

A satellite image of Earth showing a mix of green landmasses and dark blue oceans. The image is used as a background for the text.

Synergies and complementarities between ASCAT and SMOS soil moisture products

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Compare two different surface soil moisture remote sensing products and soil wetness from LSM:

- ASCAT L2 Soil Moisture Index TU-Wien model. ASCAT scatterometer instrument onboard METOP (5.255 GHz)
- SMOS L2 Soil Moisture v551. SMOS passive microwave radiometer (1.4 GHz)
- Disaggregated SMOS L2 Soil Moisture v551 at 1 km (SMOScat project)
- SURFEX/ISBA land-surface model, forced with the SAFRAN meteorological analysis system

AIM: understand their respective performances and restrictions

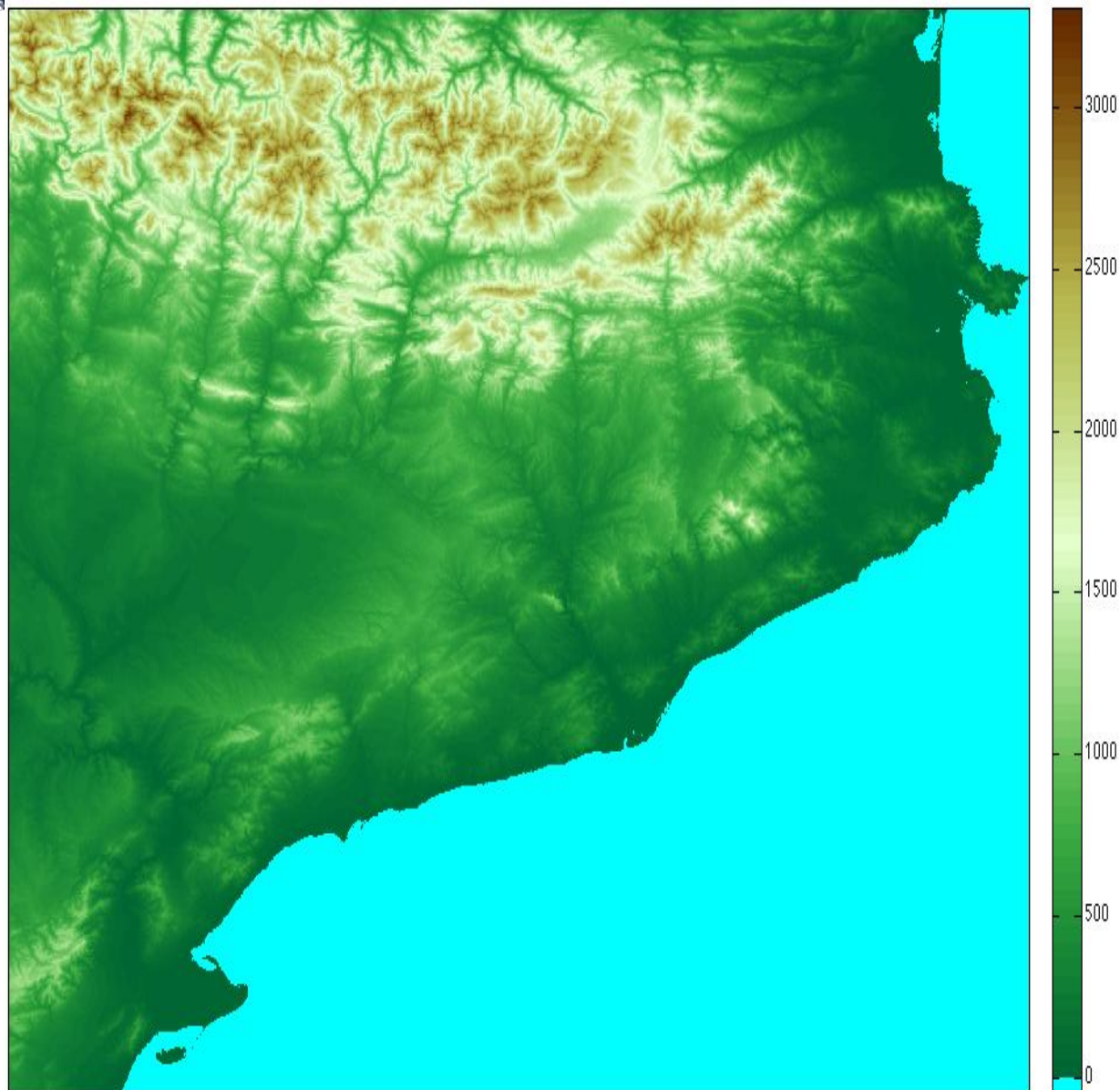
Catalonia

NE Iberian Peninsula

Mediterranean
climate

altitudes over 3,000 m

wide range of
bioclimatic habitats.



Model: SURFEX

- Developed at Météo-France.
- SURFEX is modular, we used the ISBA 3L scheme.

Spatial resolution: 5 km.

Time resolution: we decided to work with daily series

Variable of interest:

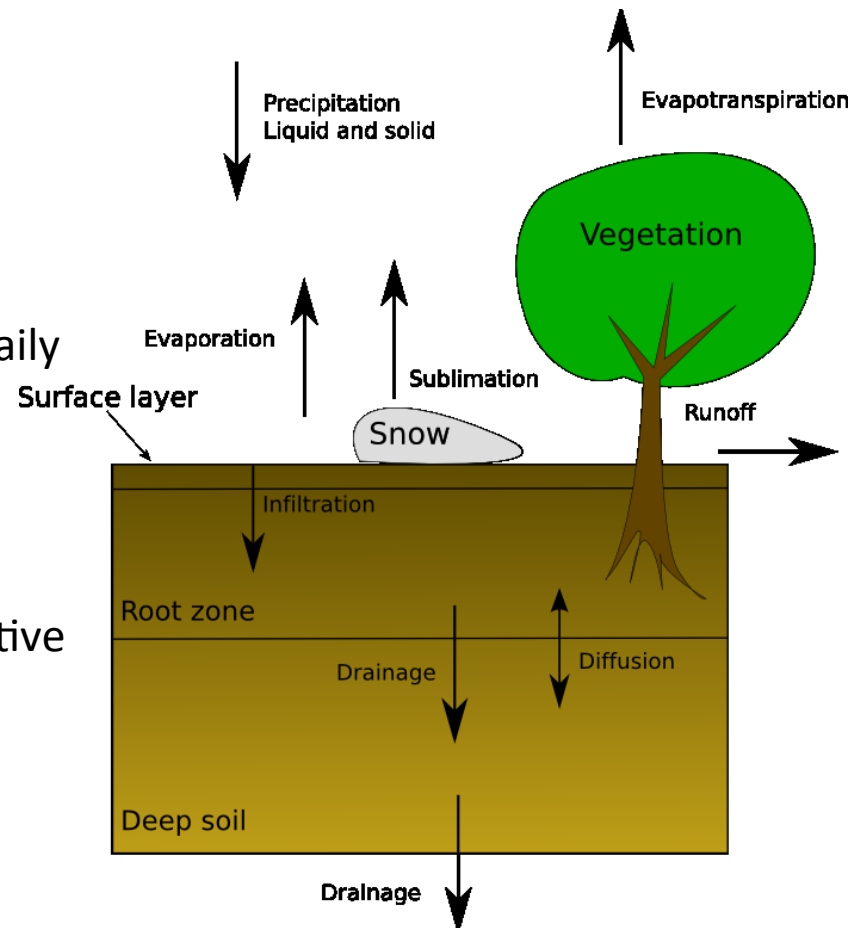
- we focused on the surface layer soil wetness.
- Satellite soil moisture products are sensitive to the first few centimeters of soil.

Simulation period:

1/9/2009 – 31/12/2011 (1 year spin-up)

Period of comparison with satellite data:

- 1 year: 2011
- Therefore, initial conditions are not an issue.

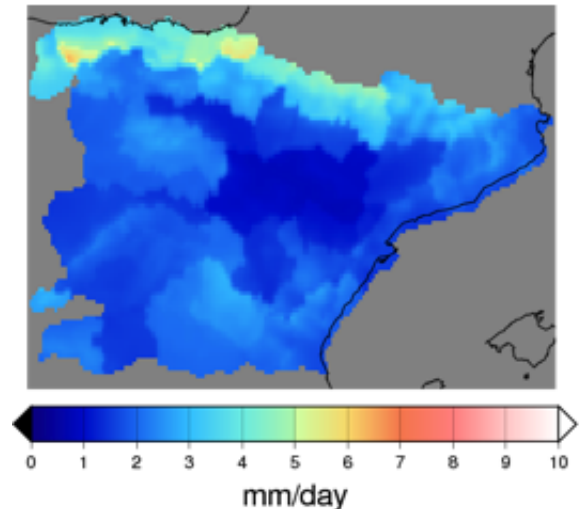


Masson et al., "The SURFEXv7.2 land and ocean surface platform for coupled or offline simulation of earth surface variables and fluxes," *Geosci. Model Dev.*, vol. 6, no. 4, pp. 929–960, 2013.
<http://www.cnrn.meteo.fr/surfex/>

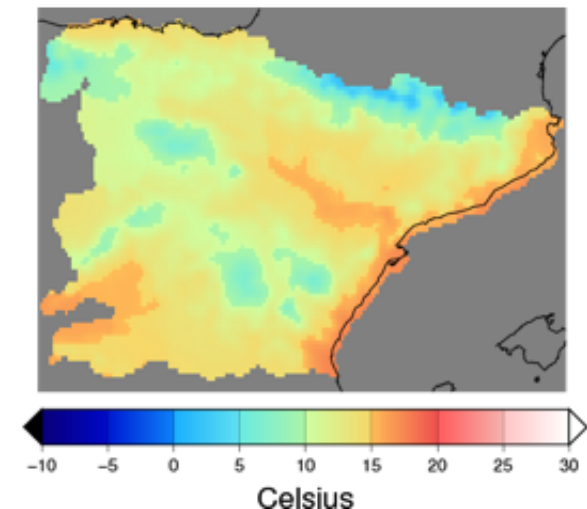
The SAFRAN meteorological analysis system was used to force the LSM.
Optimal interpolation.
First guess: HIRLAM HNR 5km. Operational NWP model at AEMET.
Observed data: All available AEMET meteorological stations.
SAFRAN analyses temperature, relative humidity, precipitation, wind and cloudiness and simulates downward short and long wave radiation.
Temporal resolution: 6h (interpolated to hourly series).
Spatial resolution: 5 km.

Quintana-Seguí et al. "Analysis of Near-Surface Atmospheric Variables: Validation of the SAFRAN Analysis over France," J. Appl. Meteorol. Climatol., vol. 47, pp. 92–107, 2008.

Precipitation (2009/10)



Temperature (2009/10)



A downscaling algorithm applied to SMOS to provide 1 km SSM

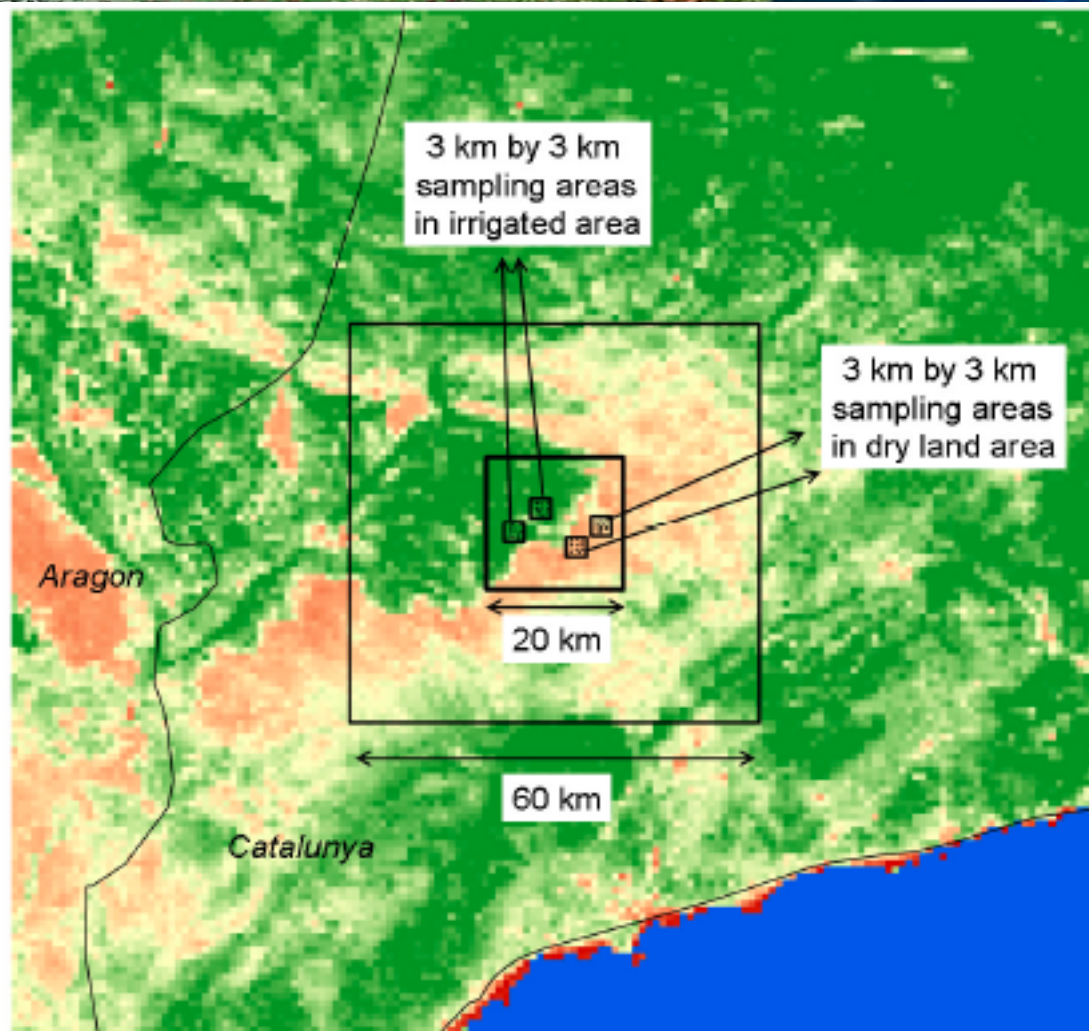
Validated over a 20 km by 20 km irrigated and dry land area area.

4 - 3 x 3 km sampling areas

10 sampling points on each 3 x 3 km area.

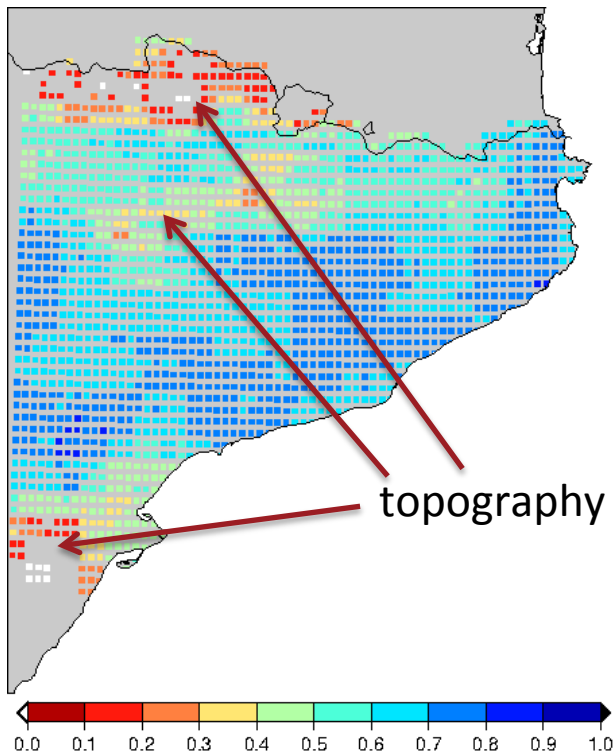
Each sampling point three separate 0–5 cm measurements

Once a month from April to October 2011

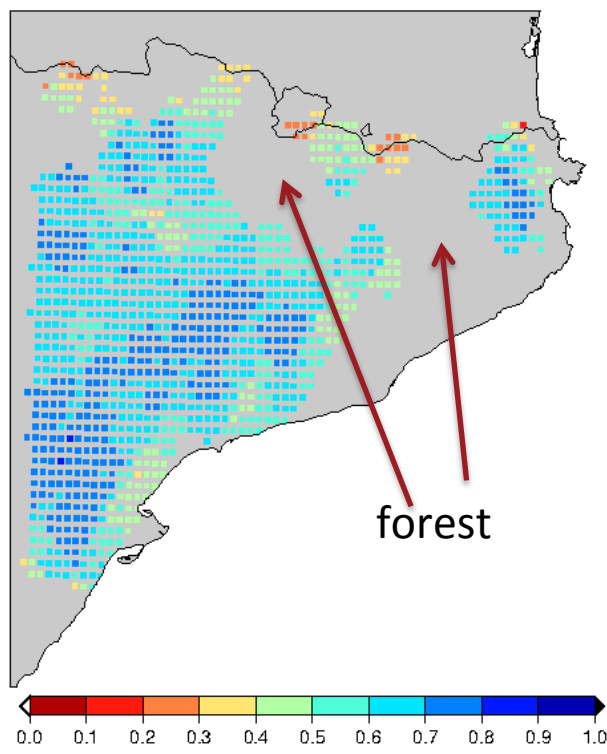


O. Merlin, M. J. Escorihuela, M. Aran-Mayoral, O. Hagolle, A. Al Bitar, and Y. Kerr "Self-calibrated evaporation-based disaggregation of SMOS soil moisture: an evaluation study at 3 km and 100 m resolution in Catalunya, Spain" Remote Sensing of Environment, 130, pp 25–38, doi:10.1016/j.rse.2012.11.008, 2013

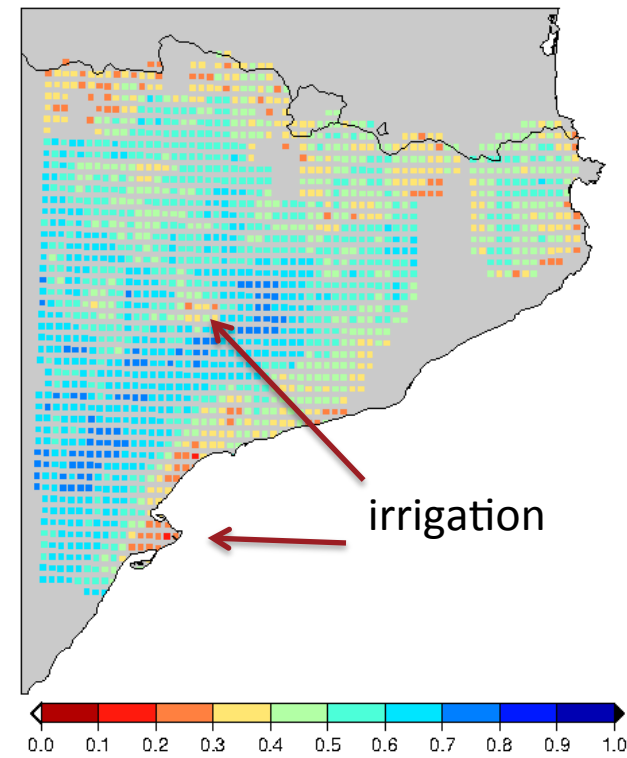
ASCAT



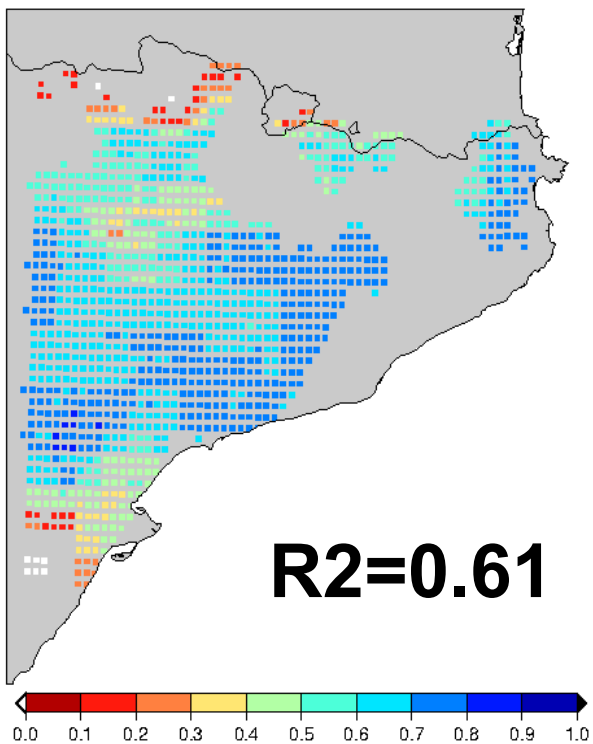
SMOS



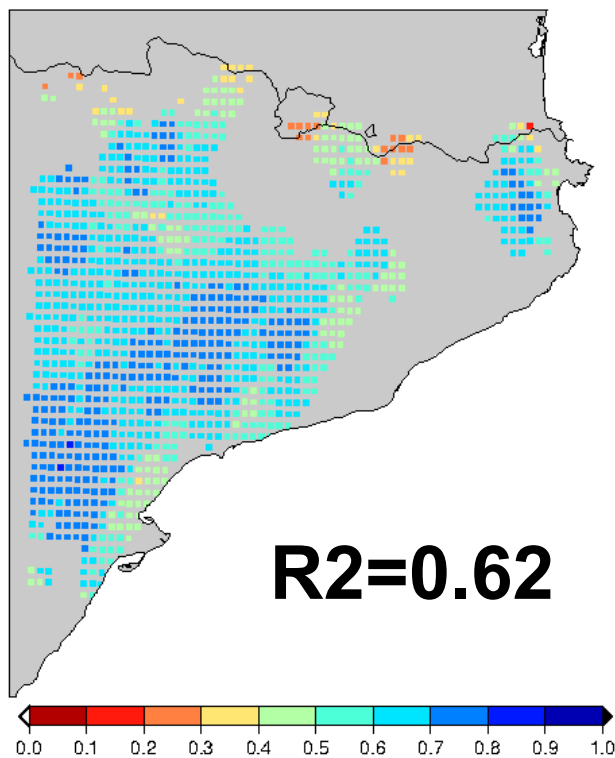
SMOScat



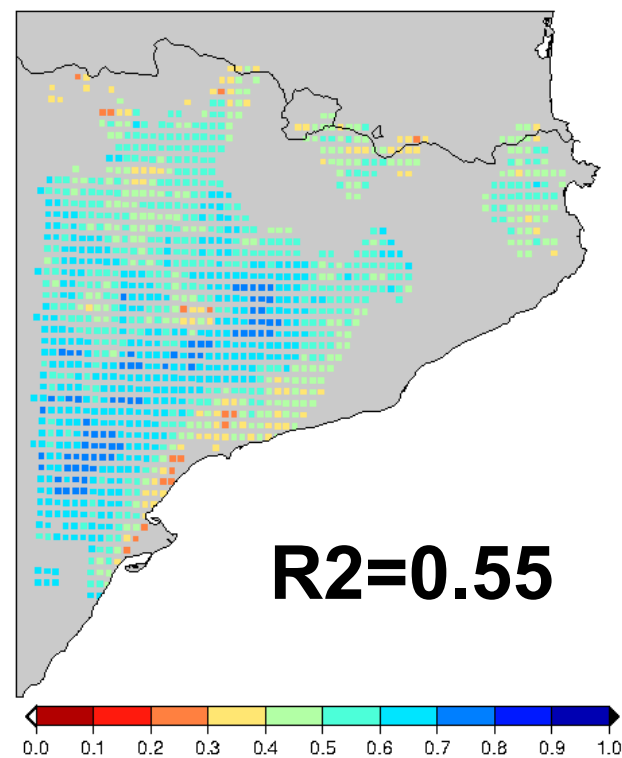
ASCAT

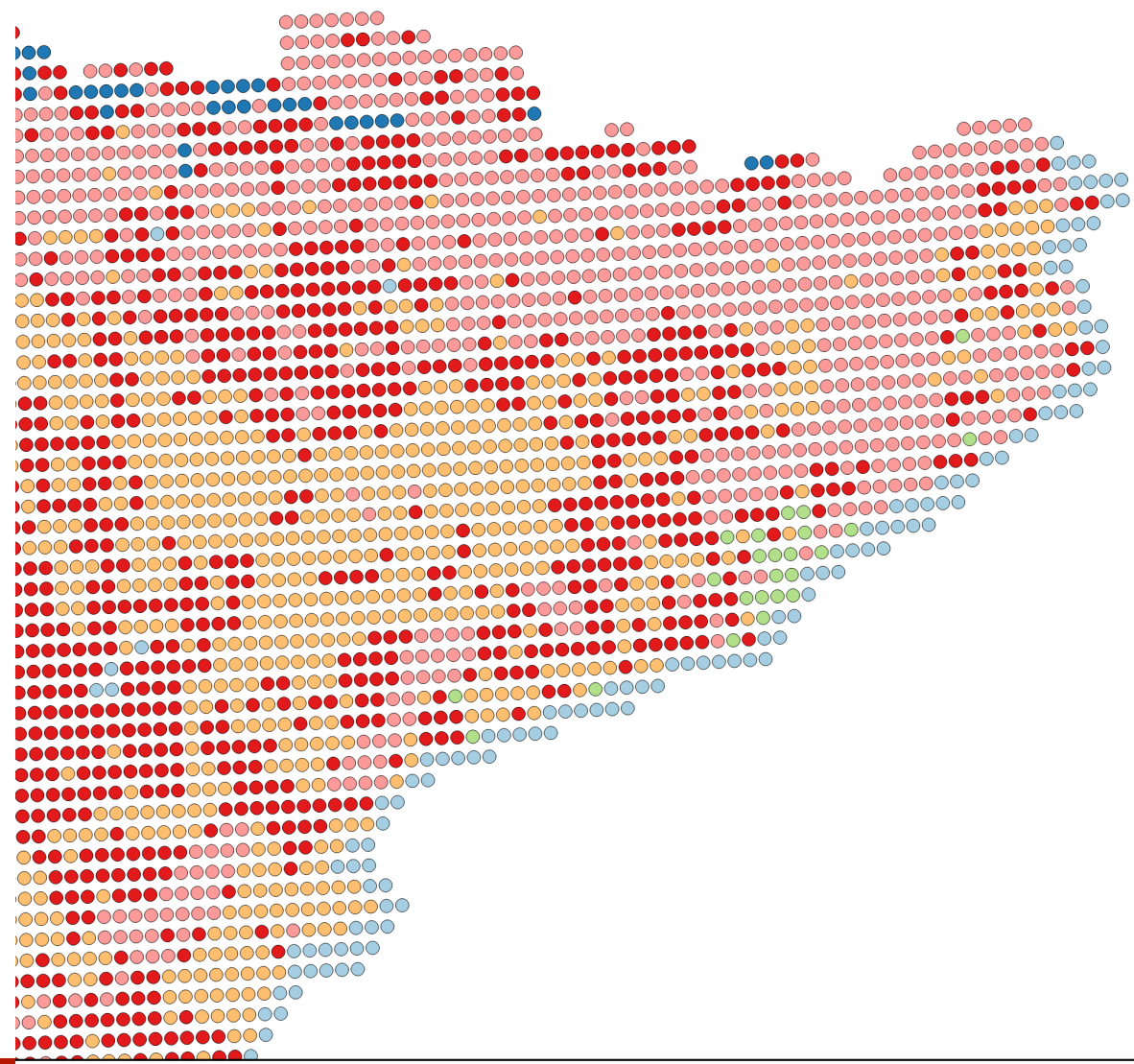


SMOS



SMOScat



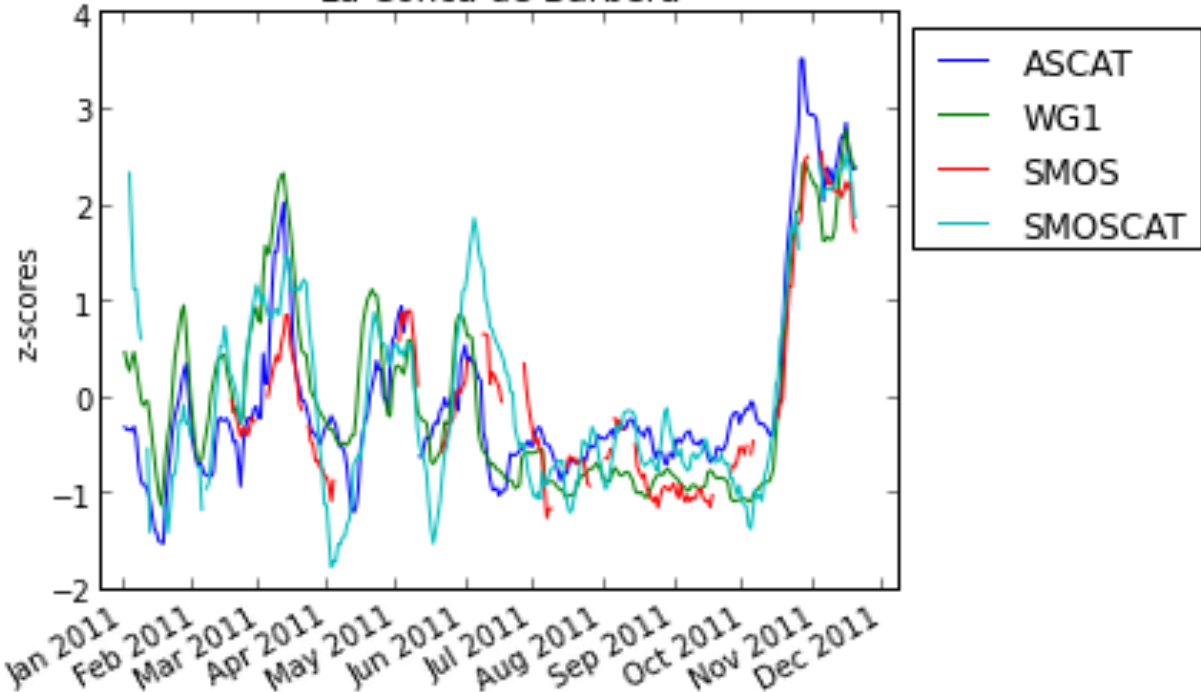


Legend

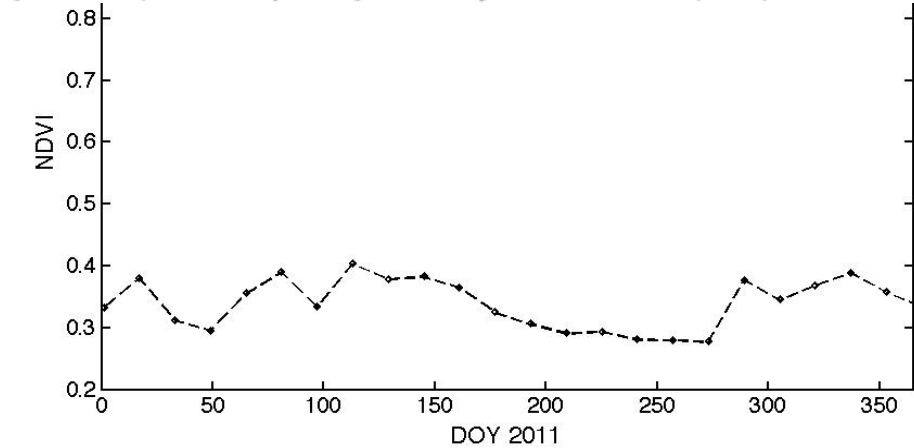
covers

- Water
- Bare
- Urban
- Forest
- Grass or Shrubs
- Crops
- Wetlands

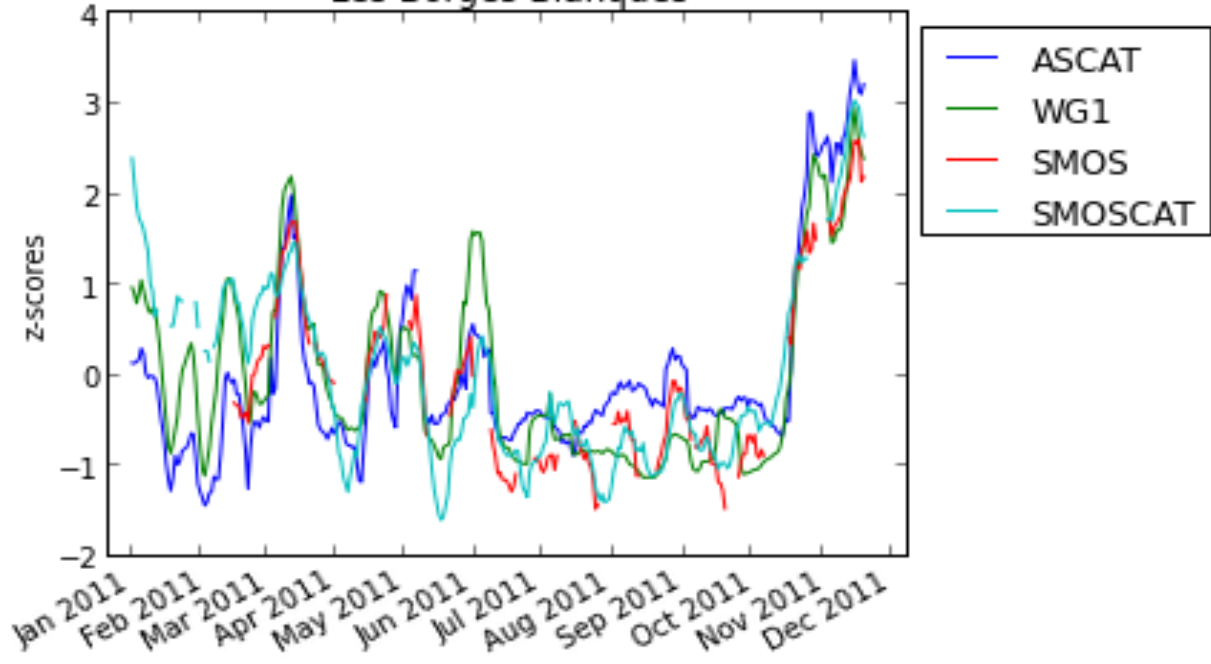
La Conca de Barbera



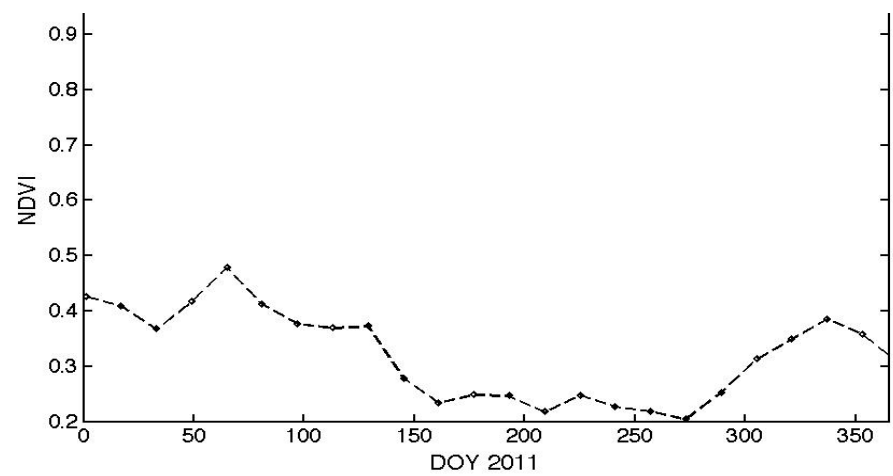
ASCAT 0.86
 SMOS 0.85
 SMOScat 0.81

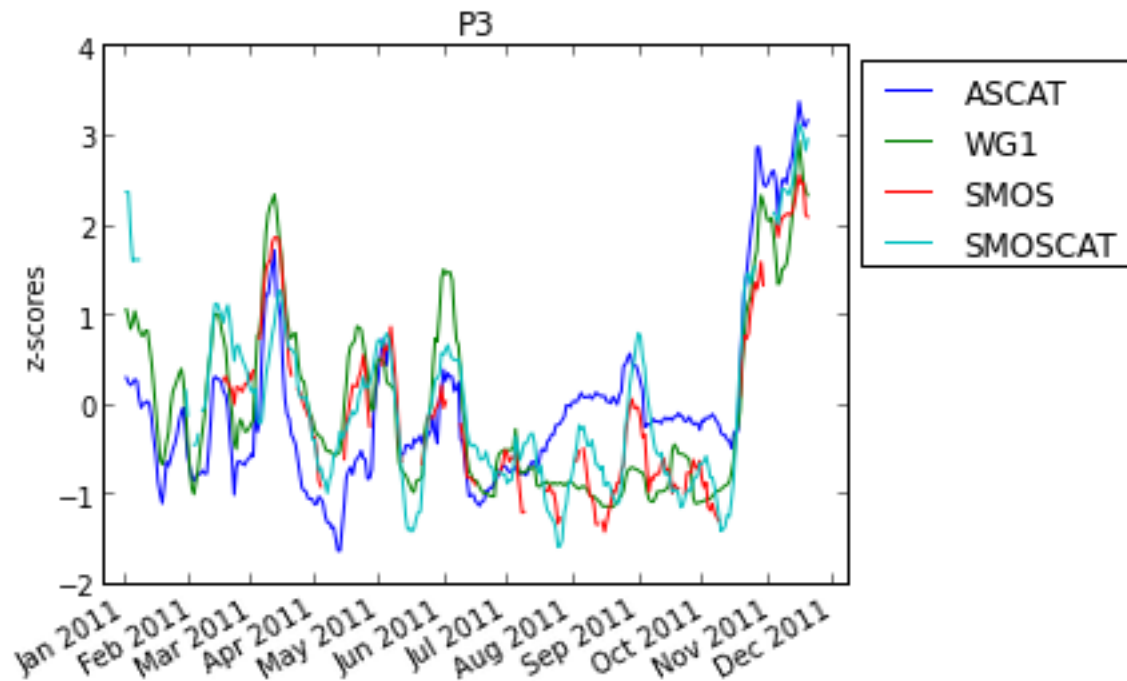


Les Borges Blanques

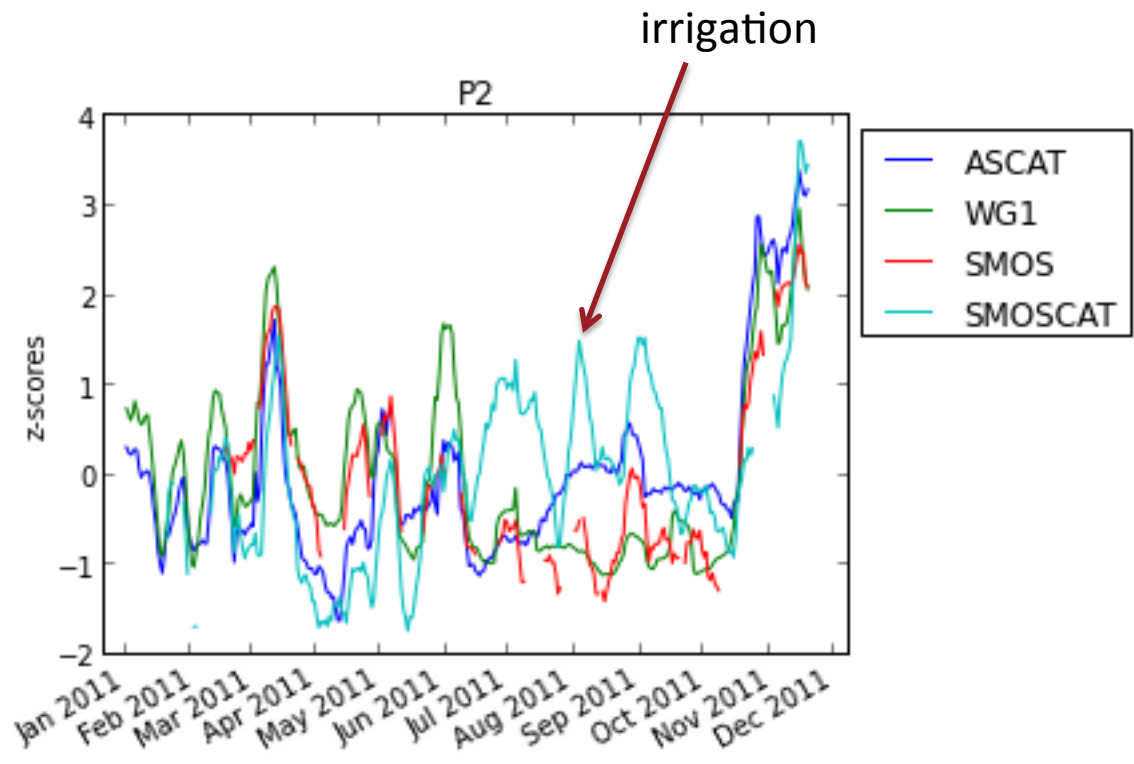


ASCAT 0.82
SMOS 0.90
SMOScat 0.87

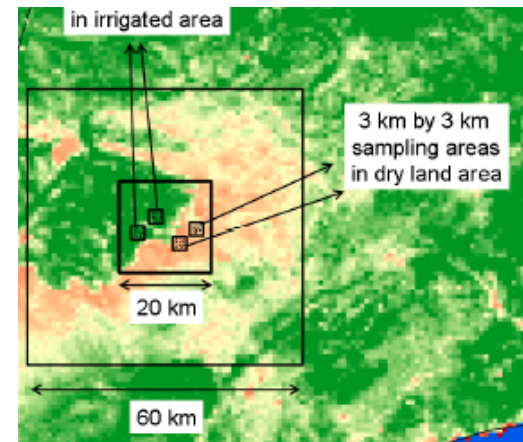
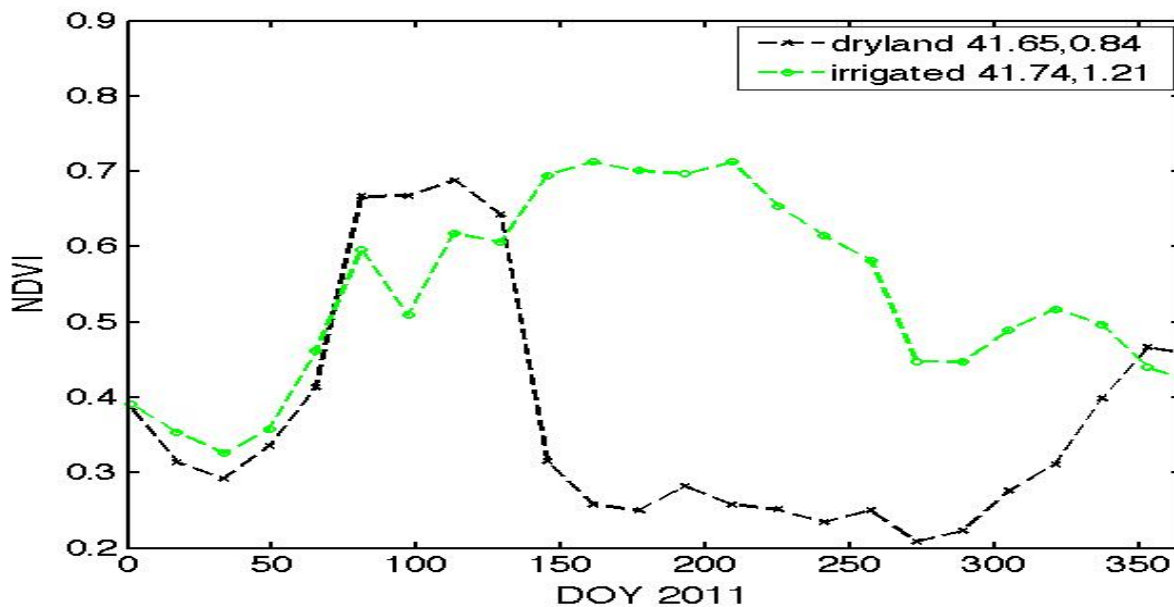




	ASCAT	SMOSCAT	SMOS
P3	0.71	0.87	0.91



	ASCAT	SMOSCAT	SMOS
P2	0.74	0.29	0.9

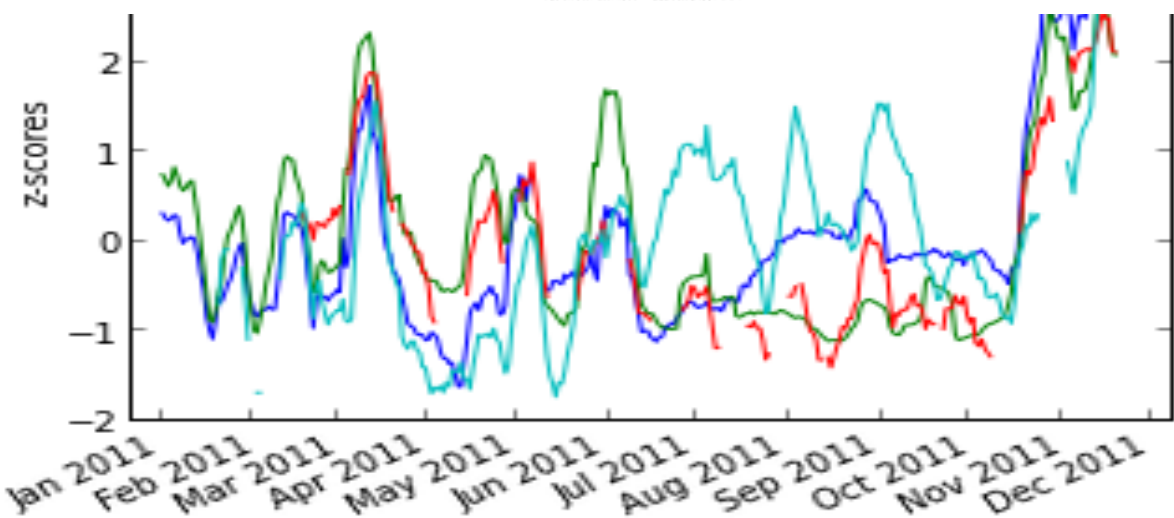


ASCAT

WG1

— SMOS

— SMOSCAT



Dominant land cover classes: grass-shrubs, crops and forest

	cover group	mean	std	n
ASCAT	grassShrubs	0.6	0.2	587
ASCAT	crops	0.6	0.1	533
ASCAT	forest	0.5	0.2	641
SMOS	grassShrubs	0.6	0.1	455
SMOS	crops	0.7	0.1	471
SMOS	forest	0.6	0.1	258
SMOScat	grassShrubs	0.5	0.1	542
SMOScat	crops	0.6	0.1	519
SMOScat	forest	0.5	0.1	505

- Compare two different surface soil moisture remote sensing products ASCAT, SMOS and a high resolution product from SMOS (SMOScat) and soil wetness from LSM in Catalonia
- ASCAT provides more data coverage and shows lower correlation over areas with high topography
- SMOS L2 v551 shows less data under forest cover
- SMOScat is able to discriminate irrigated areas
- Overall correlation with LSM: ASCAT 0.61, SMOS 0.62, SMOScat 0.55
- Correlation per cover class higher for SMOS specially crops 0.7 and forest 0.6
- Over crops, ASCAT soil moisture increases from July to Novembre probably due to increase of roughness (ploughing or increase of penetration depth)

- A more refined land cover class is needed
- Analyse topography effects is needed
- The analyses will be extended to other satellite MW SM products



Thank You !

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