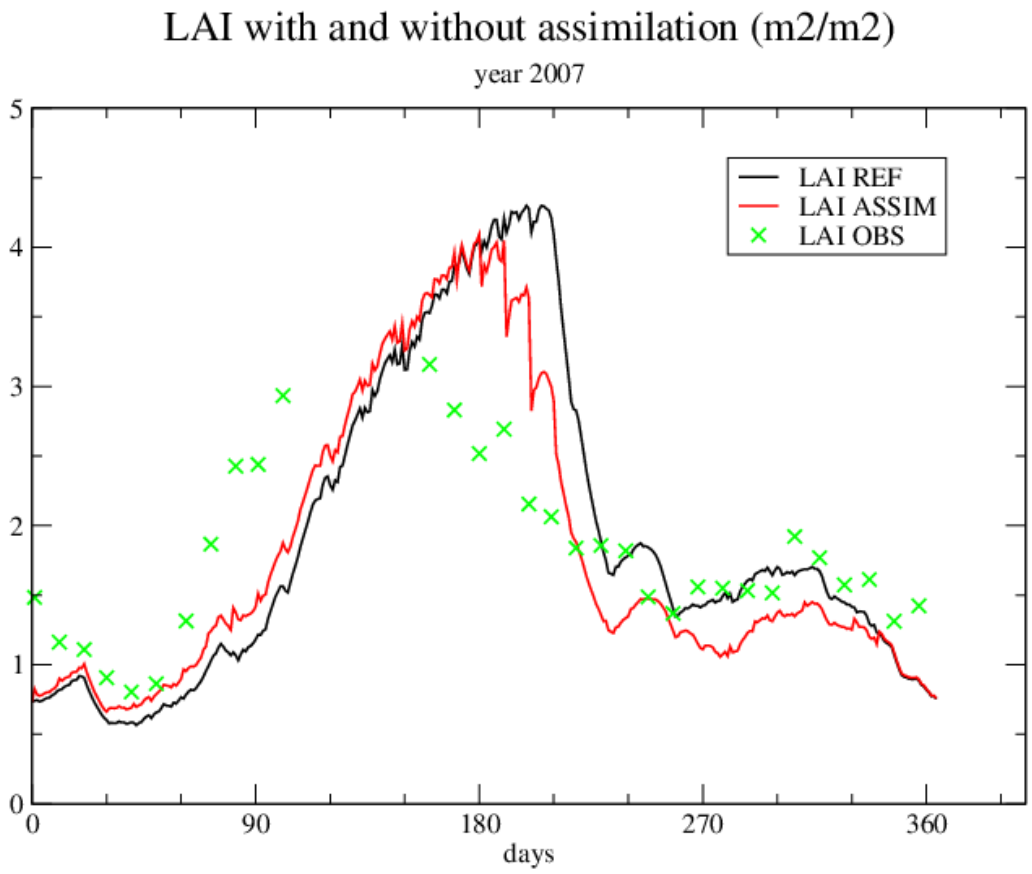
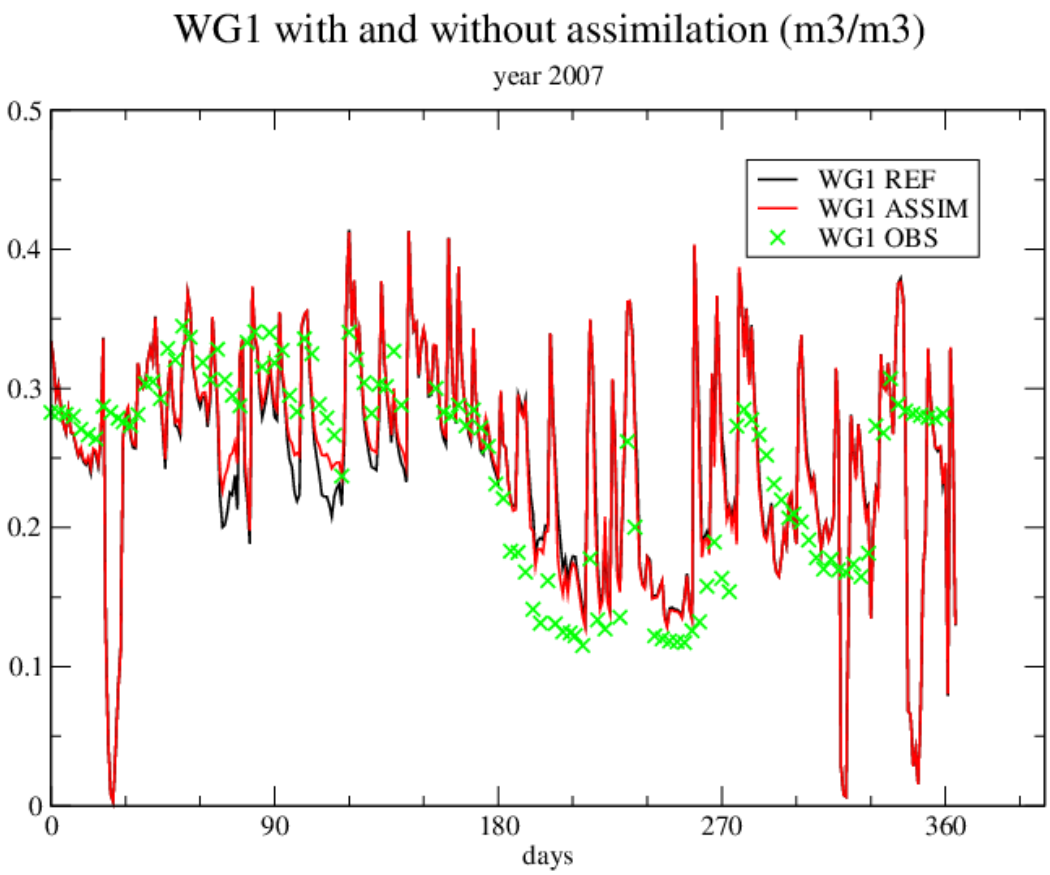
F – isba-ekf with soda correction

F.3.

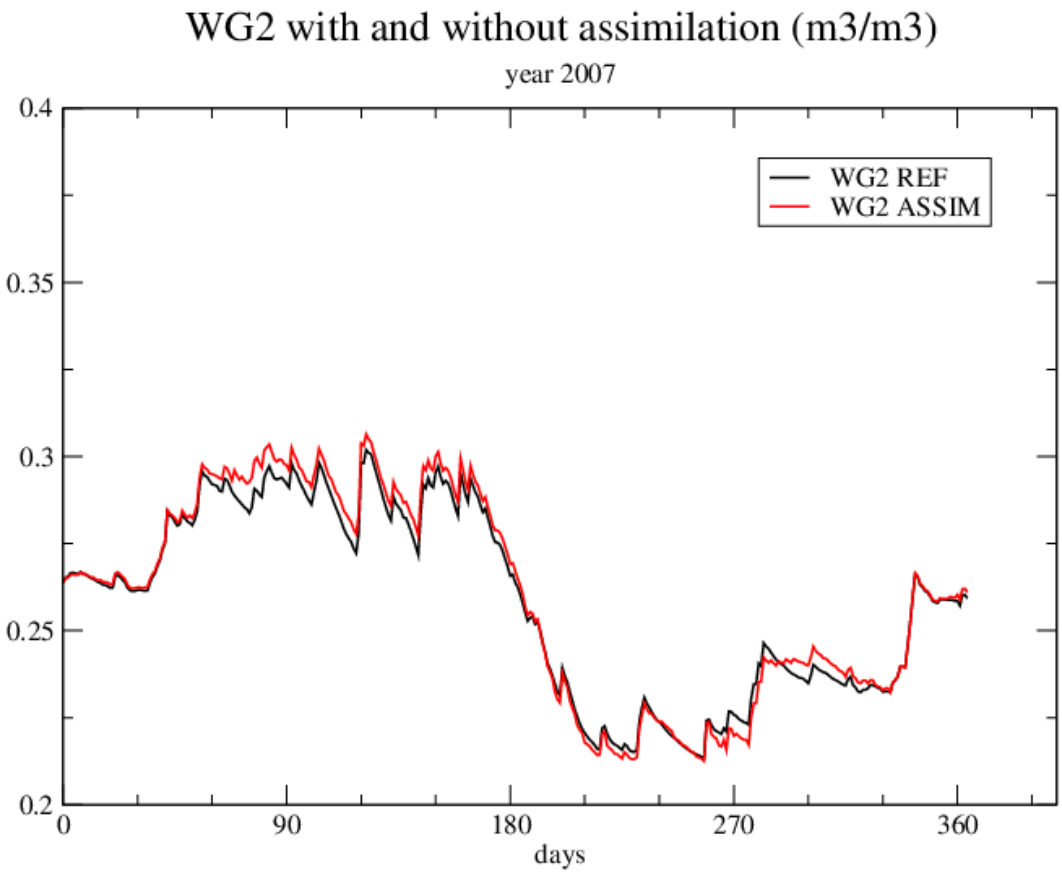


With assimilation of LAI and WG1, LAI grows in the first part of the year (January -> April) and moves closer to observations. During July and August, assimilated LAI is lower and closer to observations, too. From September to November, assimilated LAI is farther to observations, certainly linked to the WG1 observations (with less water in the soil, vegetation can't grow as much as before).



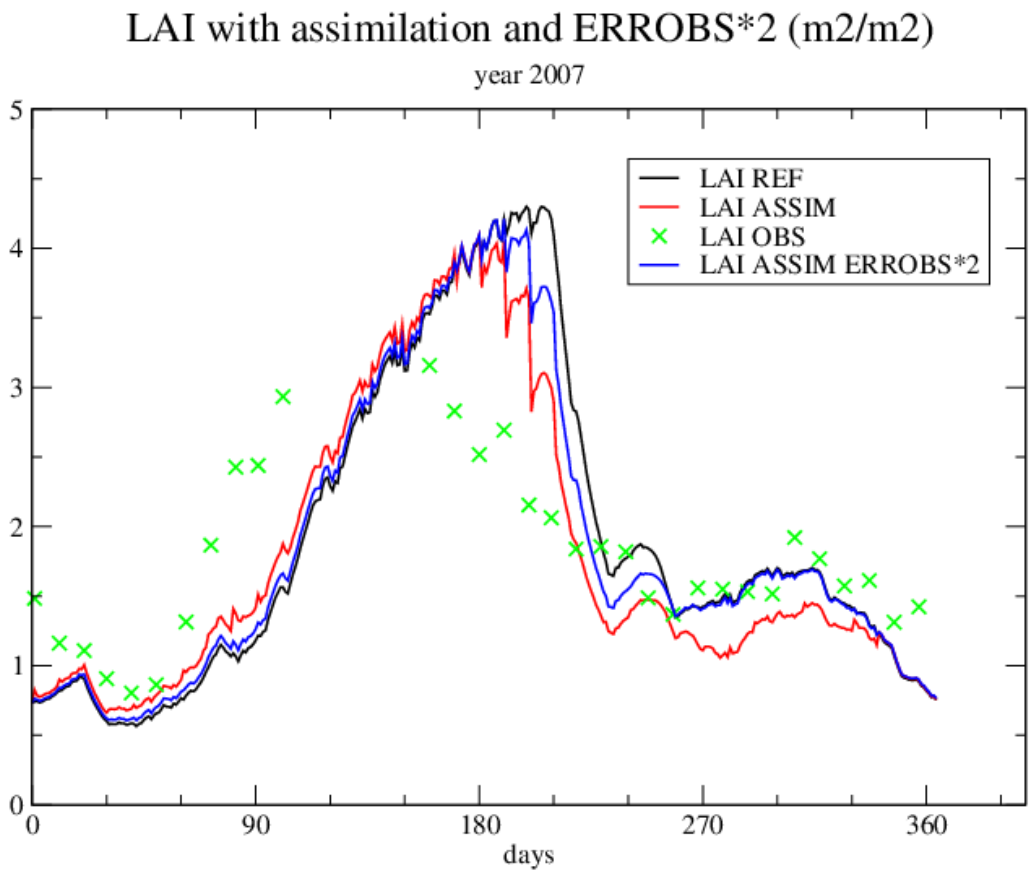
According to observations, there is more water in the soil first layer during Spring (March -> May). Assimilation allows the simulated WG1 grows compared to the reference one. During Summer and early Automn (July -> beginning of October), there is less observed water in the soil first layers. The impact during this spell is no very visible on assimilated WG1 but quite more on assimilated LAI (see upper graph).

To be noted that the assimilation scheme doesn't assimilate WG1 data when there is ice in the soil (downwards peaks on this graph).

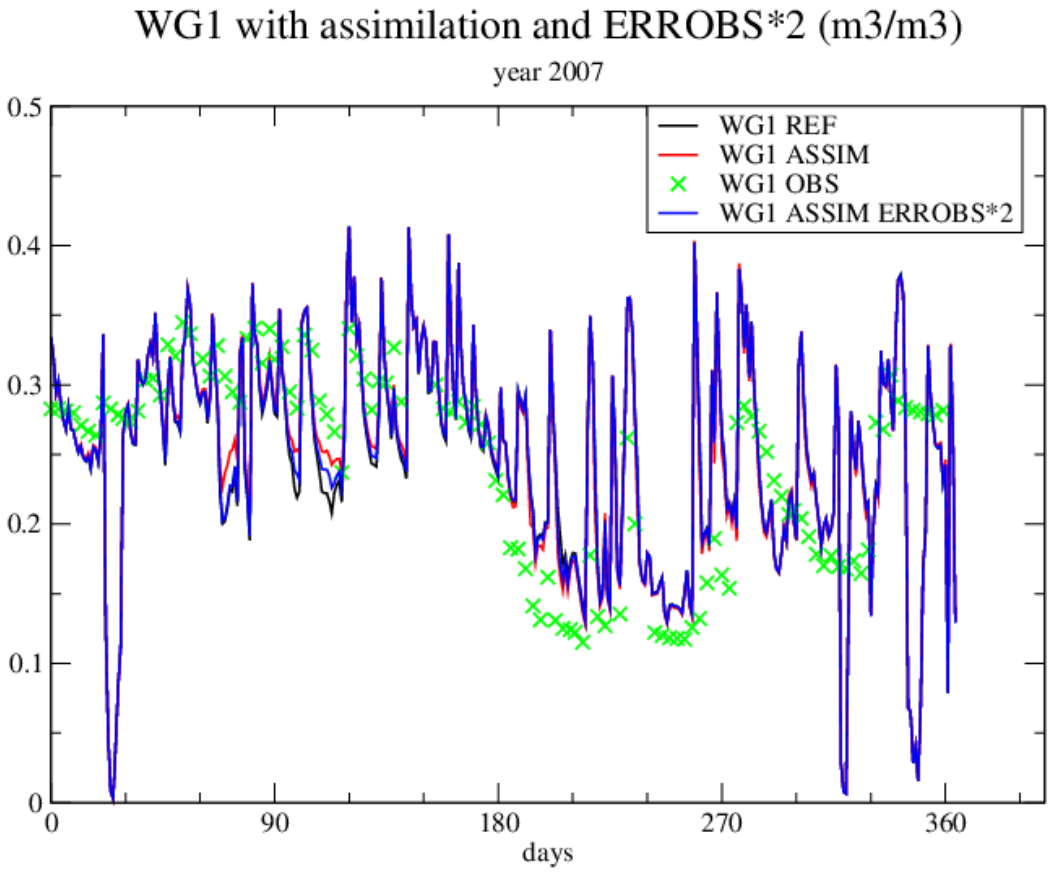


The assimilated WG2 follows the tendency observed between observation and reference for WG1 : more water during Spring, less water during Summer and early Automn and more water at the end of Automn and beginning of Winter.

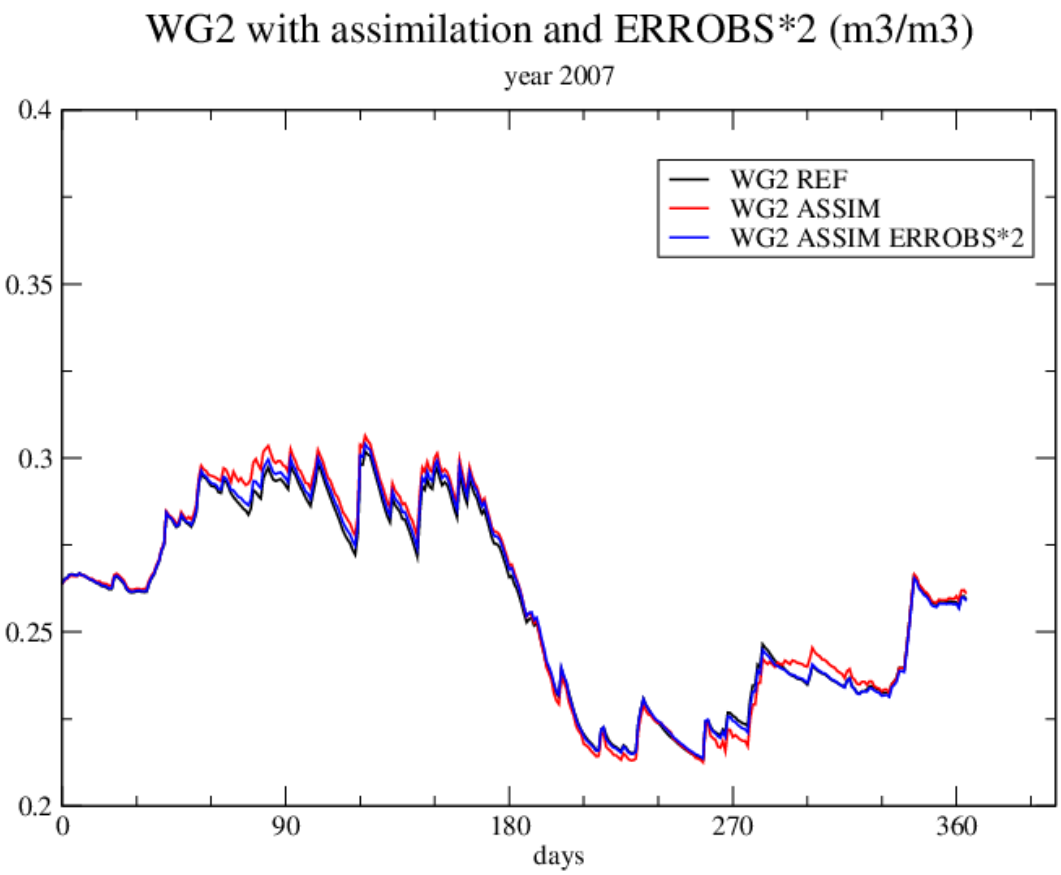
F.5.



Doubling the observation error ERROBS_M for assimilated data leads to reduce the impact of assimilation, as it can be verified on this graph : the blue plot is closer to the reference plot that the red one. Indeed, increasing ERROBS_M means that we don't trust the observation as much as before. A similar impact would have been found in we had reduced the model error, SIGMA_M (in NAM_VAR) : in this case, it means that we trust the model very much and its weight would increase compared with this of observation.

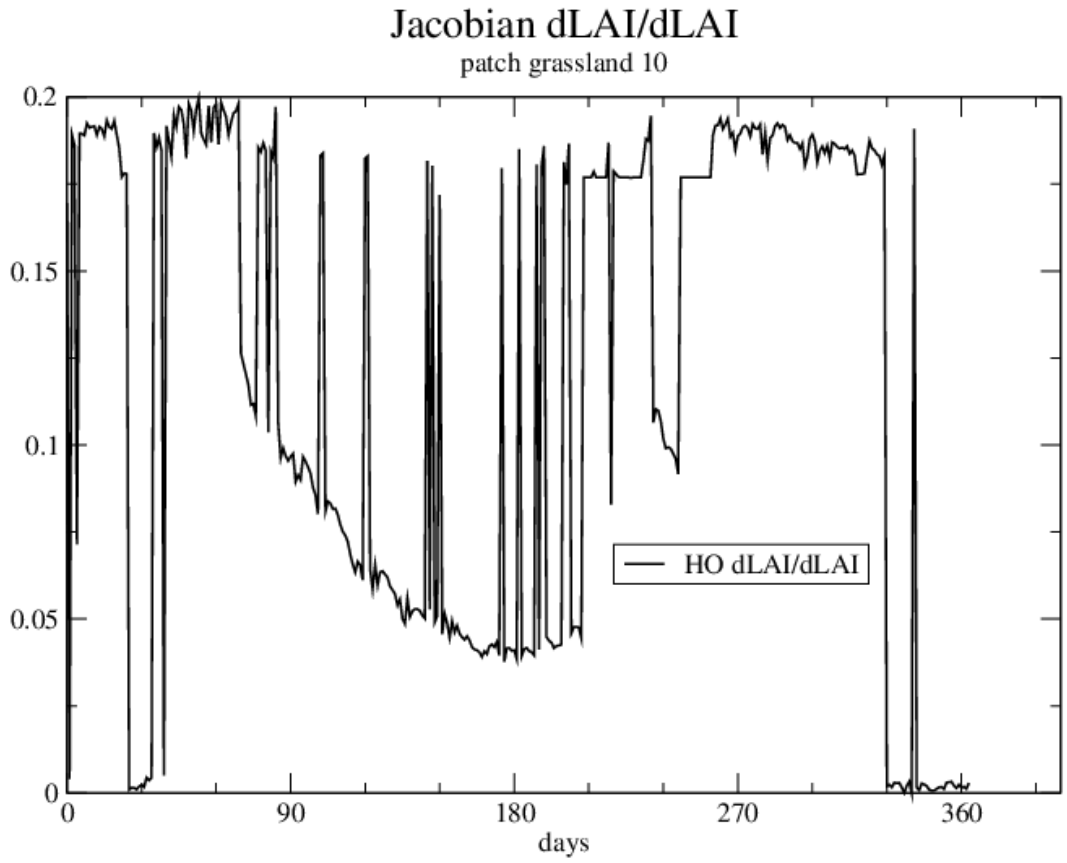


Here for WG1 we can do the same remark as for the LAI : the blue plot is closer to the reference plot than the red one. The tendency is the same.



... and the same for WG2.

F.6.



Concerning the element of the Jacobian matrix ∂LAI(t)/∂LAI(t0)
we may identify that three types of Jacobian values:
(1) a value identical to zero,
(2) a close-to-maximal value equal to the fraction occu-
pied by the plant functional type, and
(3) a fraction of maximal value decreasing during the growing phase of the vegetation.
This behaviour is common to all patches. The zero Jacobian value occurs when the LAI declines down to its minimal value in winter due to environmental conditions and also during drought periods. This non-informative Jacobian
value has a larger frequency of occurrence in drought periods for the herbaceous vegetation types, as they are more senstive than forests to the water stress.

The other element of the Jacobian matrix reflect how the link between soil moisture and vegetation variables is directly exploited by the multivariate analysis. The joint assimilation is effective when

the values of these Jacobian
terms are non-zero. This means that the system is able to provide information from observations to those model variables that are connected to the data.
This element represents the sensitivity of LAI to water perturbations in the rooting layer. It has positive values, since an increase in water content directly enhances photosynthesis and plant growth.