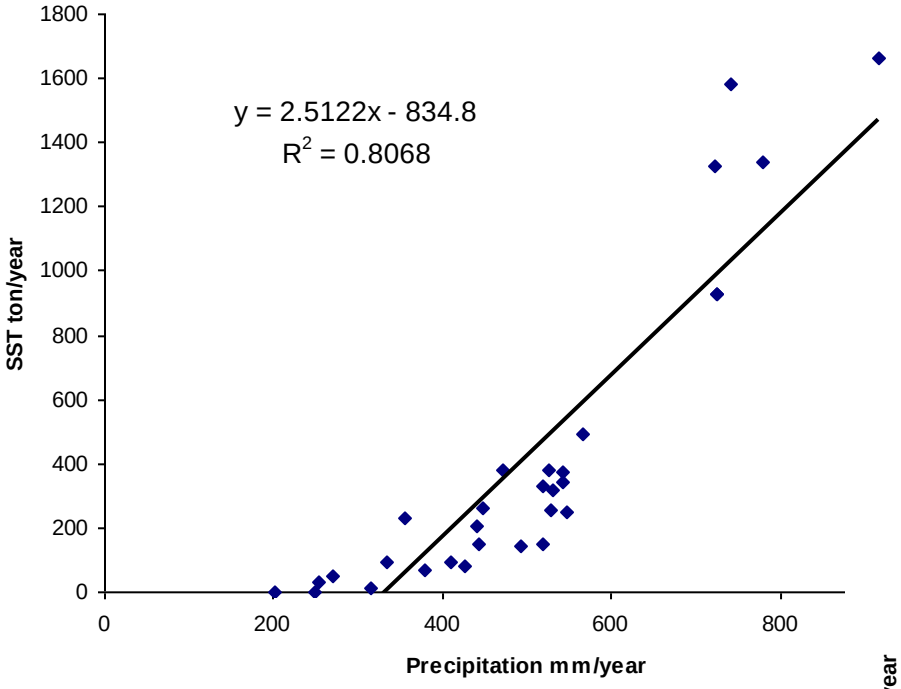
->2 ton/ha.year

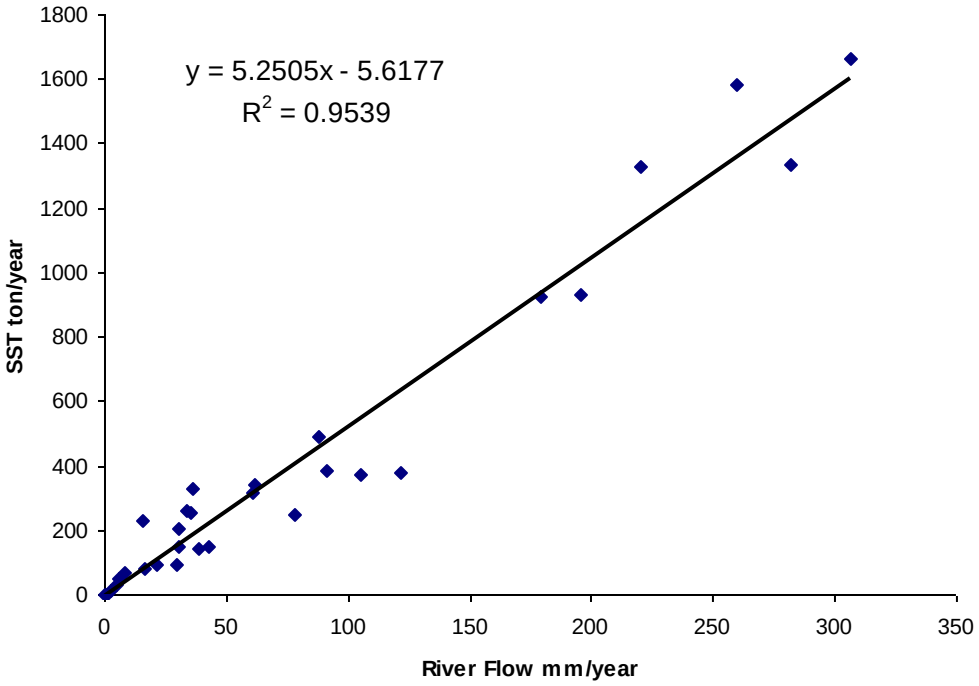
->5 ton/ha.year

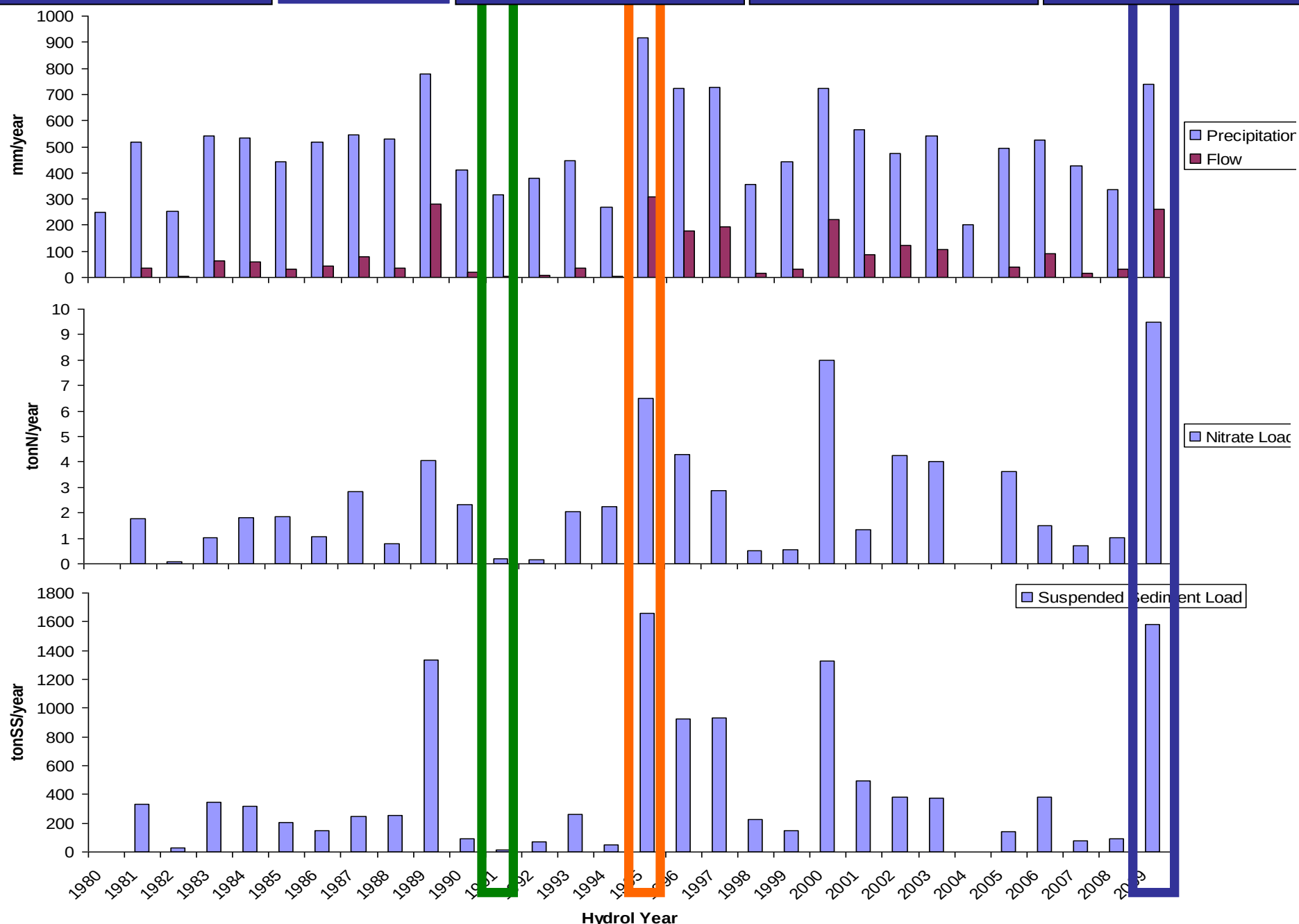
% of annual mass occuring in 2 to 4 days in year



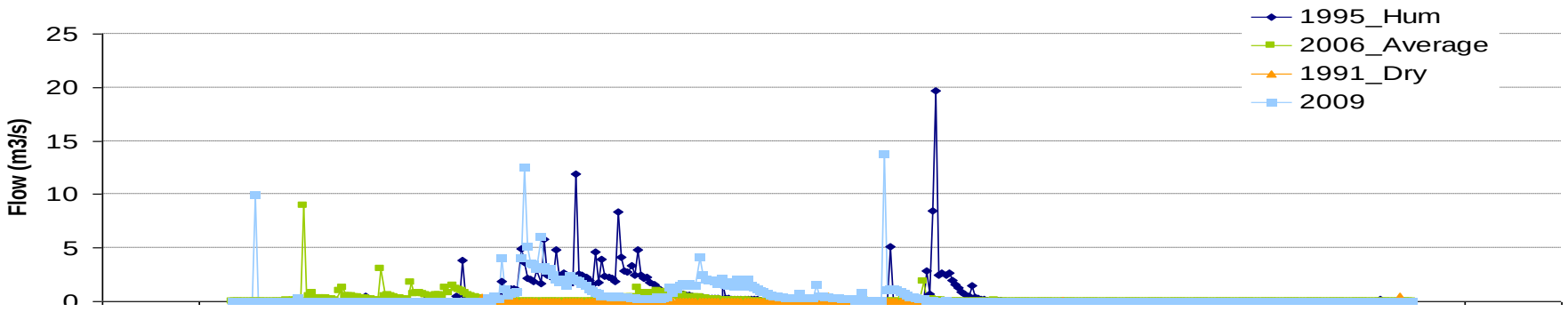
MES vs. Water yield et Précipitations



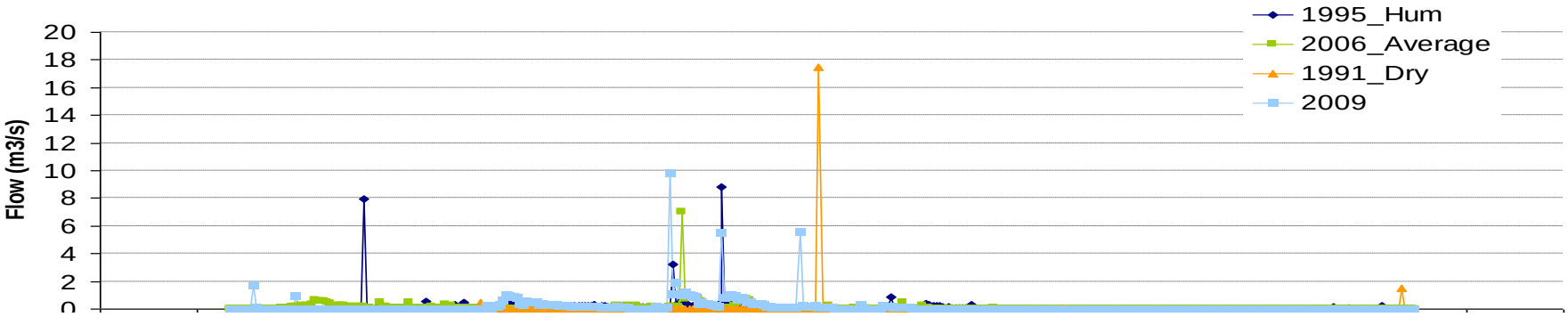



mm/year
Precipitation
Flow
tonN/year
Nitrate Load
tonSS/year
Suspended Sediment Load
Hydrol Year

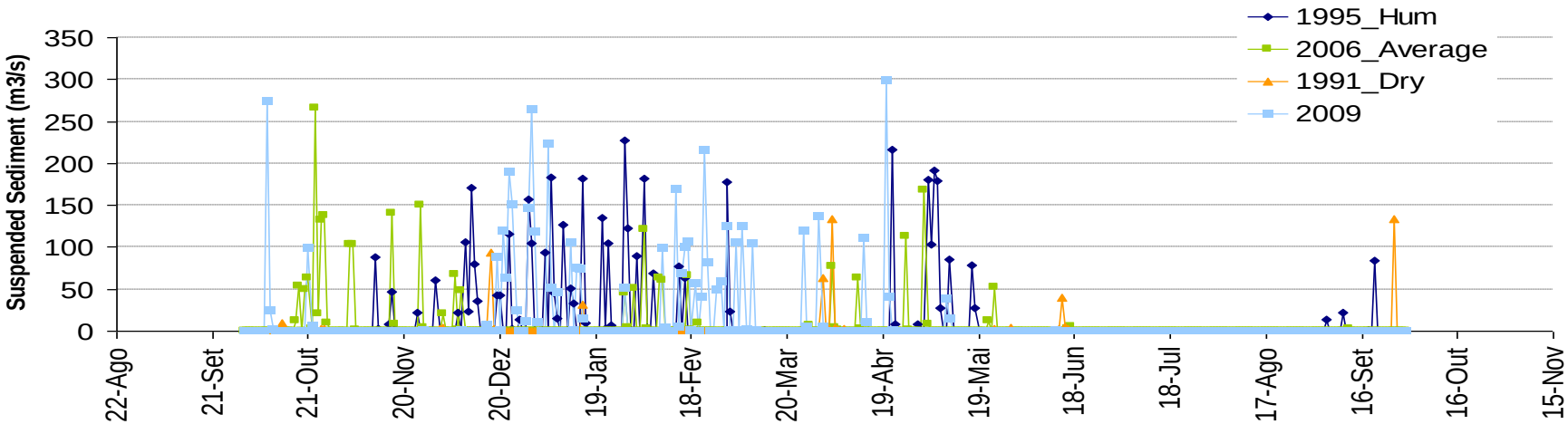
Flow Enxoé



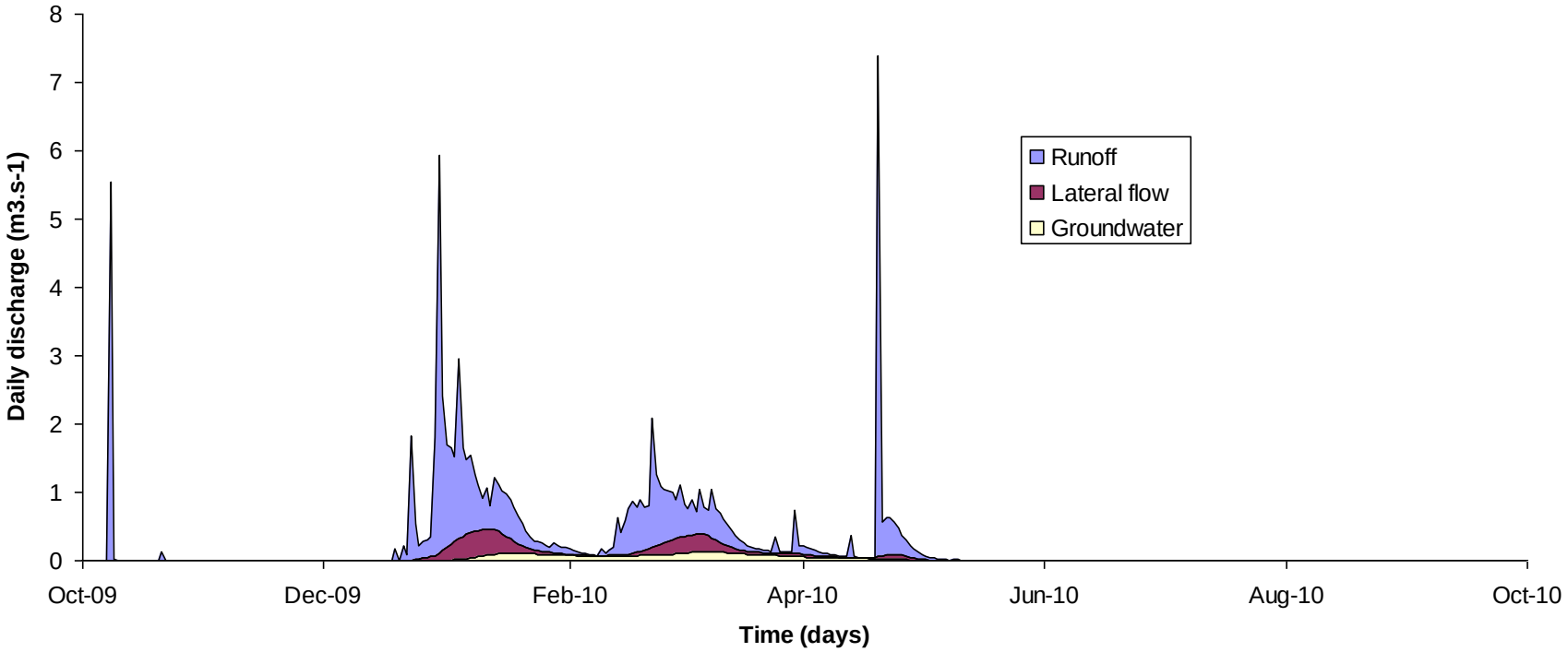
Nitrate Enxoé



Suspended Sediment Enxoé

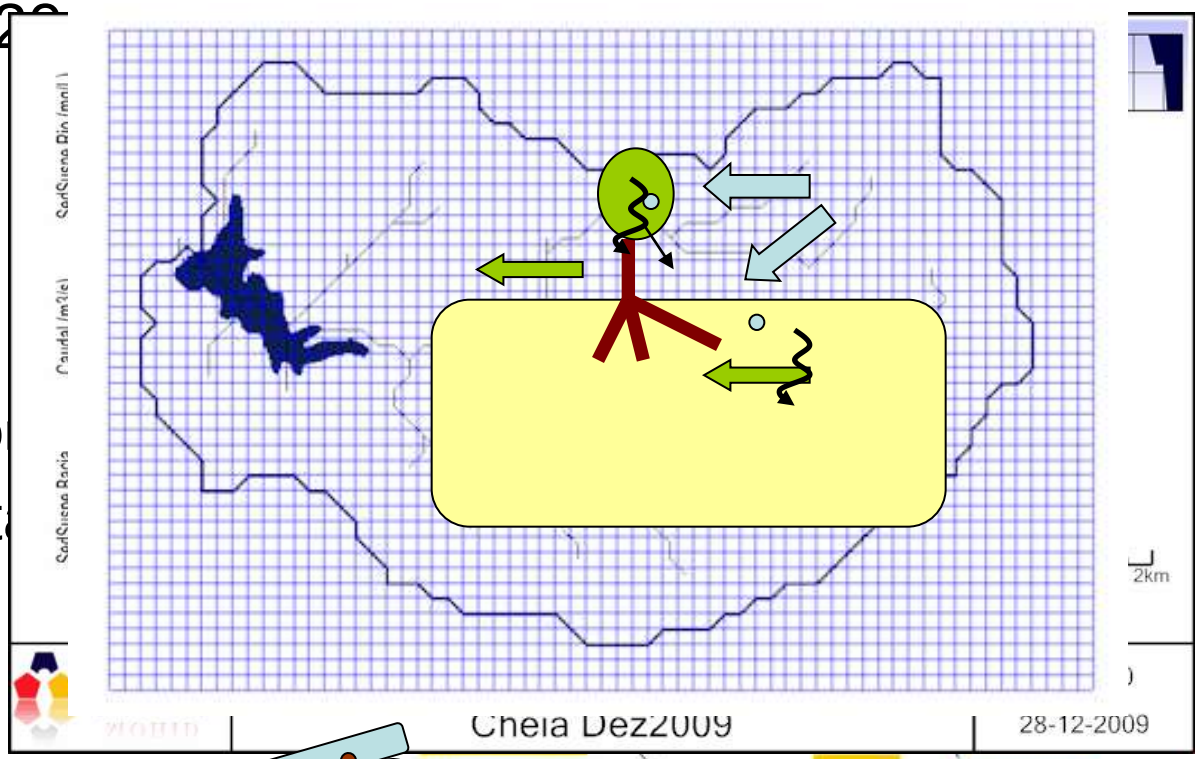


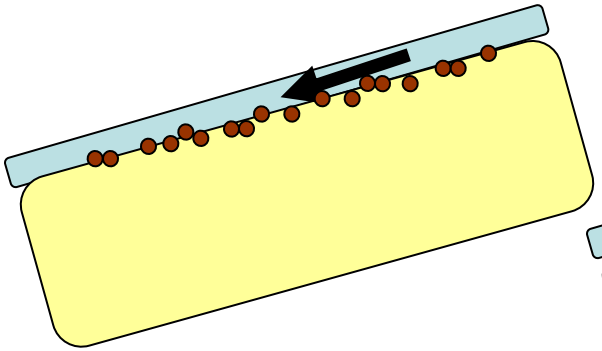
Flow decomposition

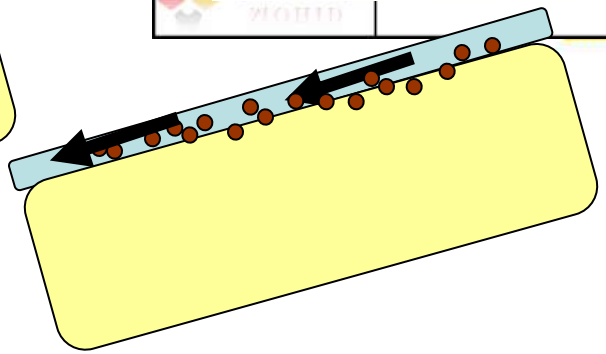


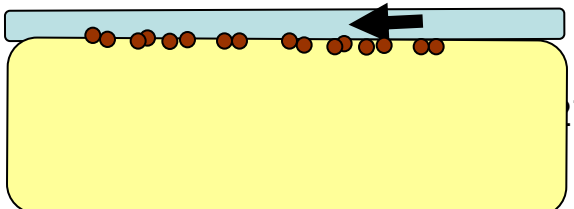
Mohid Land

- 60x40 cells 200mx2
- Developments
  - Vegetation
  - Property transport
  - Erosion/deposition
  - Pesticide applicatio
- Data for implement
- Data for validation

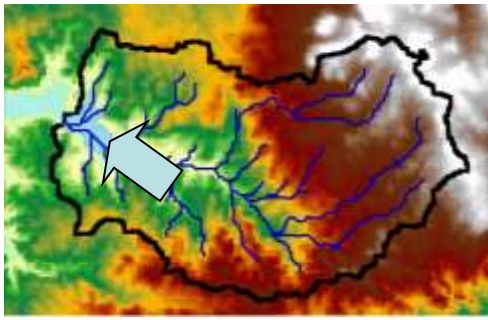


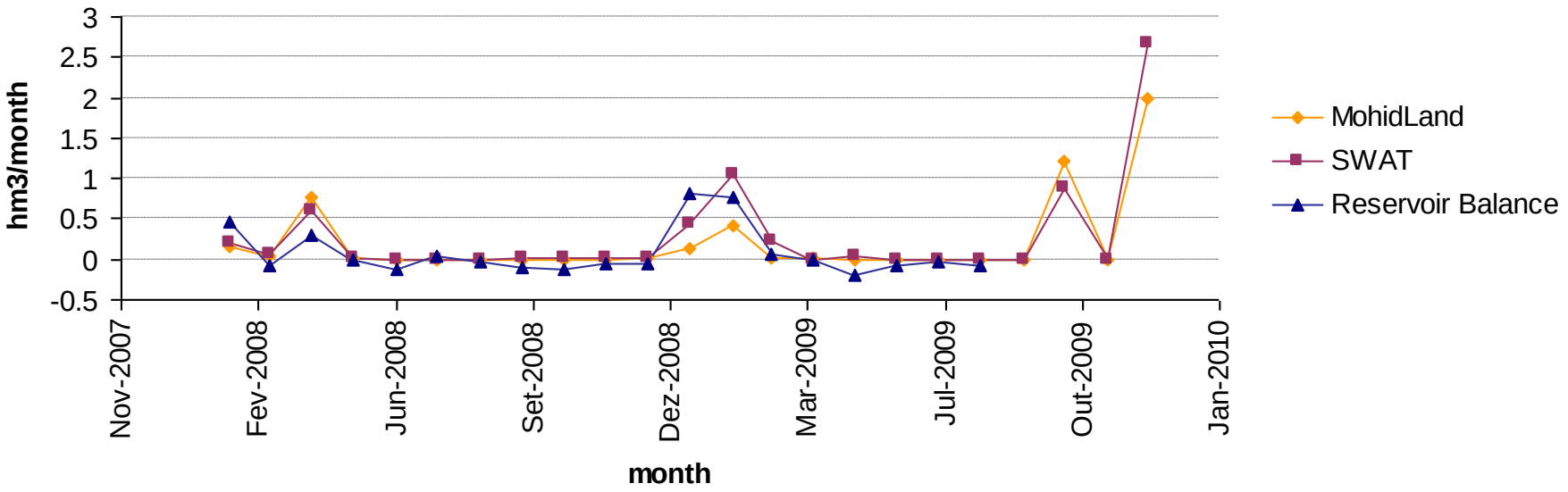






Comparison





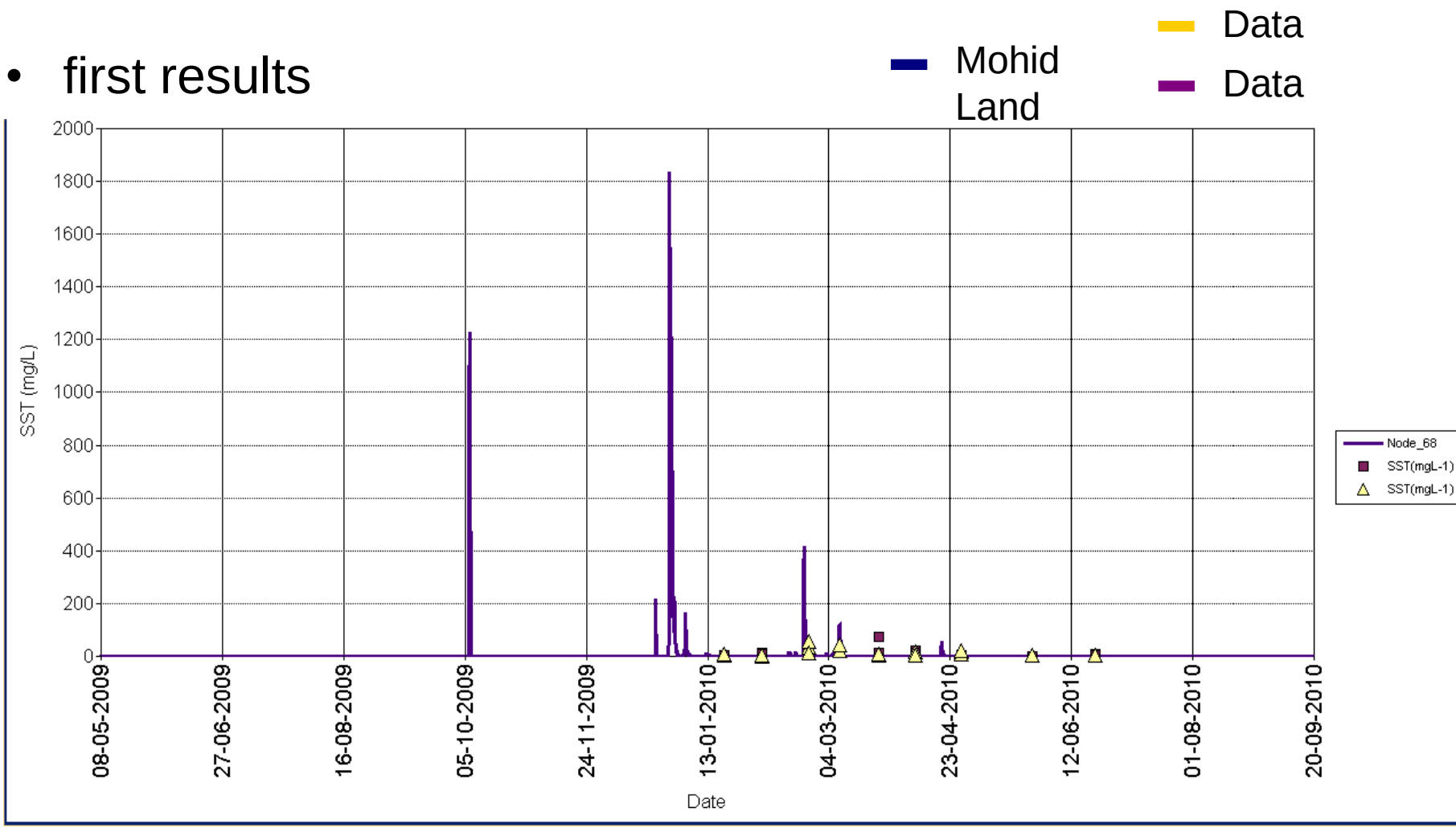
Jan-Fev 2009

SWAT ET 15-20% Precip

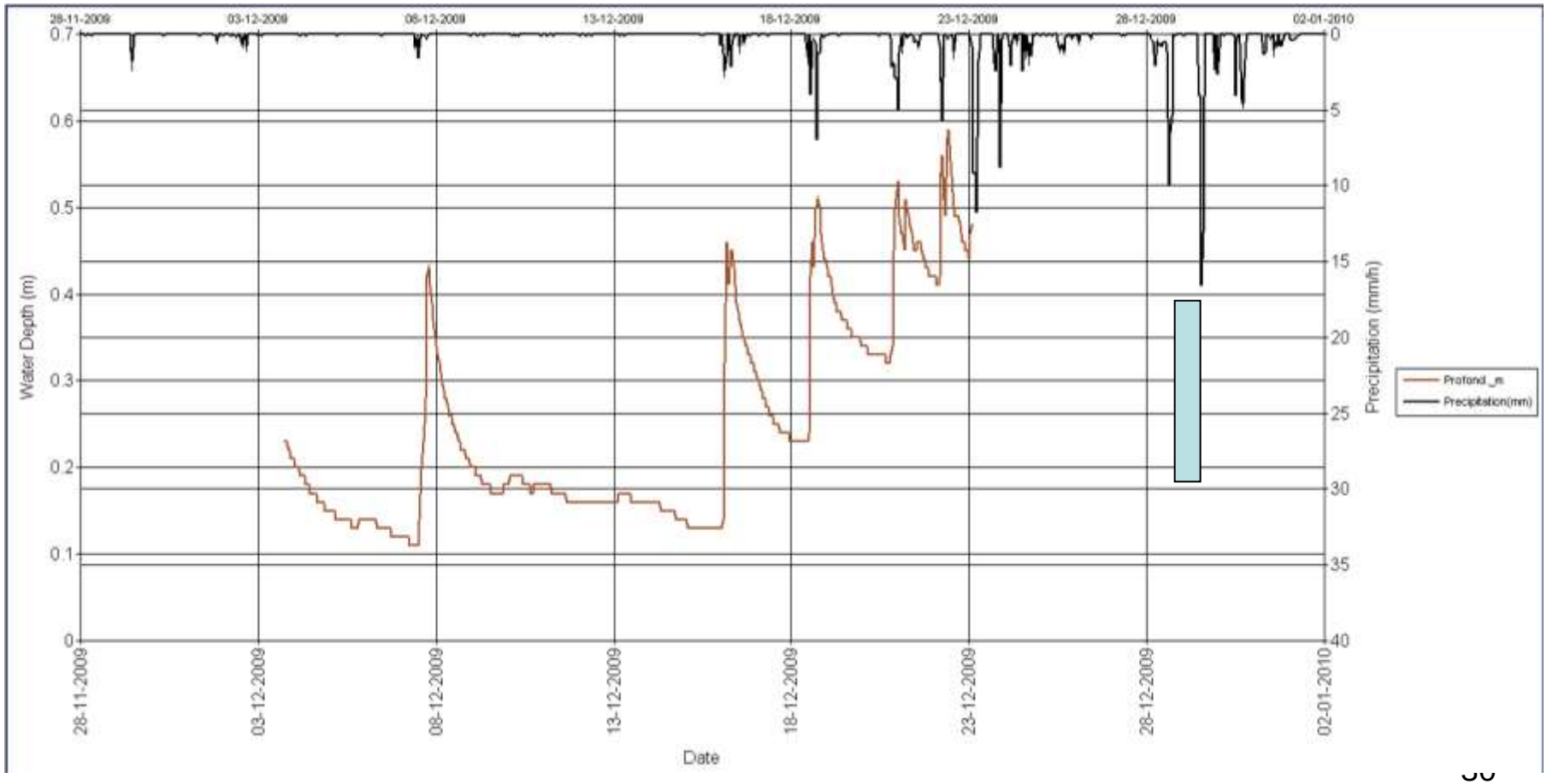
MOHID LAND ET 30%-50% Precip

SST

- first results

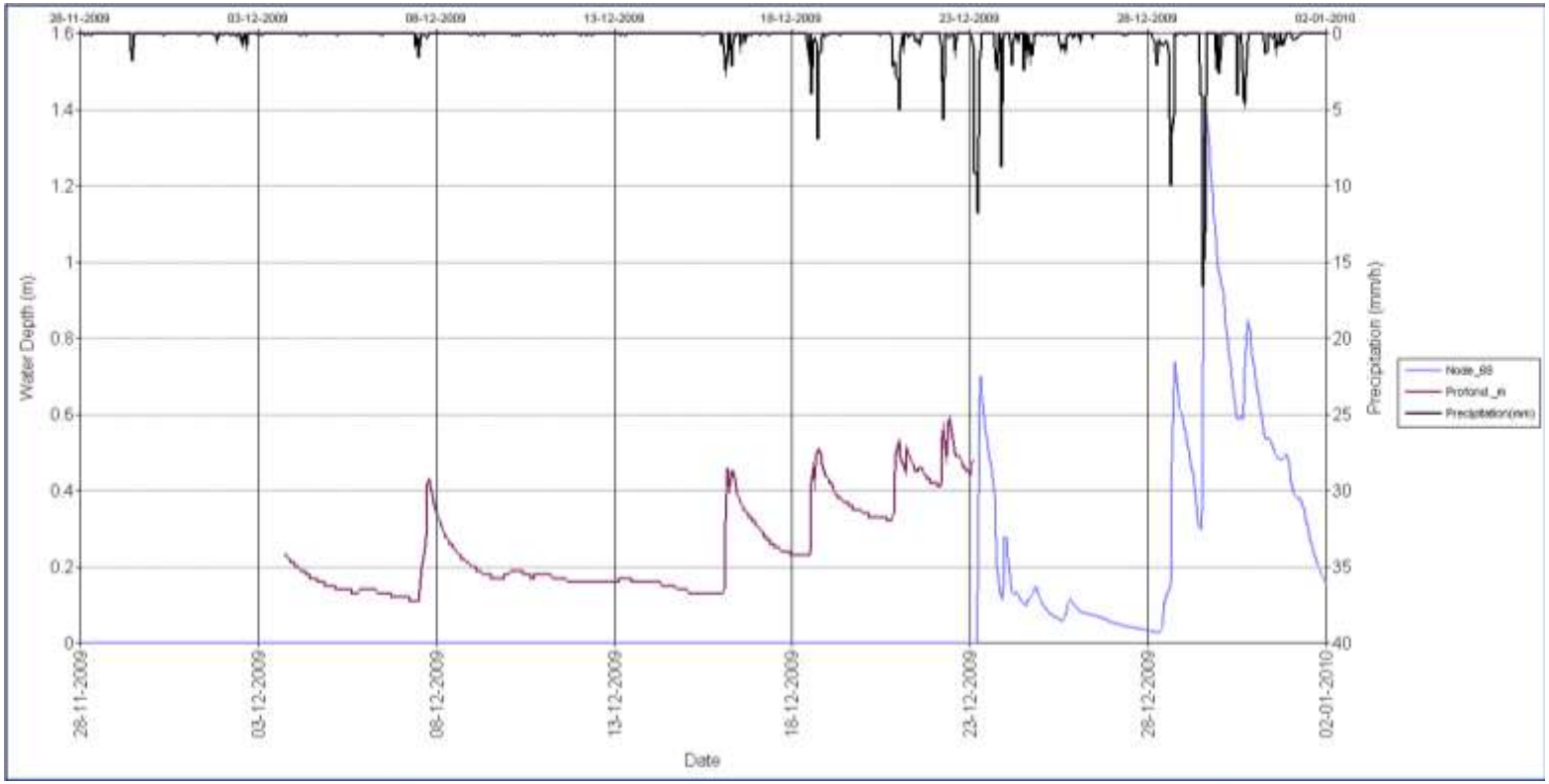


December 2009 events



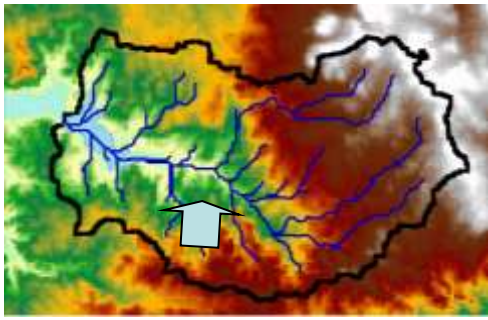
December 2009 events

- Water Depth

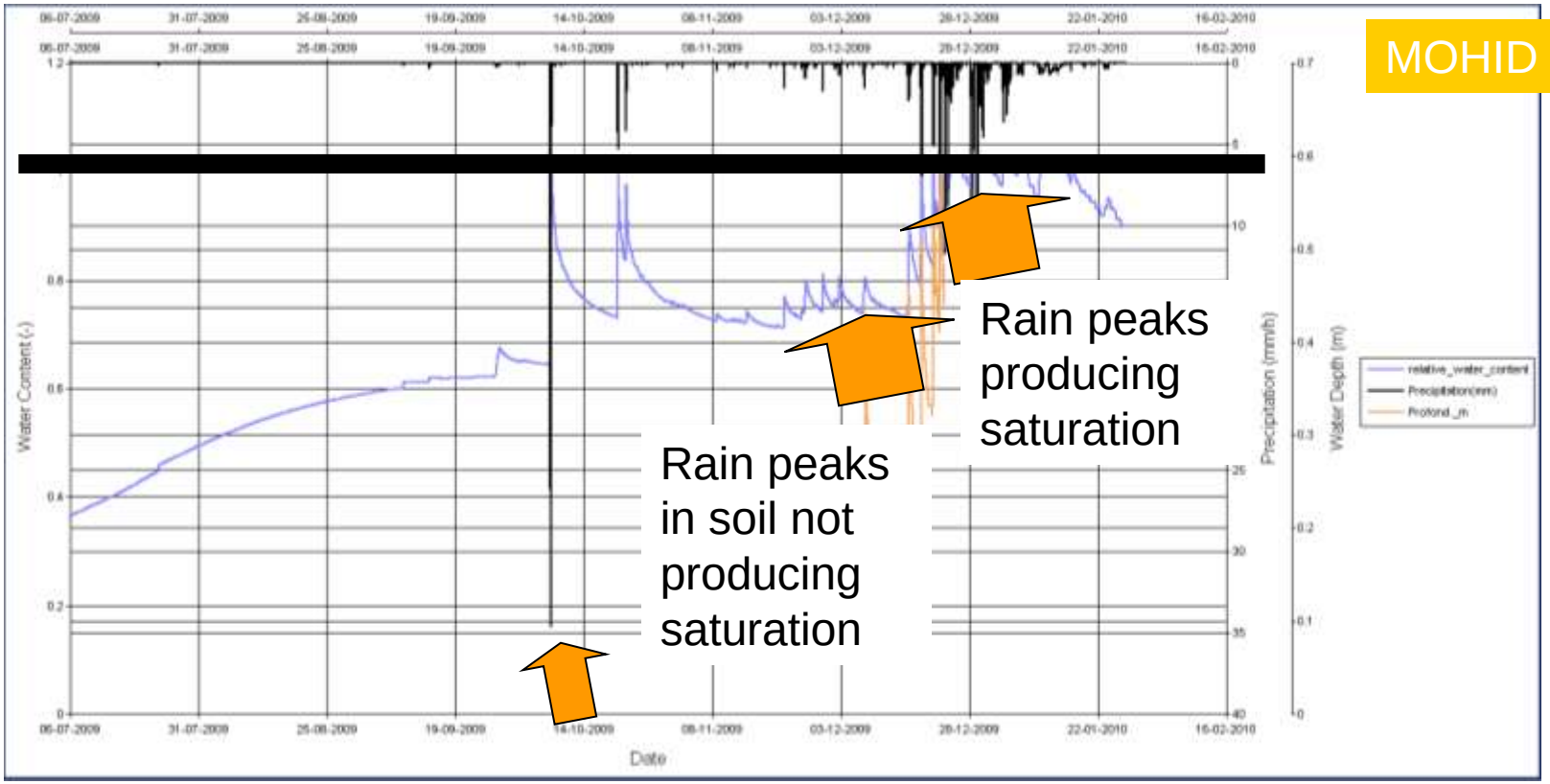


Probe MOHID

December 2009 events

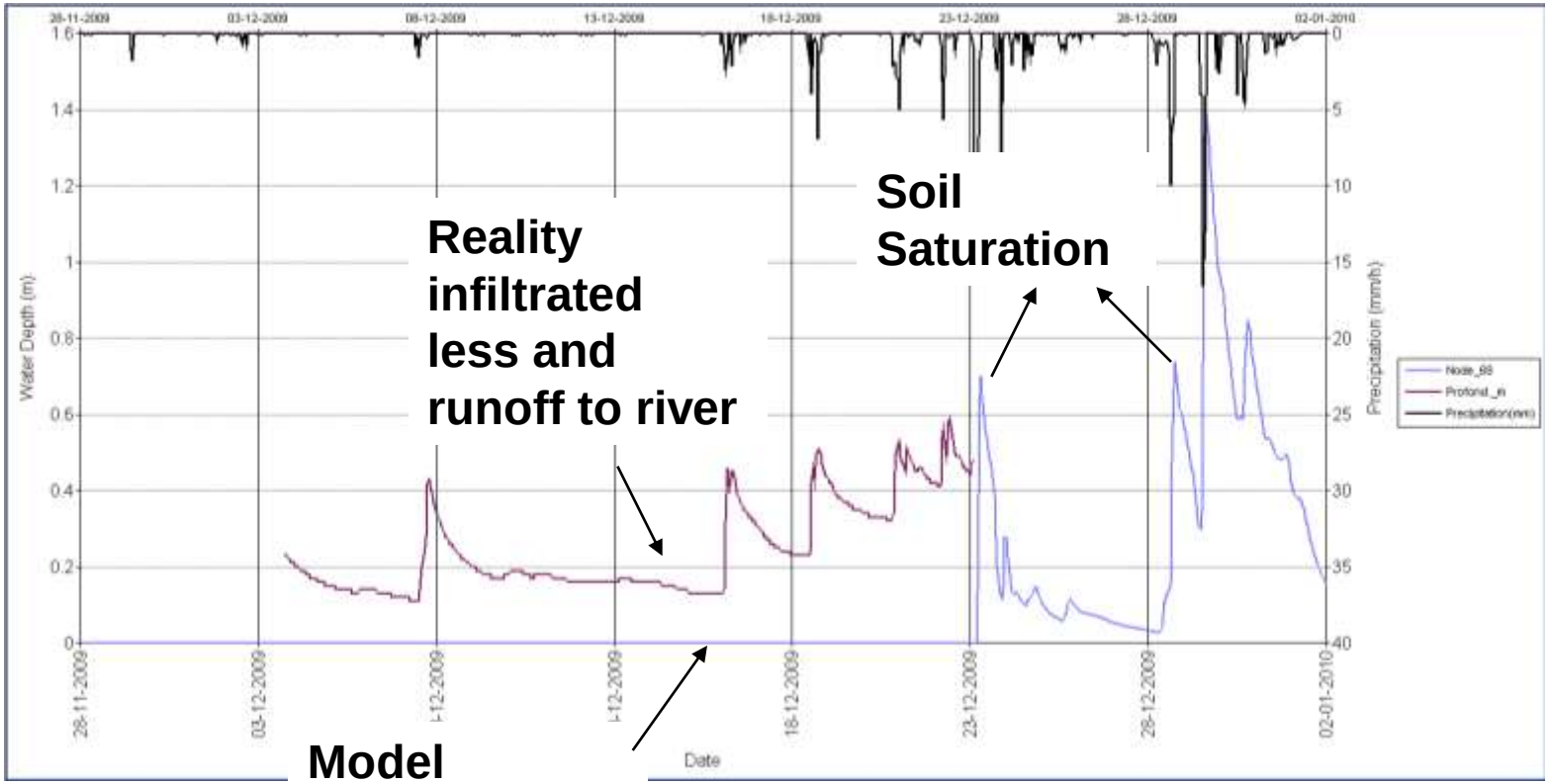


- Where did the water went to?
  - Peaks inside soil – surface layer

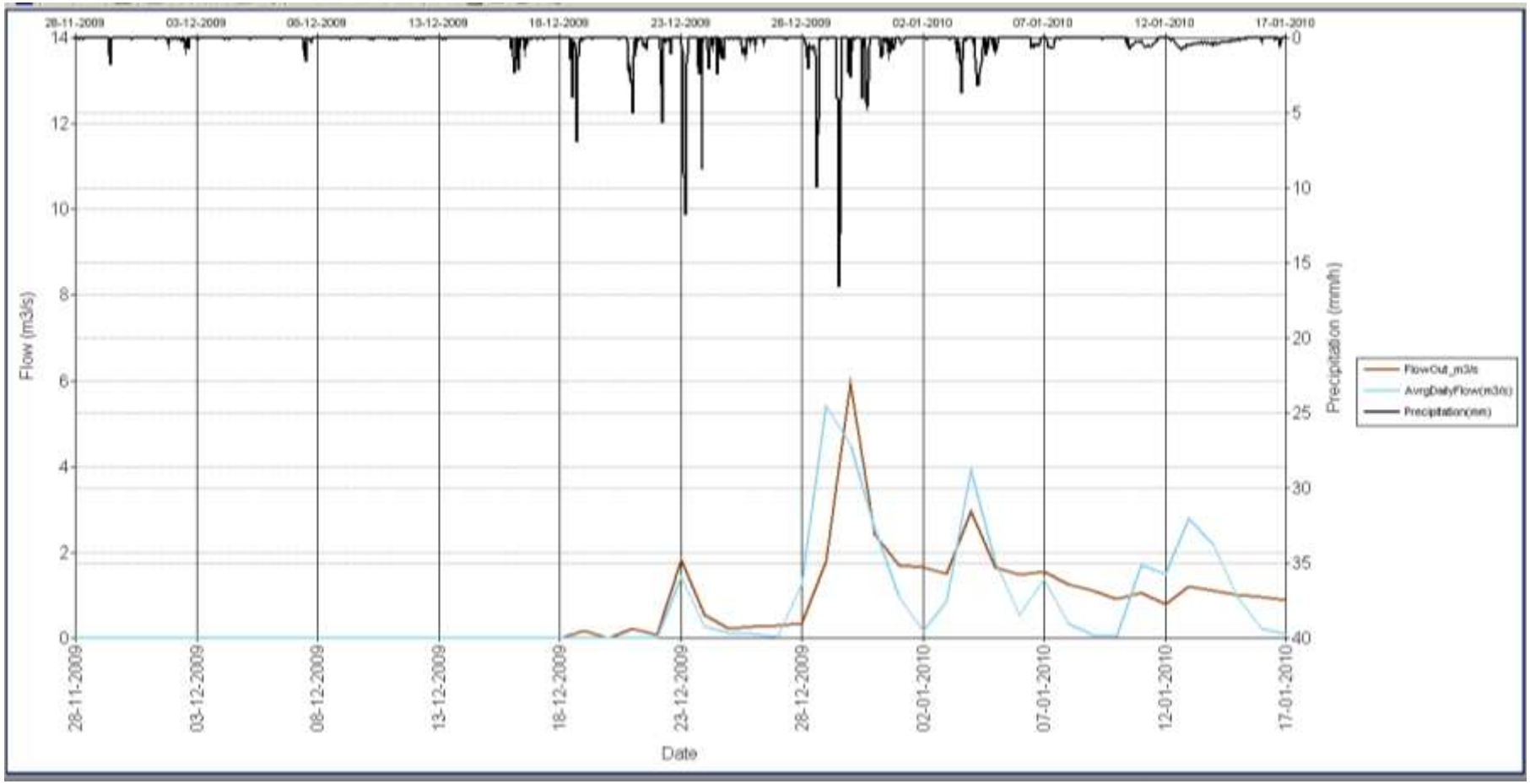


December 2009 events

- Water Depth

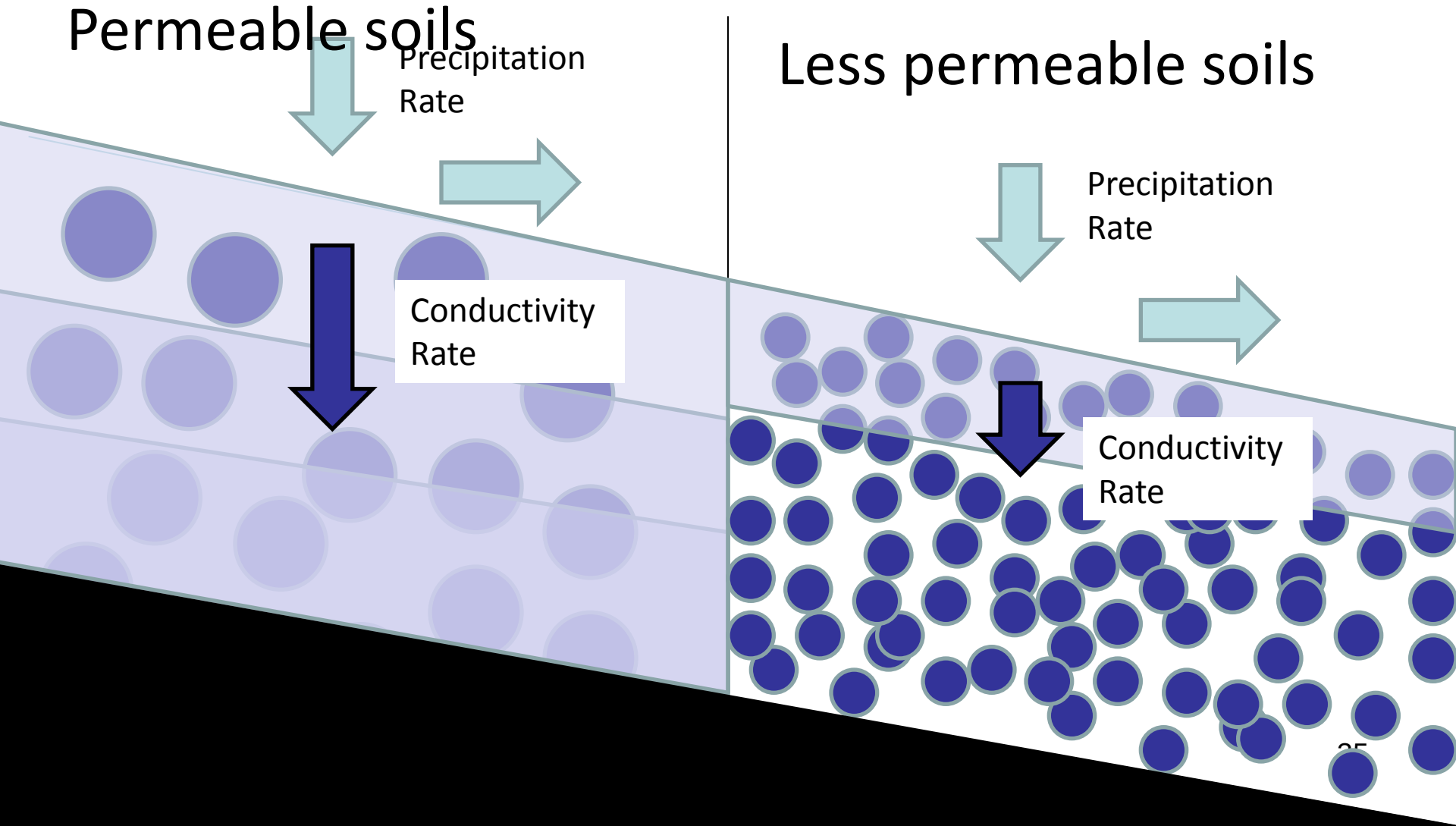


December 2009 events



SWAT MOHID

Runoff Processes



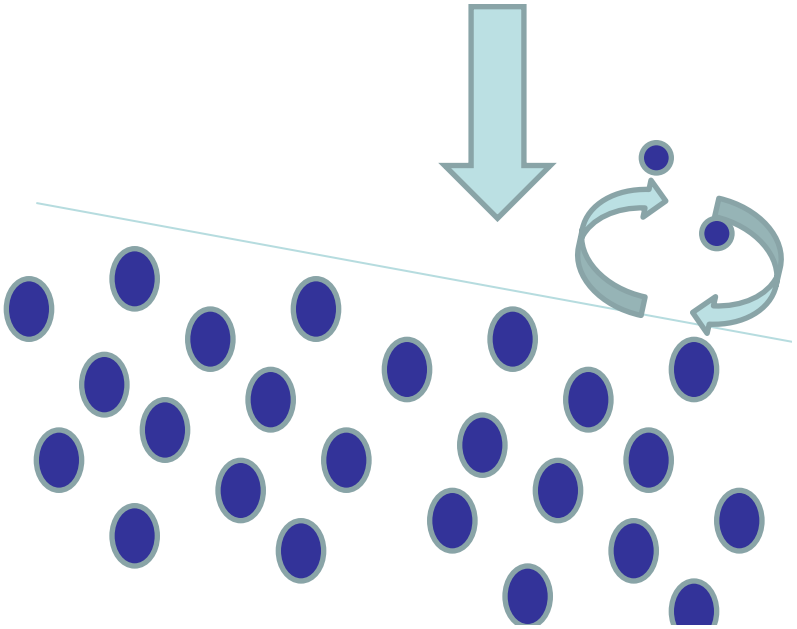
Sensitivity analysis

- Mohid Land a physic tool to understand dynamics
- Sensibility Tests
  - Lowering conductivity (promoting infiltration excess)
  - Reducing soil depth (promoting saturation excess)
  - Reducing surface rugosity (promoting flow)

Bibliography

  - Impermeabilization, soil surface sealing ?

Soil sealing Processes



Then dries out and forms a crust with low permeability

Assouline, S. and Y. Mualem, 2000, Modeling the dynamics of soil properties. Water Resour. Res. 6:2341-2349.

Assouline and Y. Mualem, 2001, Soil seal formation and its effect approximation. Water Resour. Res. 37(2):297-306.

Assouline, S. and Y. Mualem, 2002, Infiltration during soil sealing: Water Resour. Res. 38(12):1286-1293.

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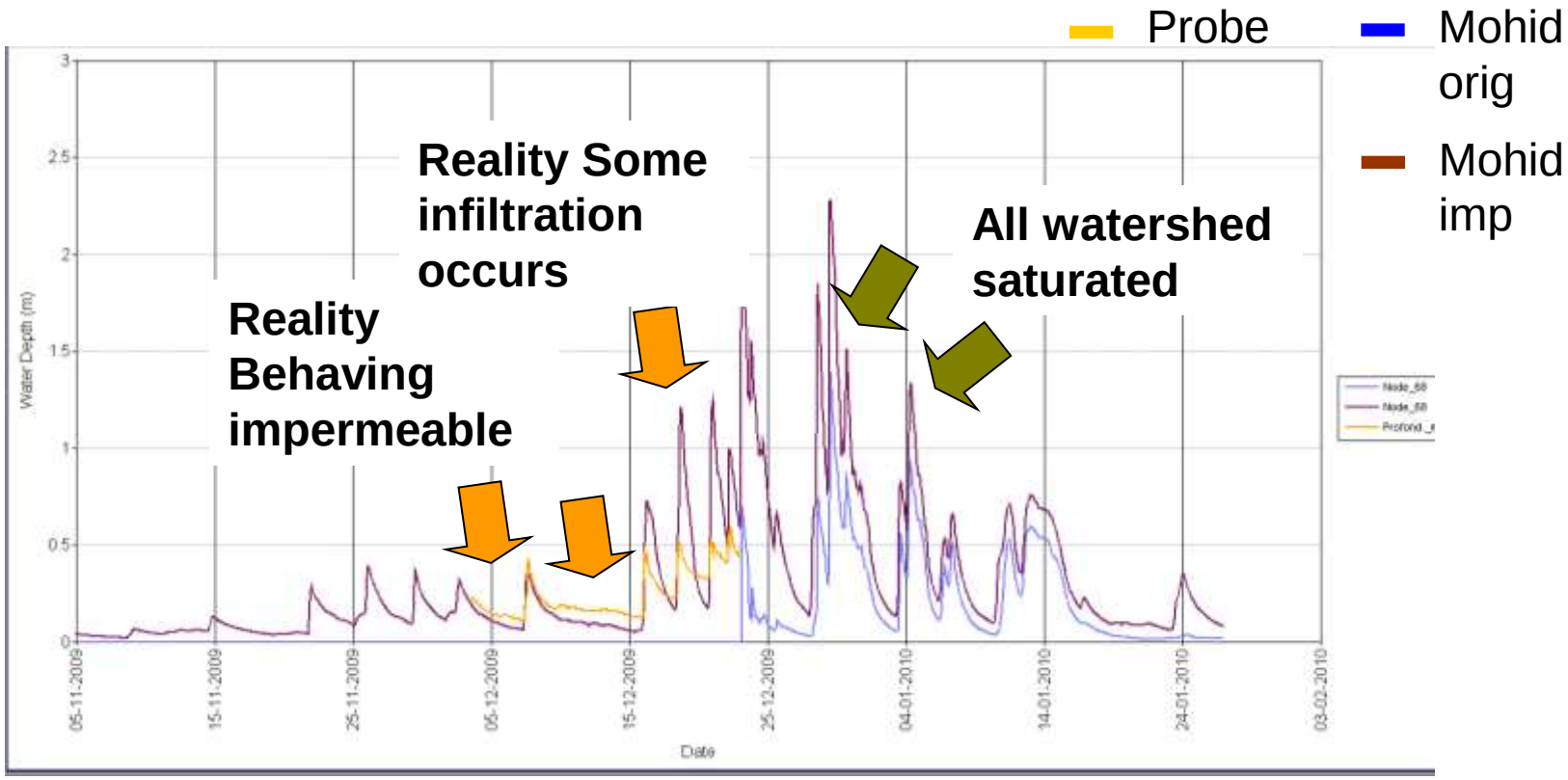
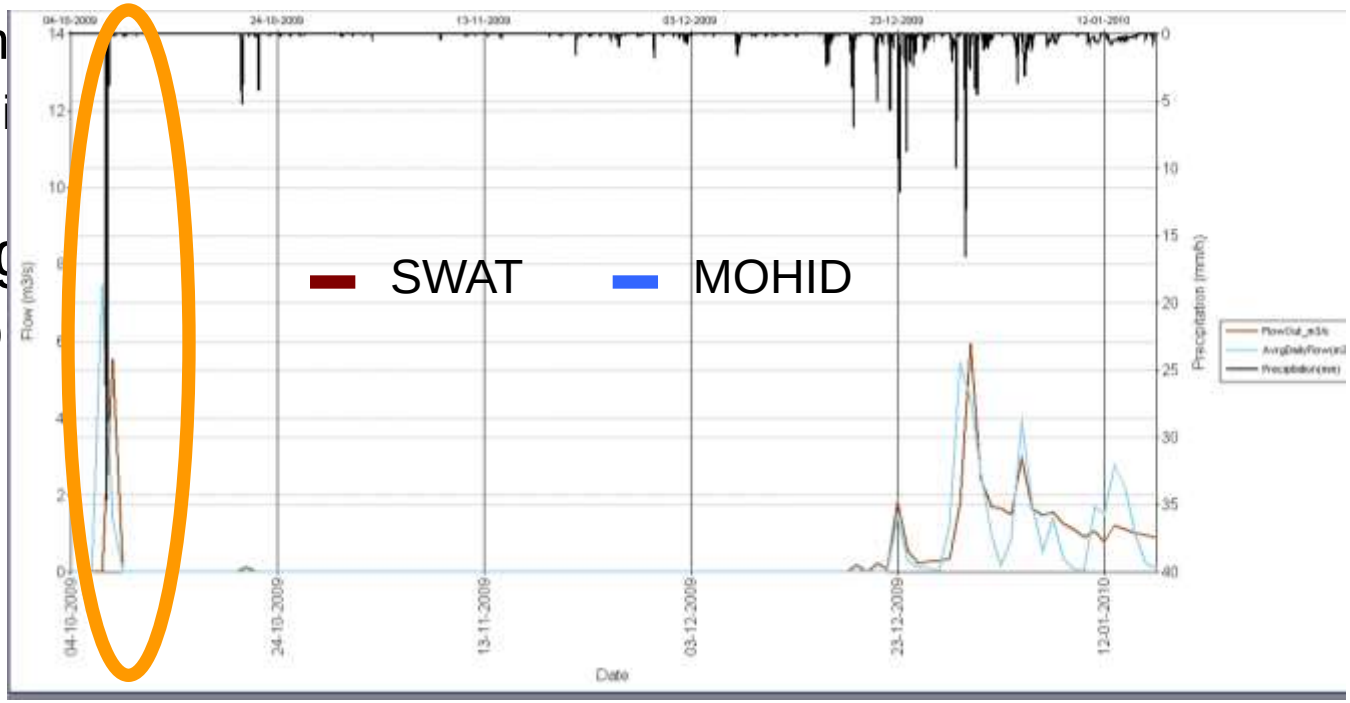
December 2009 events

- Impermeability Results

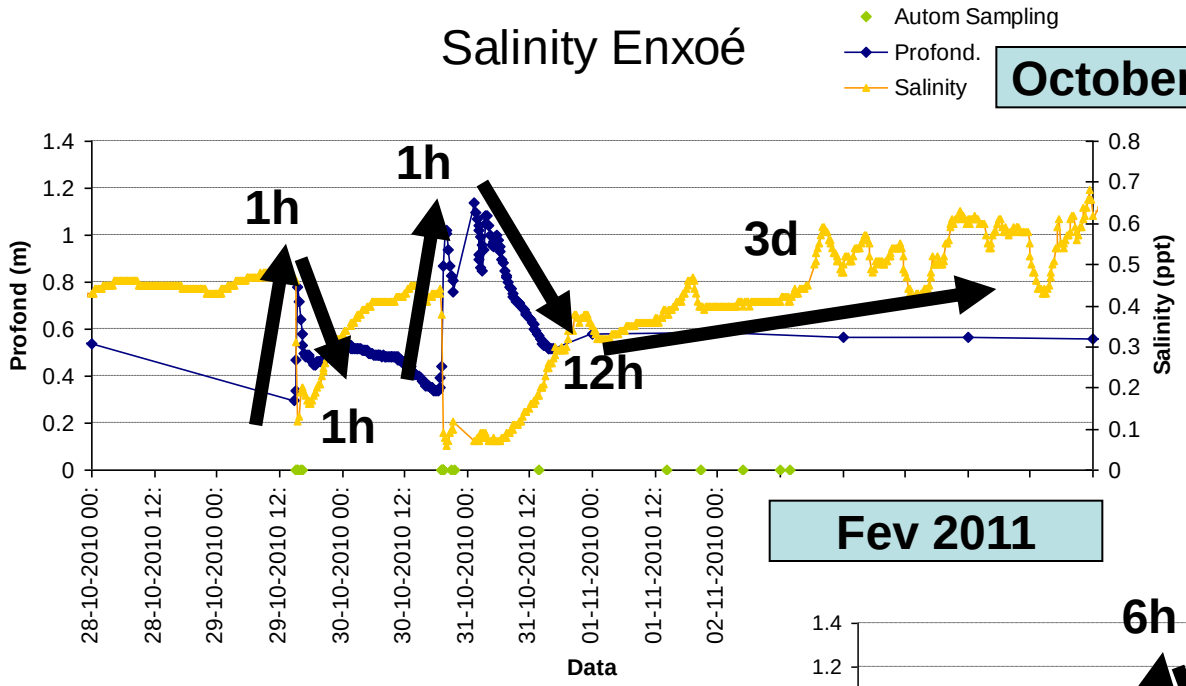


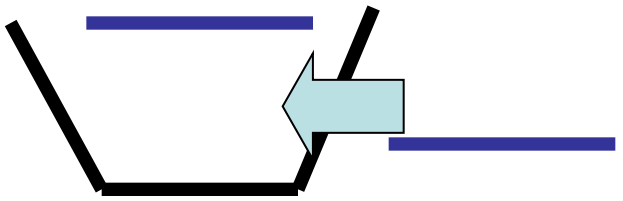
Hint: Watershed is not impermeable but behaving has impermeable

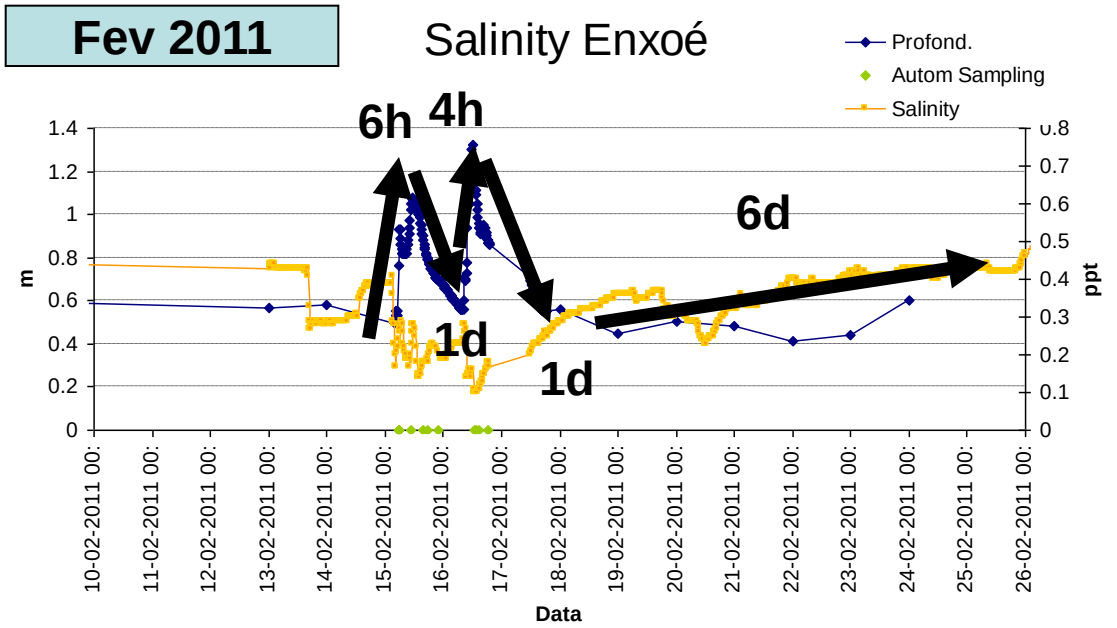
- Enxoé behaviour in December peaks
  - Related to impermeability or resistence to infiltration (as impermeable)
  - It could be ponctual behaviour – related to high precipitaion event in October (65mm in 2h)
  - Next action
    - See if thi
      records.
- Models are g
  and with Mo



What data says

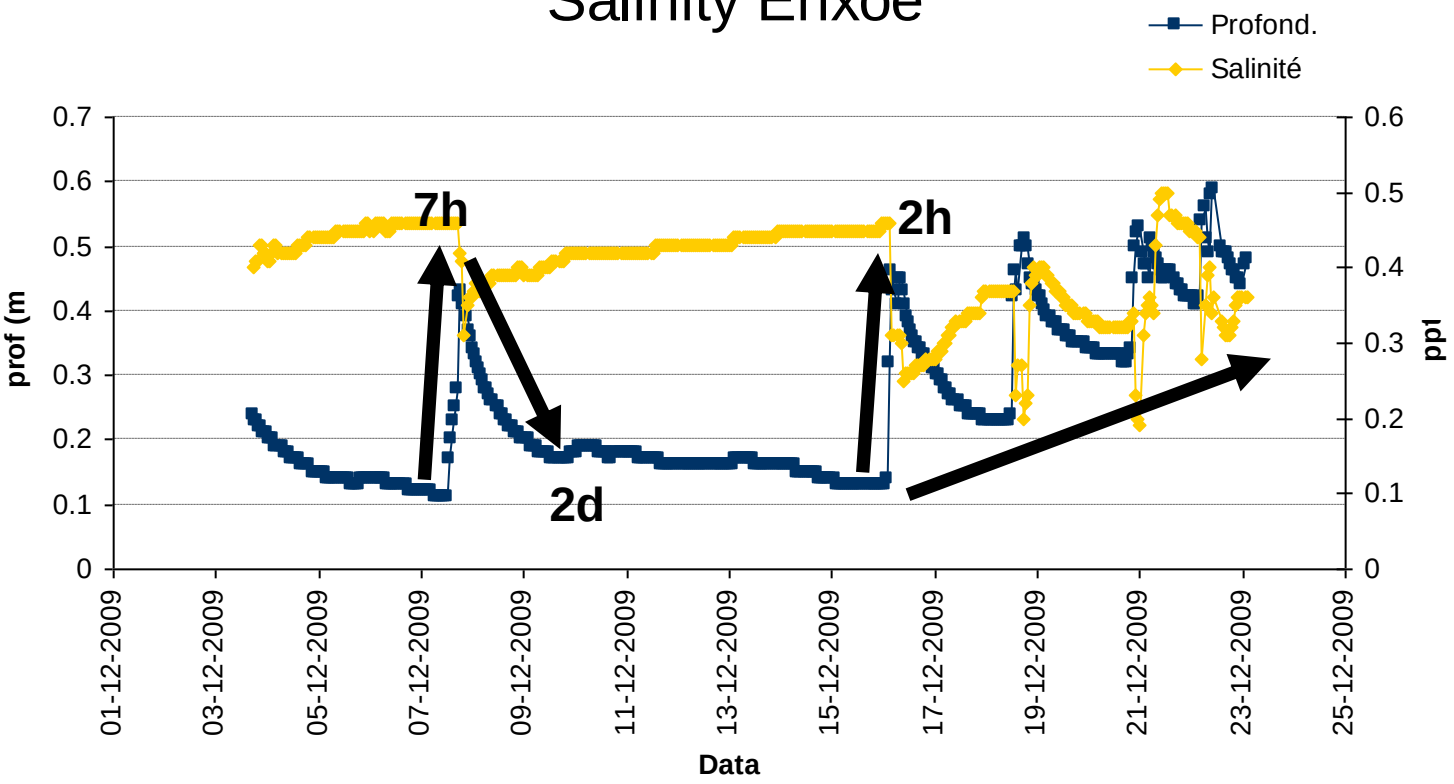




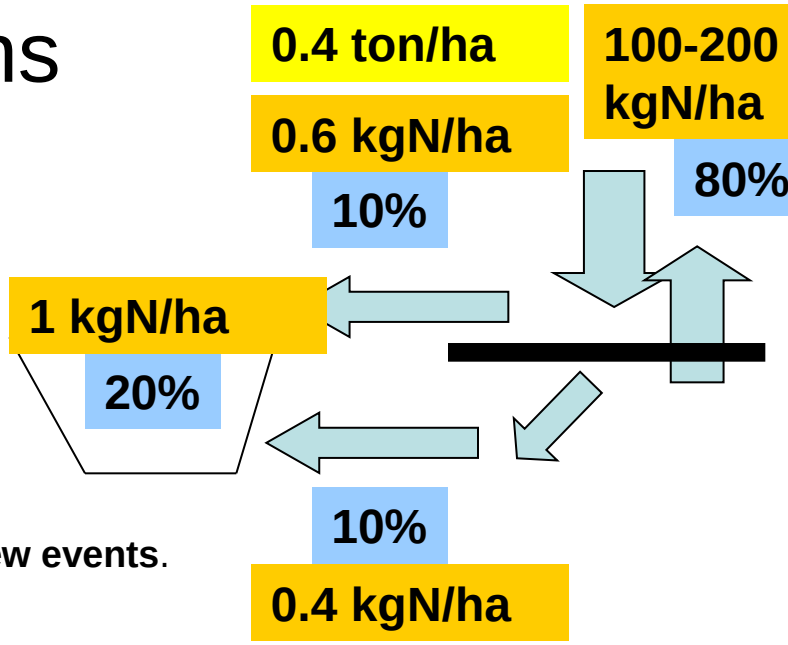


What data says

December 2009



Conclusions



- Concept model
  - Long term functioning
    - Precipitation 500mm
    - Runoff 10%
    - Percolation 10%
    - Evapotranspiration 80%
    - Nitrate loss is low consistent with extensive agriculture and data in river
    - Soil loss is not high consistent with gentle slopes, natural vegetation and data in river. **And arrives in few events**. But high percentage of anual load arrives in 2-4 days.
  - Floods
    - Floods rise in 1h – 6h and fall in 1h-1d
    - In flood arrives water with lower salinity (mainly runoff) but couple of days recovers initial salinity (groundwater replaces water).
    - Soil sealing may be important for decreasing permeability.
- Models
  - SWAT good results in long term dynamics and qualitativeli in WQ
  - Did not managed to show Dec09 peaks (CN, hydrologic group, lower drained soil..). SWAT will not solve Enxoé peaks (hours).
  - Mohid Land good results in long term dyanmics
  - Developing tool to understand watershed dynamics physically and in events

Next Actions

- Continue Sampling
  - Automatic Sampler protection against floods and mices (pictures)
- Continue modelling
  - Pesticide in SWAT (but it is not a issue)
  - Sediment and pesticide in Mohid Land
  - Impermeability continues?


Localization