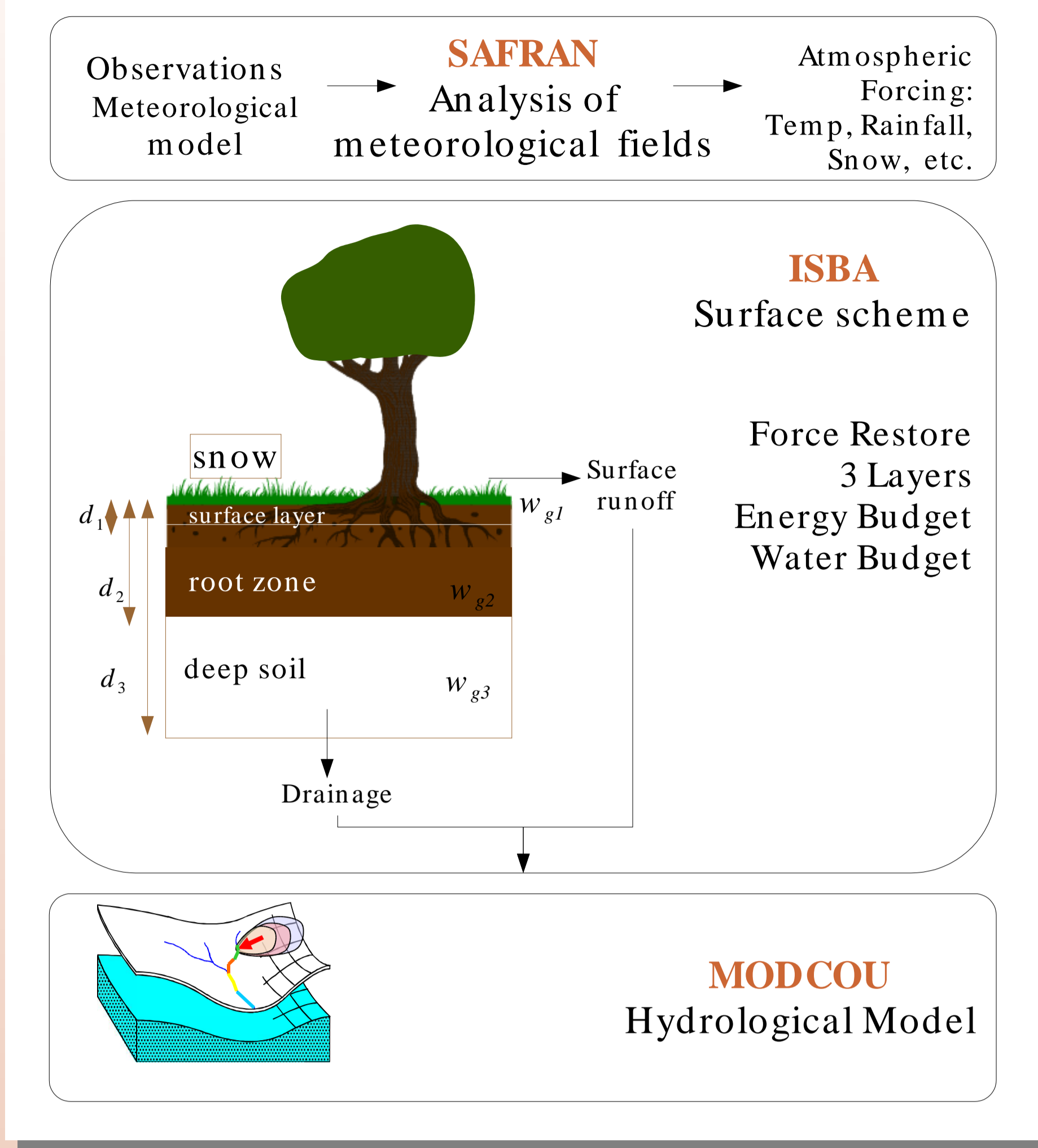


Improvement of the performance of the SAFRAN-ISBA-MODCOU model for hydrological applications on the Mediterranean region of France.

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1. The Model



2. Modification of hydraulic conductivity at saturation

Hydraulic conductivity is improved introducing a new parameterisation

$$k_{sat}(z) = k_{sat,c} e^{-f(z-d_c)}$$

$$k(w_i, z) = k_{sat}(z) \left(\frac{w_i}{w_{sat}} \right)^{2b+3}$$

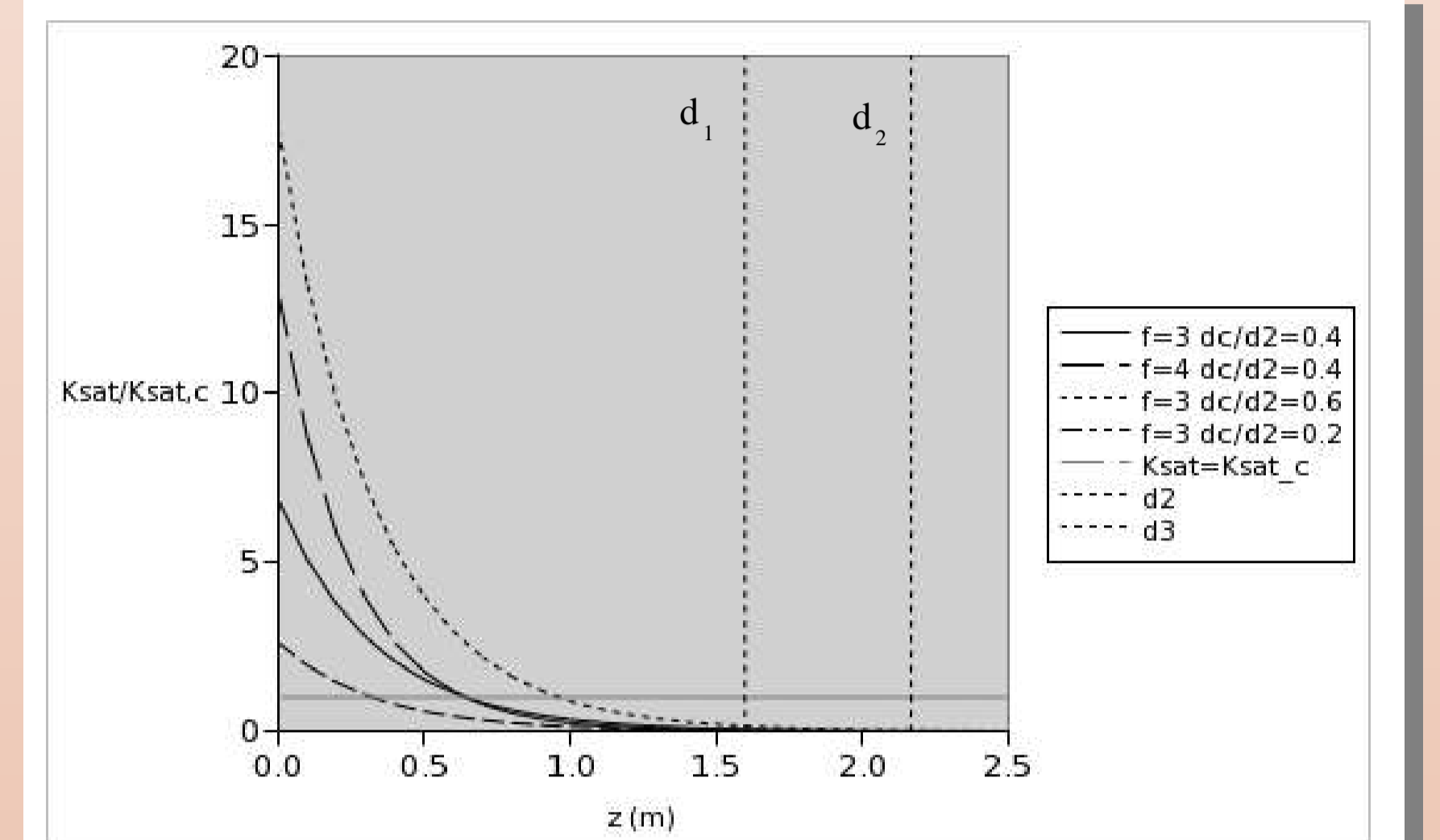
Decharme et al 2006

Before

- Hydraulic conductivity **only** depends on soil moisture.

After

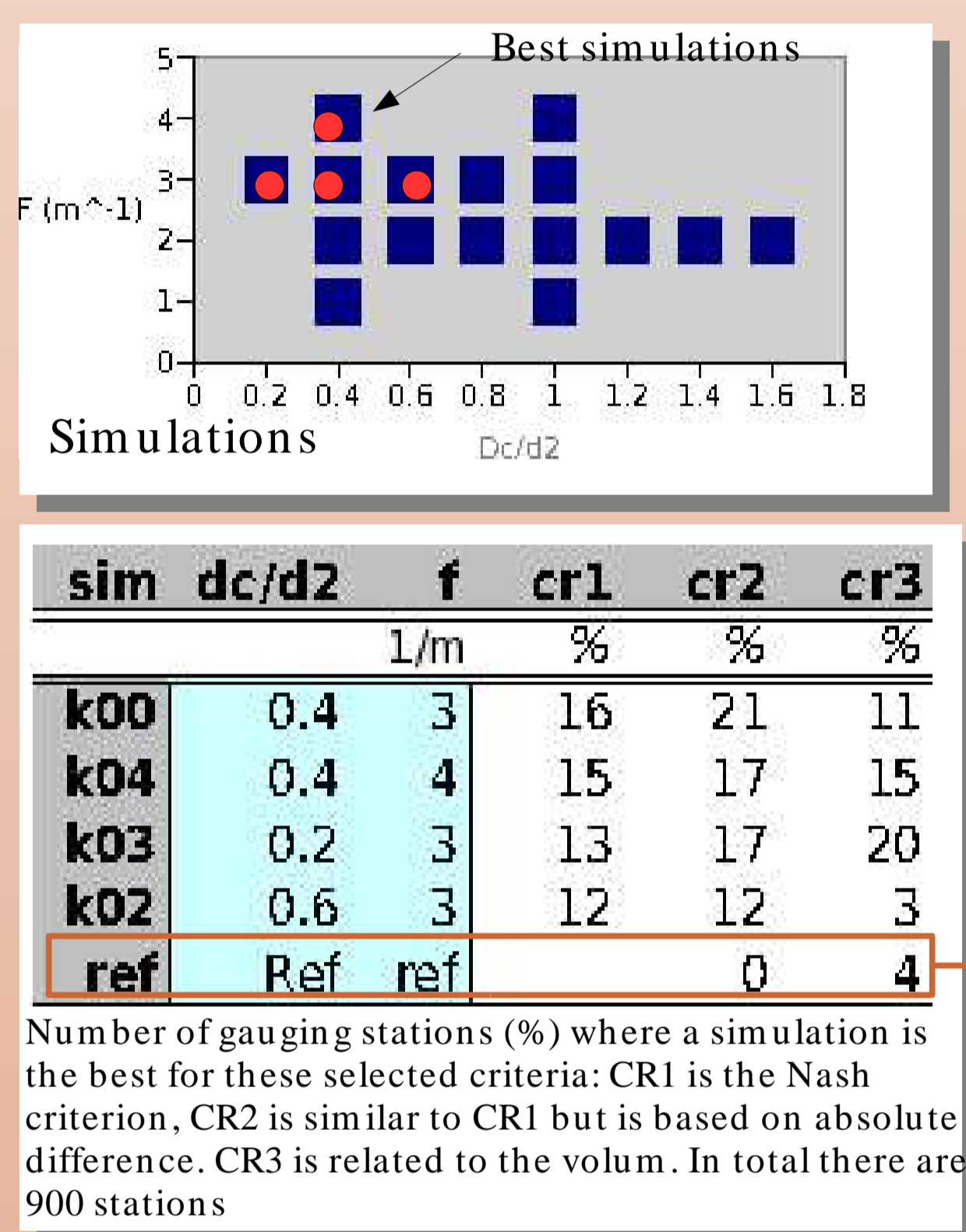
- Hydraulic conductivity depends on soil moisture and depth following an exponential profile.
- Hydraulic conductivity at saturation is higher in the upper parts of the soil and slower in the deeper.
- Two new parameters are introduced: f and d_c**



Exponential profiles for some values of the parameters in an average grid cell.

3. Parameters

- Parameters should be chosen on a per basin basis.
- Nevertheless, on average, over France, four simulations have better results than the others.

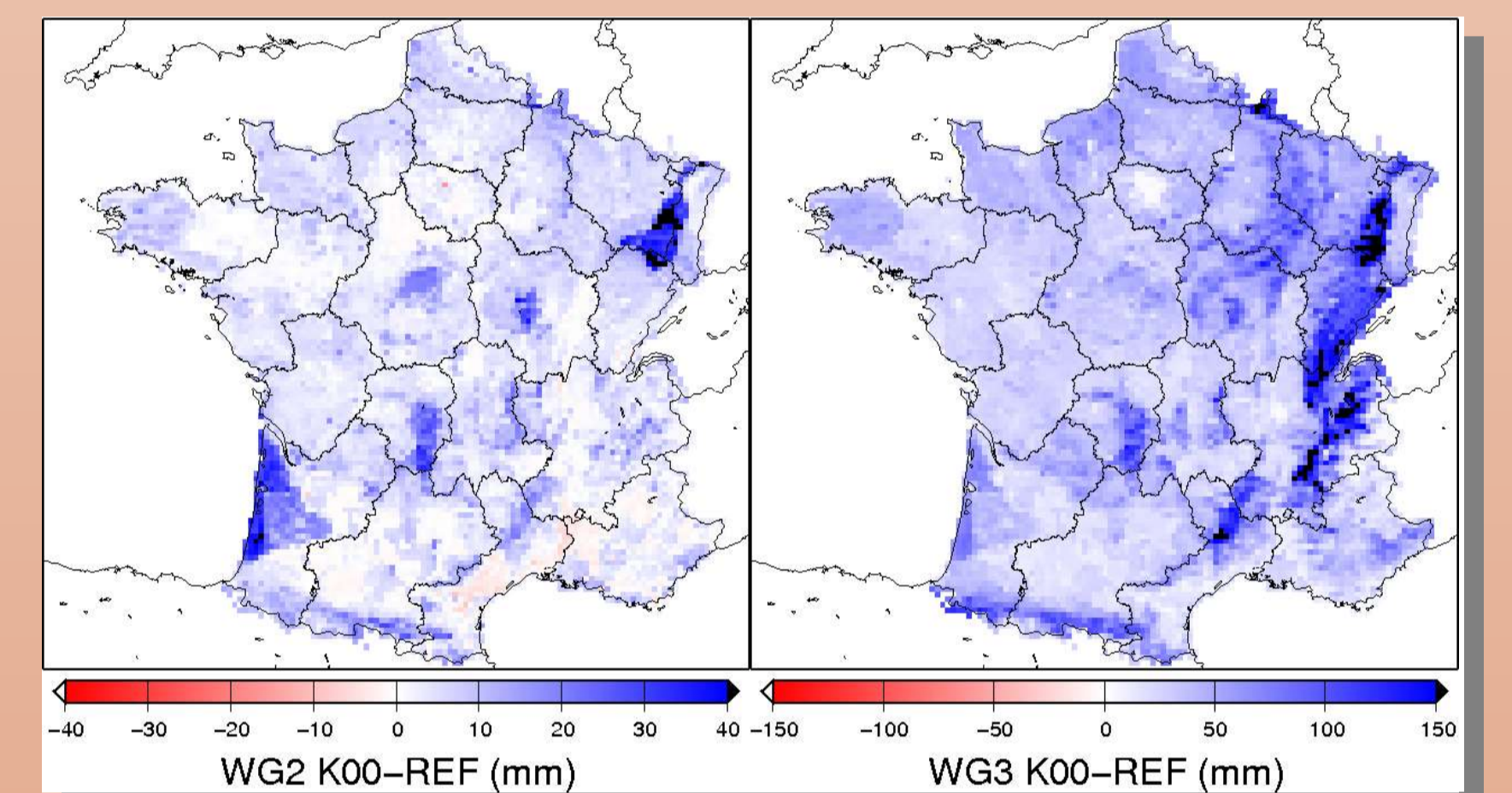


Without the exponential profile

On average, with the new parameterisation, soil water content is increased.

Right: difference between the reference and K00 ($f=3, d_c=0.4, d_2$) for root zone (w_{g2}) and deep soil reservoirs (w_{g3}).

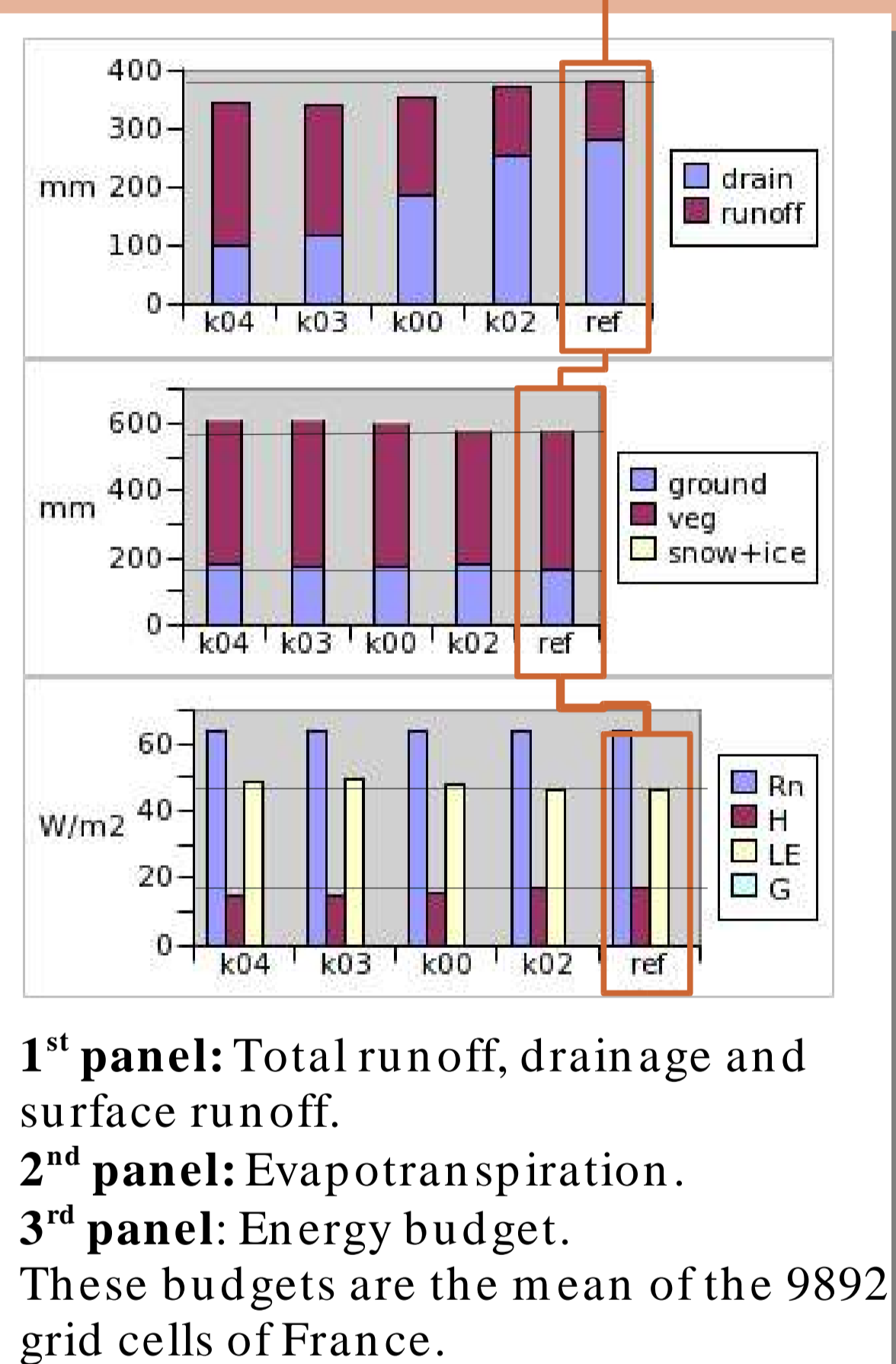
4. Soil Moisture



Without the exponential profile

5. Budgets

- Drainage (subsurface runoff) diminishes in favour of surface runoff.
- Total runoff diminishes, evaporation is increased.
- The energy budget remains very stable, even though LE increases.



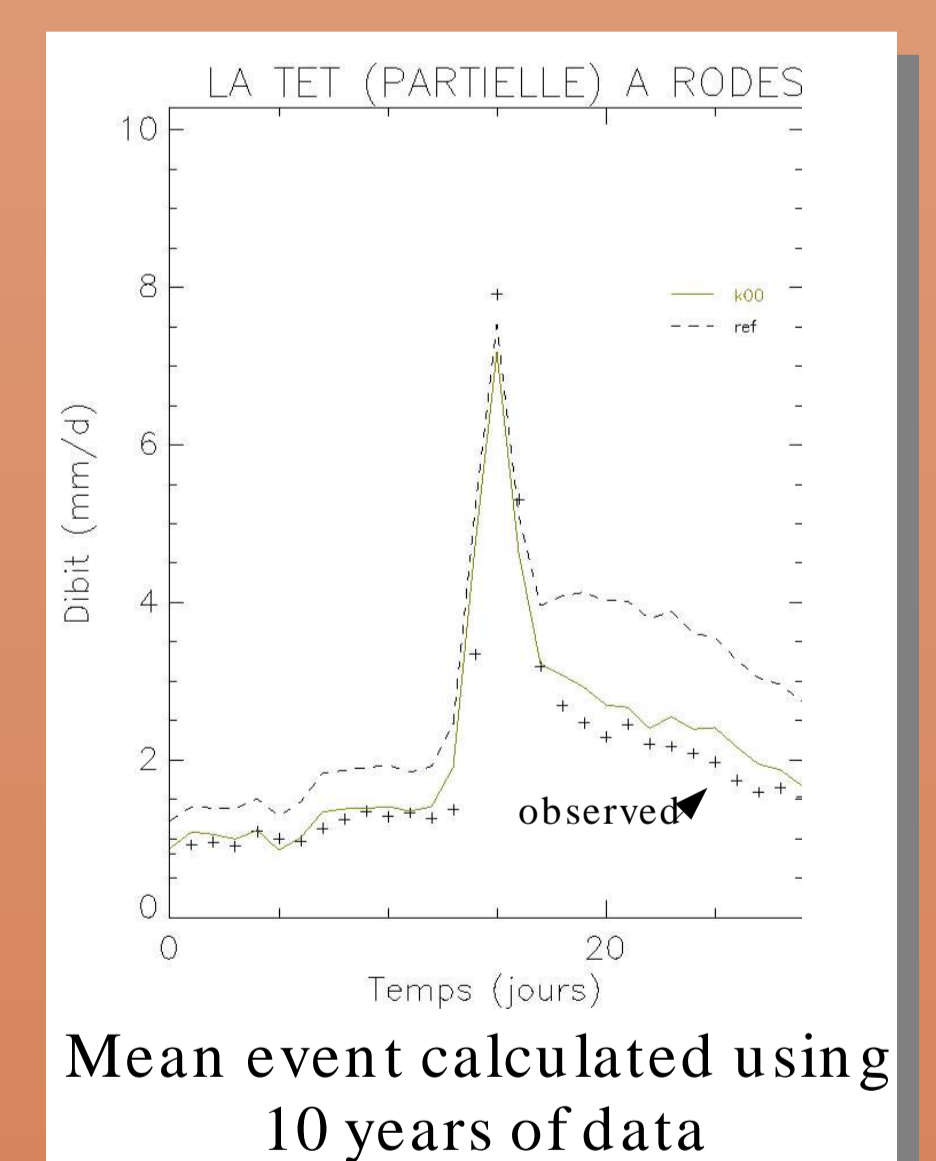
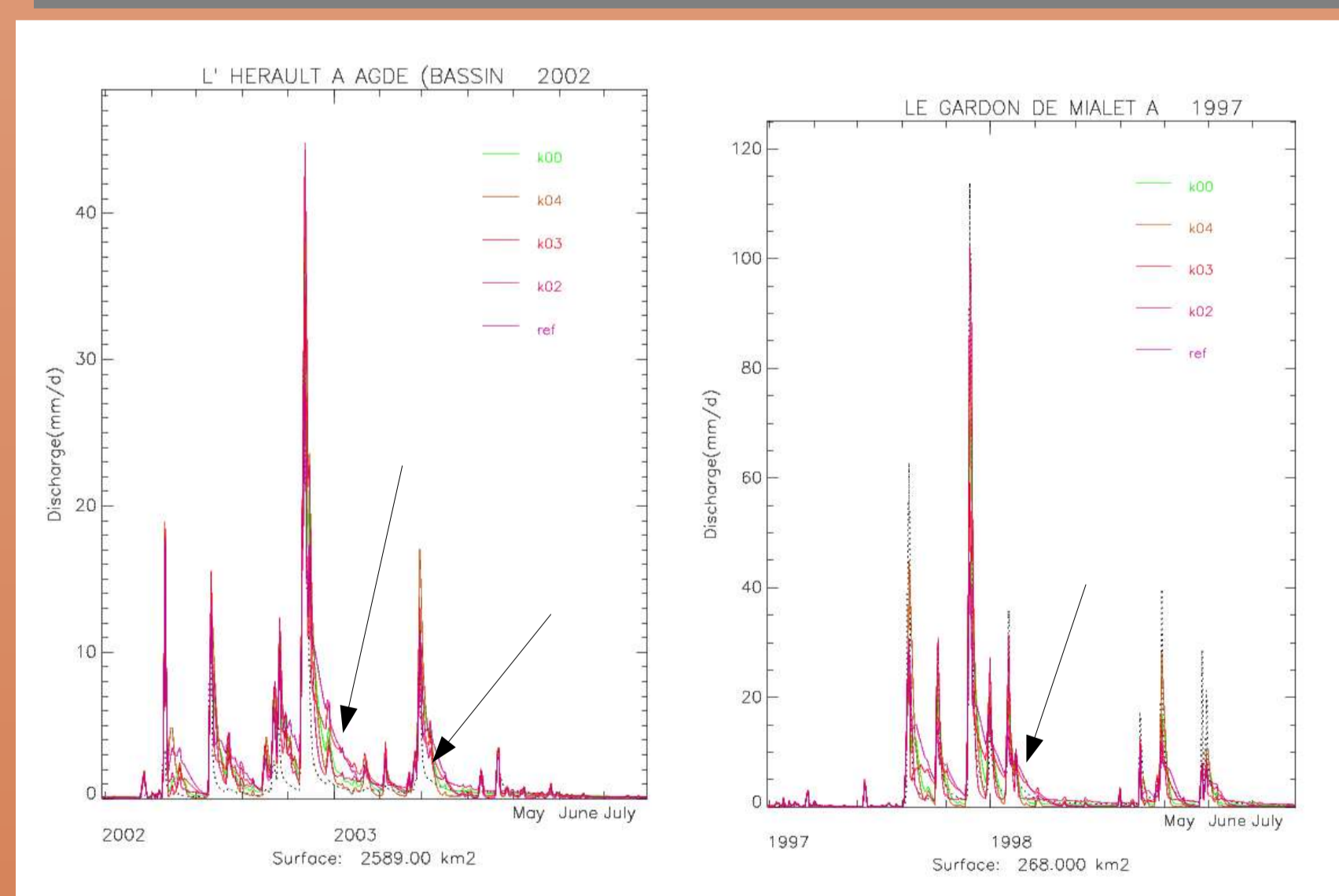
6. River Discharges

Before

- Drainage is too fast, water appears into the river too soon, creating a secondary peak just after the main peak.
- There is not enough water during low flow.

After

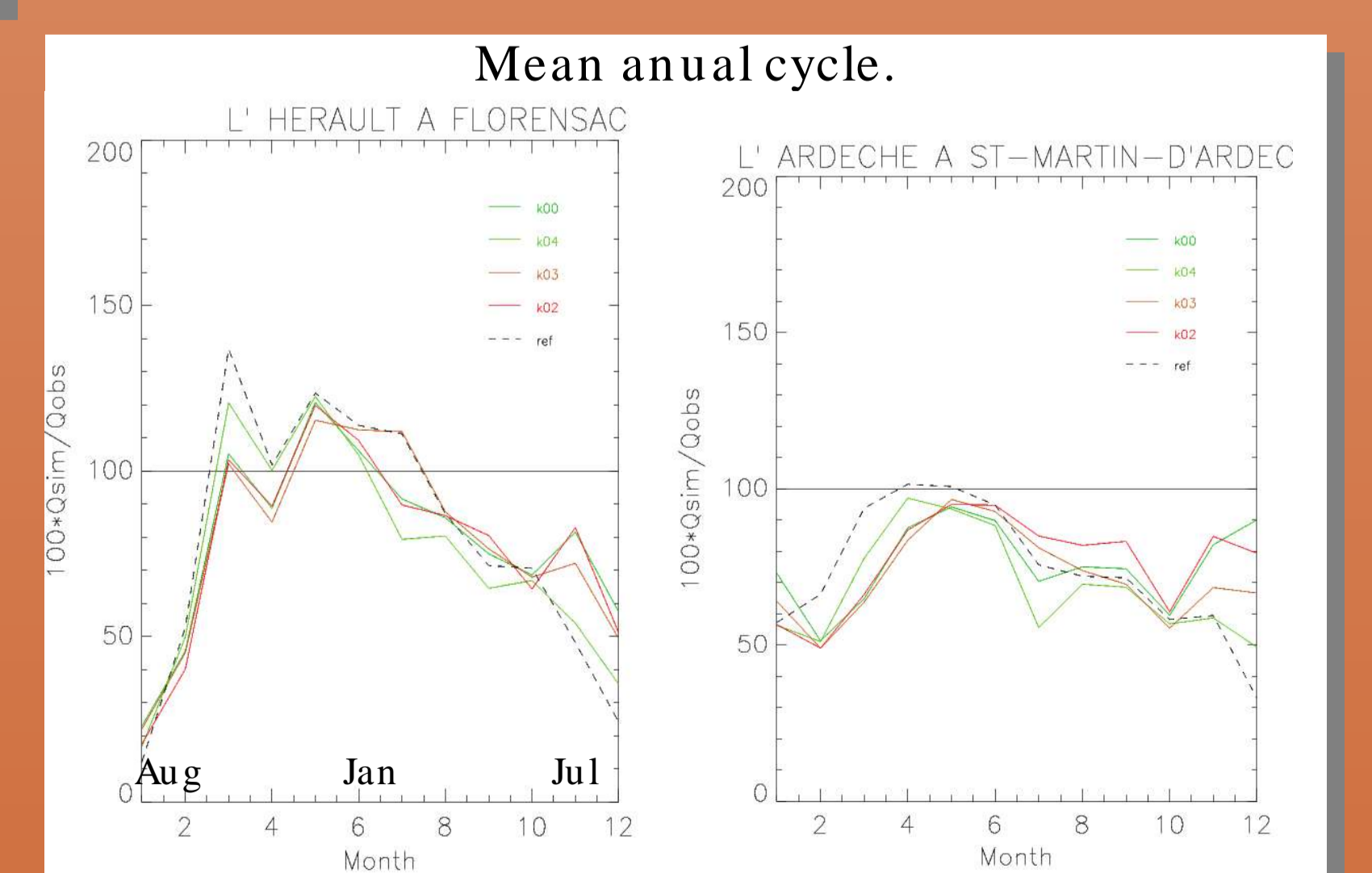
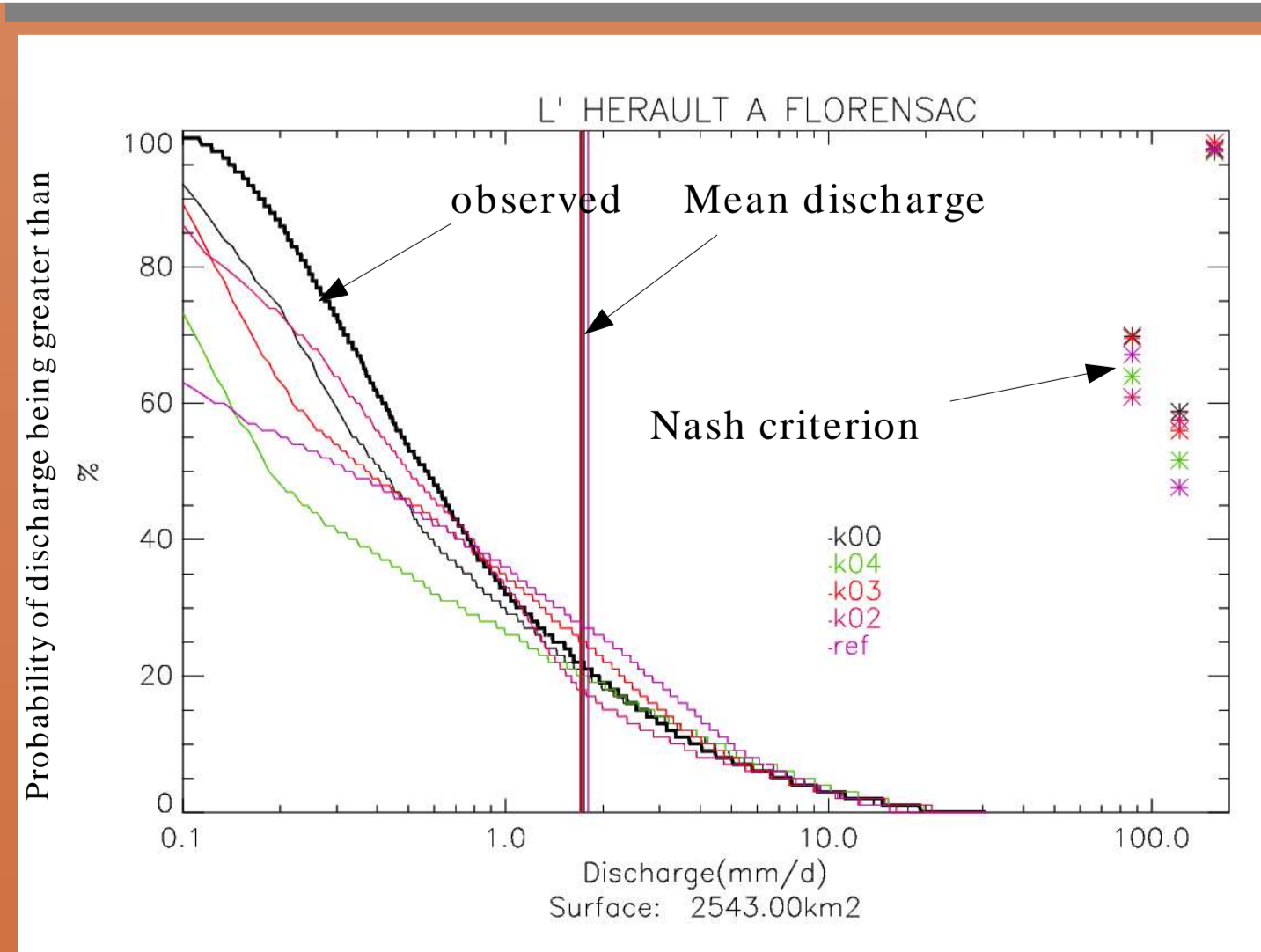
- Drainage is slower, the secondary peak disappears.
- The model is more reactive.
- Low flow is improved.



7. Conclusions and perspectives

- River discharges are improved due to a better partition between surface and subsurface runoff (drainage).
- Soil water content and evaporation are higher.
- Two new parameters need calibration.

- This work will be continued focusing on the Mediterranean watersheds.
- The improved SAFRAN-ISBA-MODCOU will be used to study climate change impact on the hydrology of the Mediterranean region of France under the framework of the CYPRIM project.



- Decharme et al, 2006 : *Impact of an exponential profile of saturated hydraulic conductivity within the ISBA LSM : Simulations over the Rhône basin.* Journal of Hydrometeorology, 7, 61–80.
- Habets et al, 1999 : *Simulation of the water budget and the river flows of the Rhône basin.* Journal of Geophysical Research, 104, 31145–31172.
- Noilhan, J. and S. Planton, 1989 : *A simple parameterization of land surface processes for meteorological models.* Monthly Weather Review, 117, 536–549.