Global soil moisture monitoring: possible assimilation of a suite of satellite observations from the visible to the microwave

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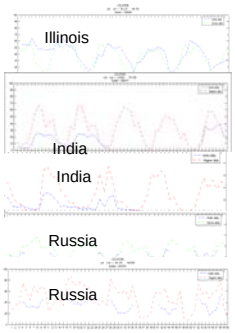
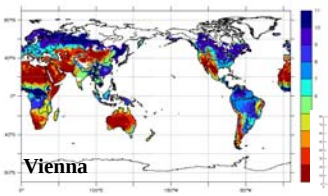
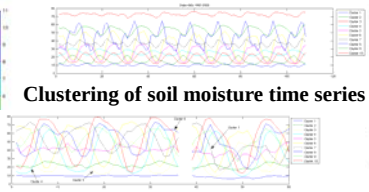
Comparison of current global soil moisture datasets using an innovative error cluster metric

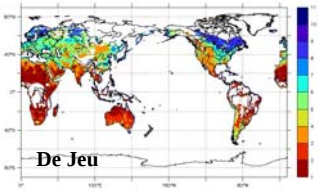
In the dataset developed at the Vienna University of Technology, a change detection algorithm is used to retrieve soil moisture from the ERS scatterometer (Wagner *et al.* 2003). This dataset covers a period from 1992 to 2000. Another dataset considered here uses the Land Retrieval Parameter Model (Owe *et al.*, 2008) applied to the Special Sensor Microwave Imager (SSM/I) brightness temperature measurements (more informative TMI observation will also be considered).

	Wagner	De Jeu	Nb stations
Illinois	0.13	0.70	17
Russia	0.39	0.53	56
India	0.73	0.15	09
Global	0.37	0.52	82





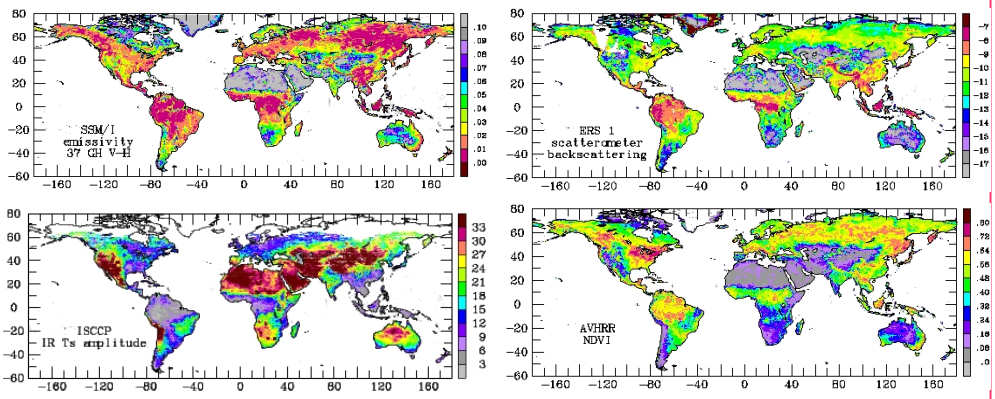




Validation against in situ measurements

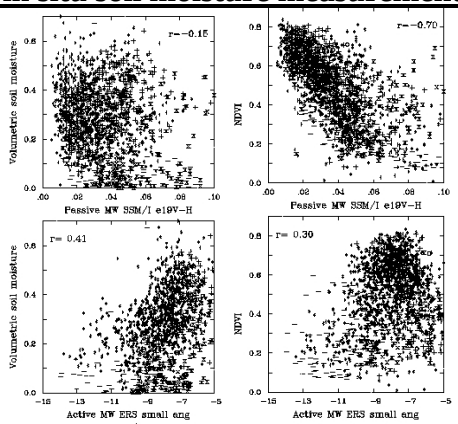
Analysis of the available satellite observations to soil moisture at a global scale for climatological applications

- passive microwaves: land surface emissivities derived from SSM/I observations (19 GHz to 85 GHz, both polarizations) (Prigent et al., JGR, 199)
- active mcirowaves: backscattering coefficients from the ERS scaterrometer (5.25 GHz)
-thermal infrared: ISCCP (Rossow and Shiffer, 1999) surface skin temperature, statistically analyzed to reconstruct the diurnal cycle (Aires et al., JGR, 2004)
-visible and near-infrared reflectances and derived NDVI from AVHRR (Pathfinder)

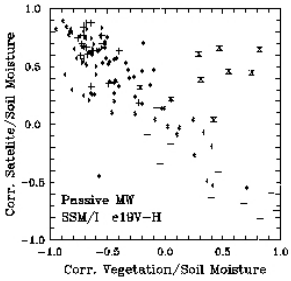


Analysis of collocated satellite data and in situ soil moisture measurements

Global Soil Moisture Data Bank (Robock et al., BAMS, 2000): soil moisture measurements in different environments (Russia, Mongolia, India, USA)



Lower correlation between satellite observations and soil moisture than with vegetation

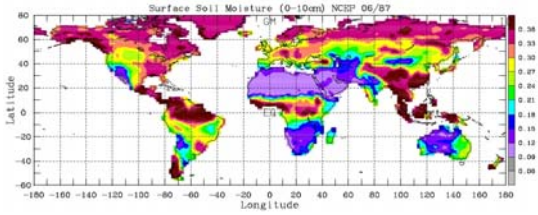


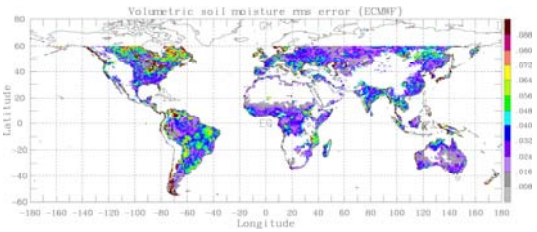
Correlation satellite / soil moisture related to correlation vegetation /soil moisture

Find a method that uses all information, even the soil moisture and vegetation link at global scale

- **neural network between the satellite data and the soil moisture at global scale**
- **advantages:**
  - **does not depend on radiative transfer codes that can be very questionable globally**
  - **data-fusion of multi-spectral satellite observations**
  - **nonlinear model ⇒ situation-dependent (important for global scale)**

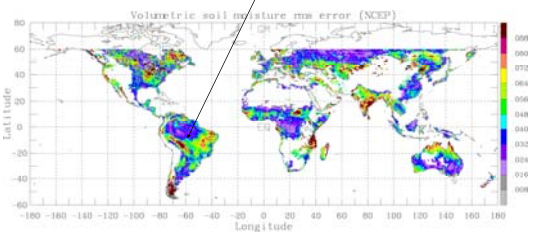
-NCEP and ECMWF soil moisture estimate to train the network:
- **good index for large-scale variability**
- **similar behaviour with satellite with in situ**
- **training of the neural network on monthly time-scale**





RMS differences

problems



Conclusions and perspectives

- **Consistency checking method: Check the consistency of any model output with satellite observations**
- **Variational assimilation applications: Define a link between observations and model (link coherent with model);**
- **additional constraint to the model: spatial and temporal coherency with satellite observations**

References

- **Prigent et al., JGR, 2005;**
- **Aires et al., JGR, 2005;**
- **Owe et al., 2008;**
- **Wagner et al. 2003.**