UN SPIDER Expert Meeting on Crowdsource Mapping
for Disaster Management and Emergency Response

The Use of satellite-derived Soil Moisture for agricultural Drought Monitoring

Markus Enenkel
me@ipf.tuwien.ac.at
Department of Geodesy and Geoinformation (GEO)
Vienna University of Technology

Outline

- Introduction
- Remote Sensing
- Objectives/Method
- Validation via Mobile-phone Application
- Future steps

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- Steps steps

Background

- Department of Geodesy and Geoinformation

  → geometric and physical modelling

- Research Focus

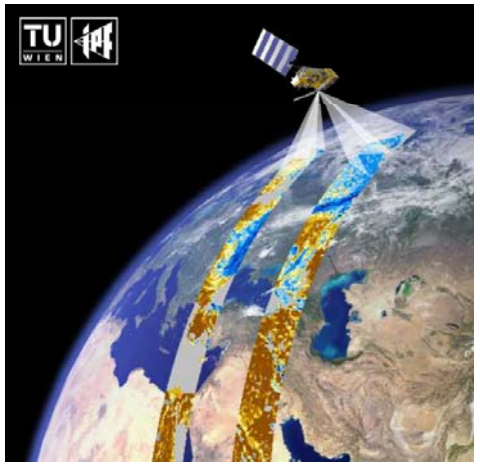
→ Radar Remote Sensing of Soil Moisture, Laserscans

- Personal Background in Natural Resource Management (Water and Risk Management)

→ GLobal WAter Scarcity Information Service (GLOWASIS)

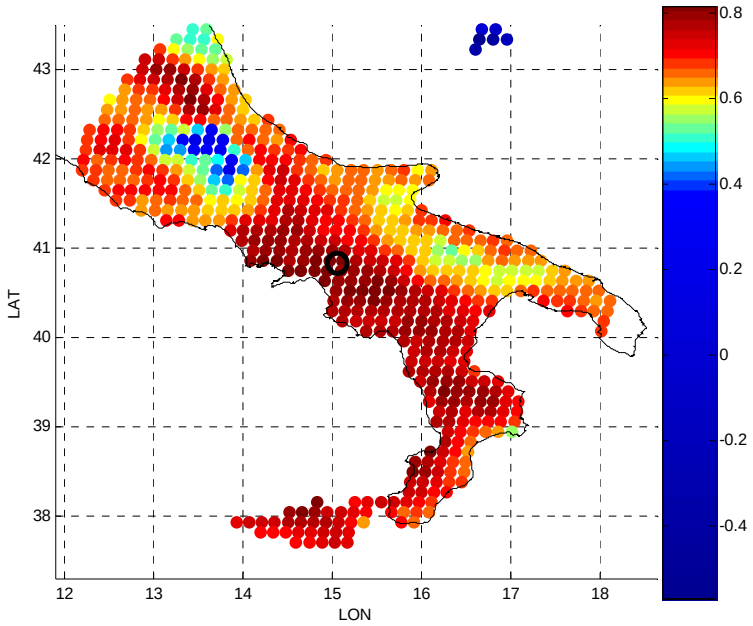
The Issue with Droughts

- No commonly accepted definition (comparison?)
- More than 50% of global land surface potentially threatened
- Natural disaster with most severe impact (hot spots)
- Higher impact in developing countries (lack of preparedness, individual strategies, lack of trust in “new” technologies)
- High potential for satellite-derived datasets



The Role of Soil Moisture

- Measure of actually available water in pore space
- Higher frequency of (hydro-) meteorological extreme events
- In-situ measurements vs. models vs. remote sensing
- Improve hydrological models
- Temporally stable spatial patterns



Source: BROCCA, 2009

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Microwave Remote Sensing (active/passive)

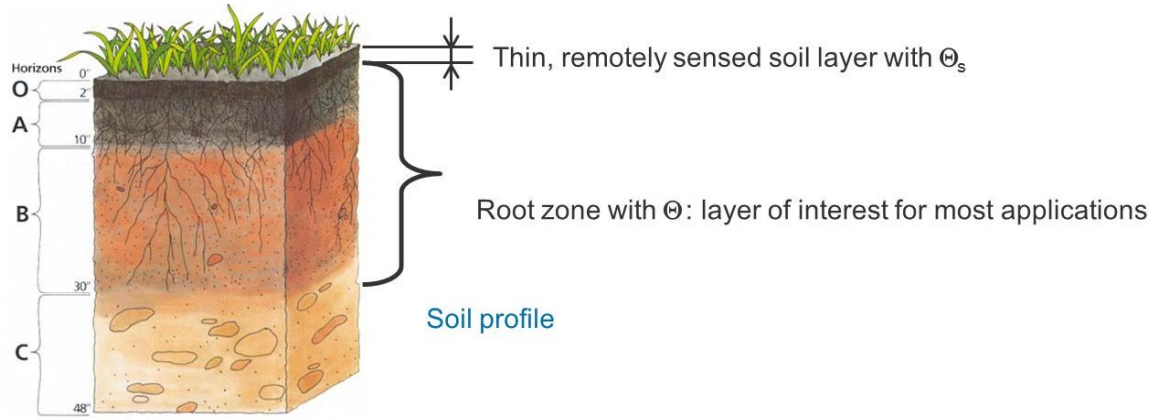
Advantages:

All-weather, day-round measurement capability,

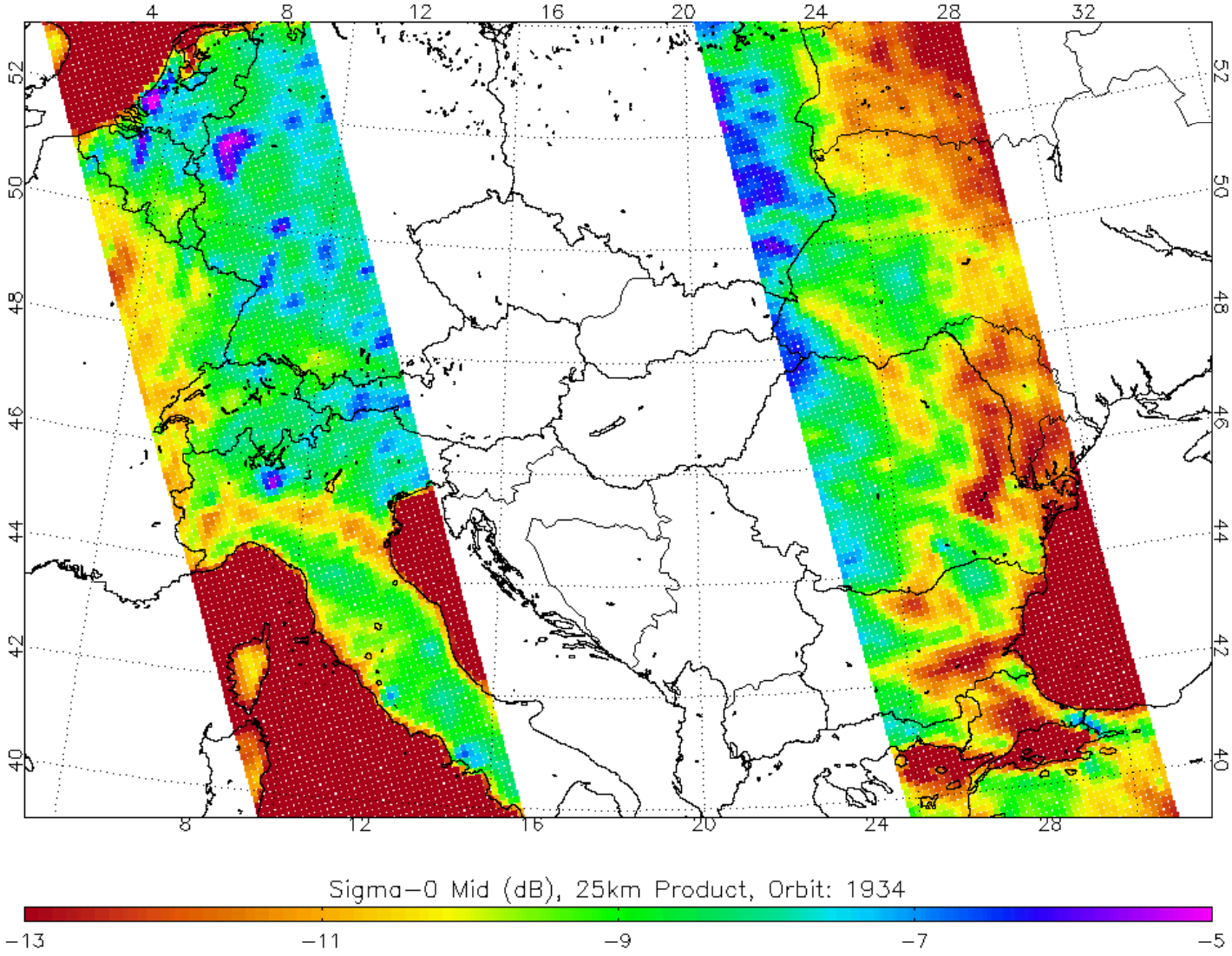
No auxiary data needed (only backscatter), NRT products

Disadvantages:

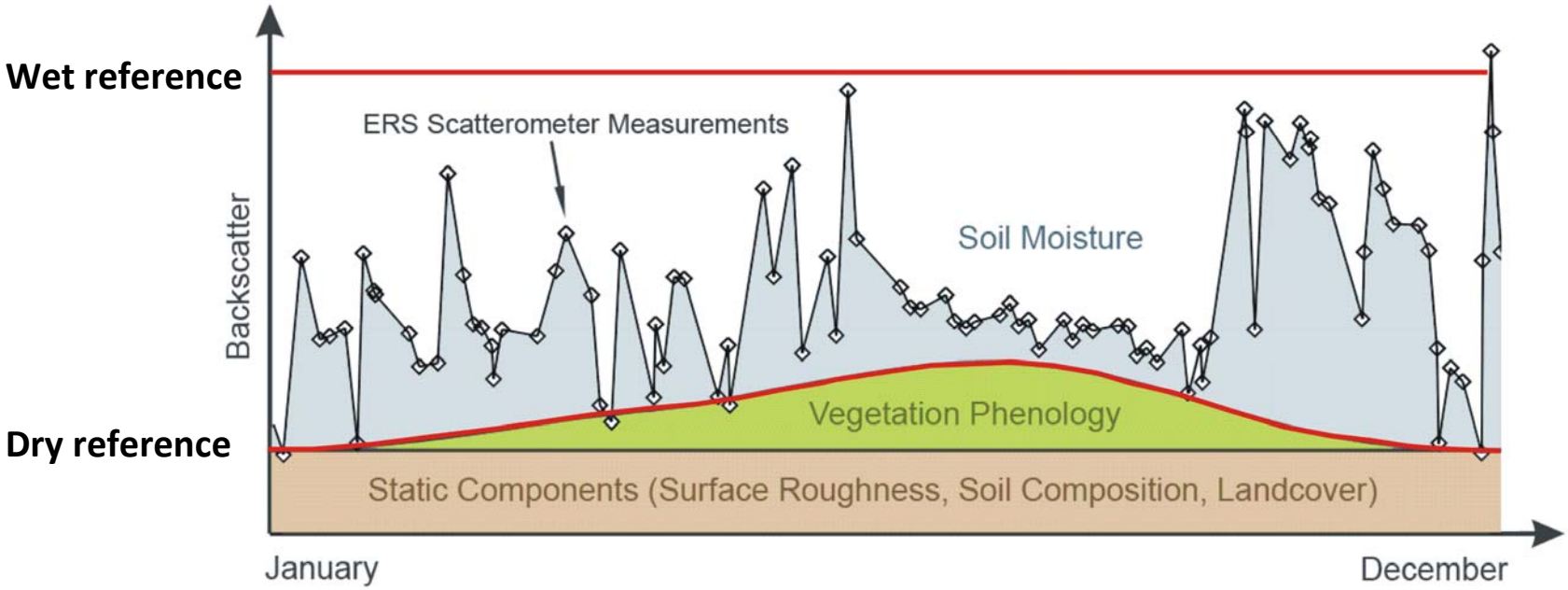
Retrieval issues over frozen soils, dense vegetation and complex topography

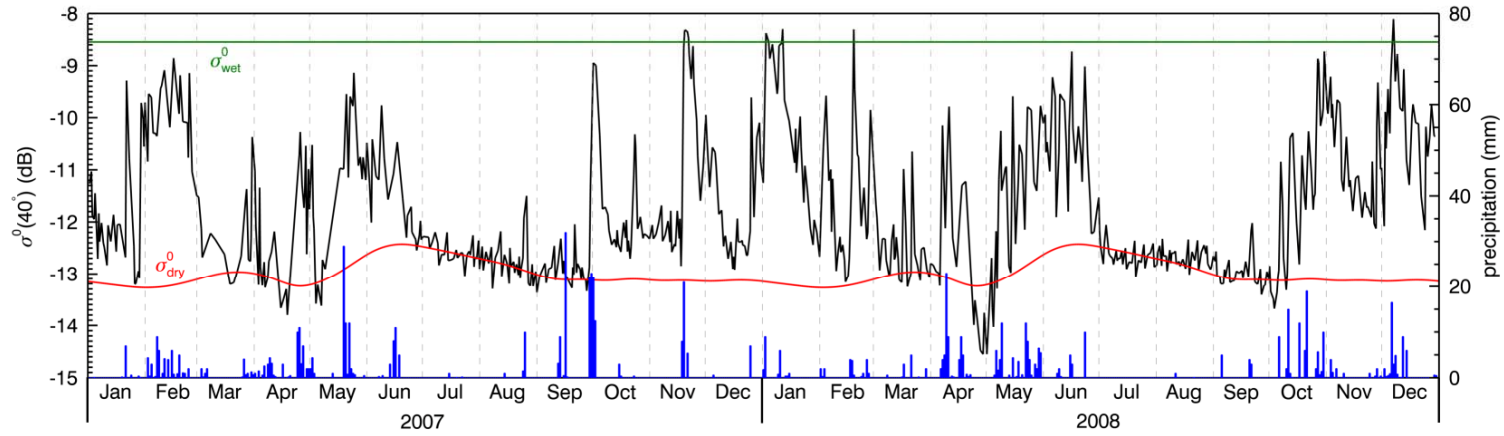


Backscatter measurements

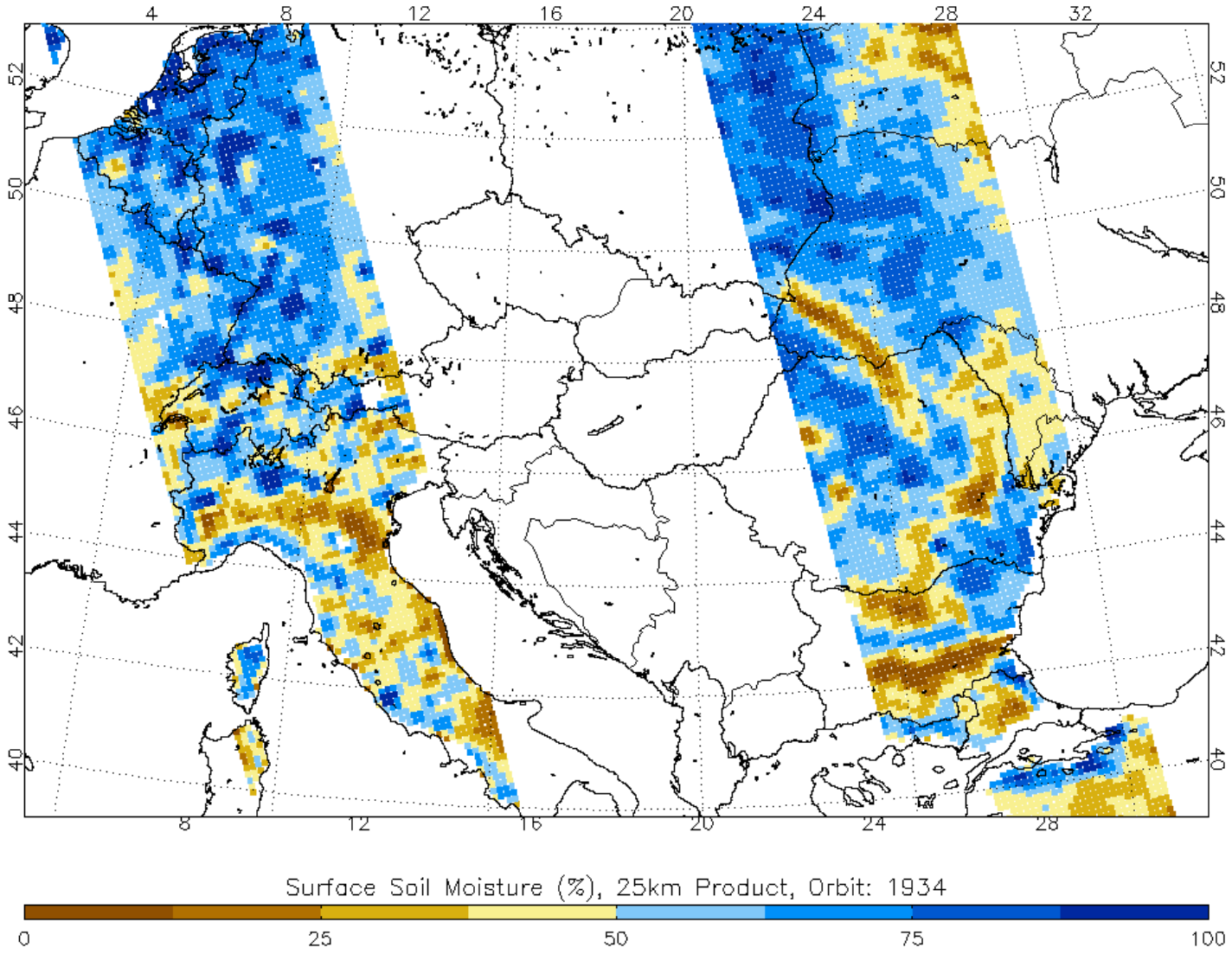


Change Detection (physically based)



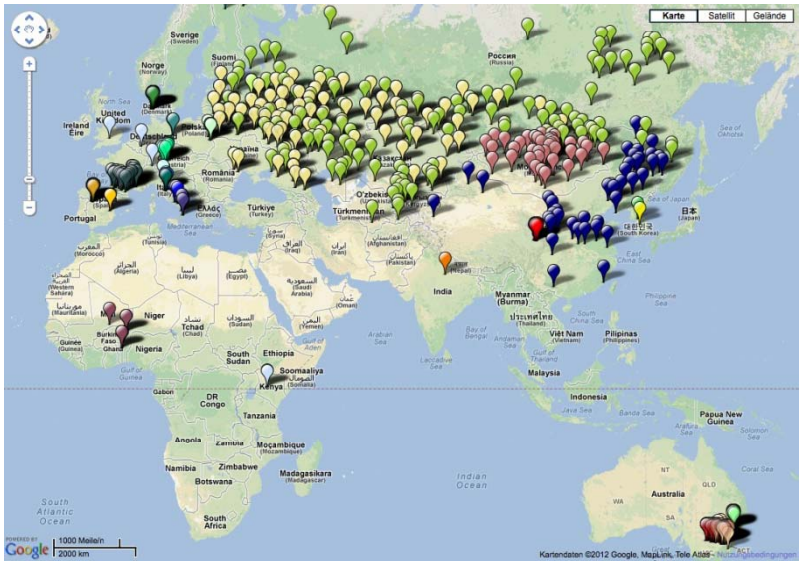


EUMETSAT ASCAT orbit data example for Surface Soil Moisture



Products – all freely available (25 kilometer resolution)

- Surface Soil Moisture (SSM, orbit-format, global, NRT, EUMETSAT)
- Surface Soil Moisture (time-series, global, GEO)
- Soil Water Index (SWI, global, four layers, ECMWF)
- ESA Climate Change Initiative (SSM, 1978-2010)
- International Soil Moisture Network



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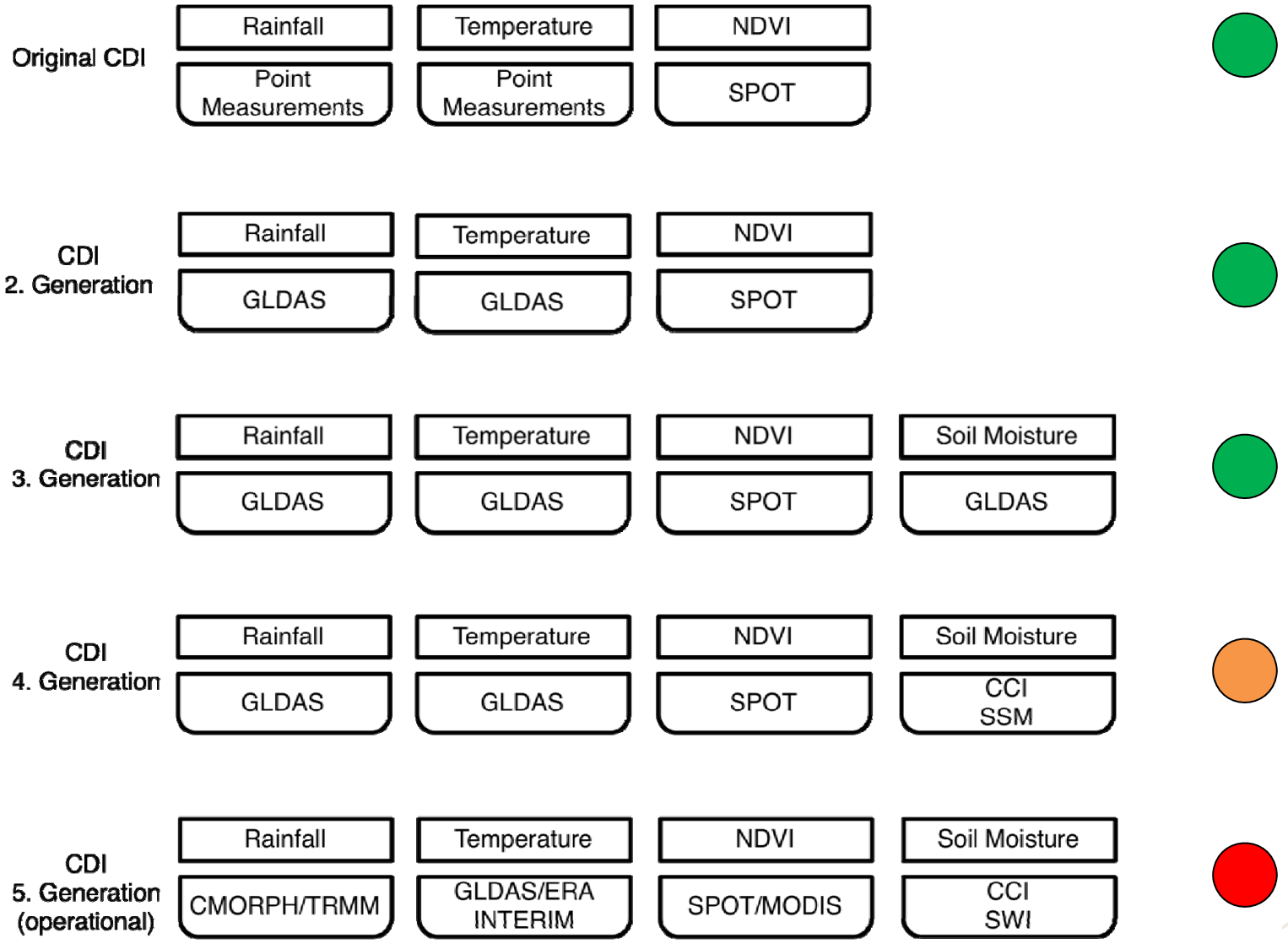
Objectives

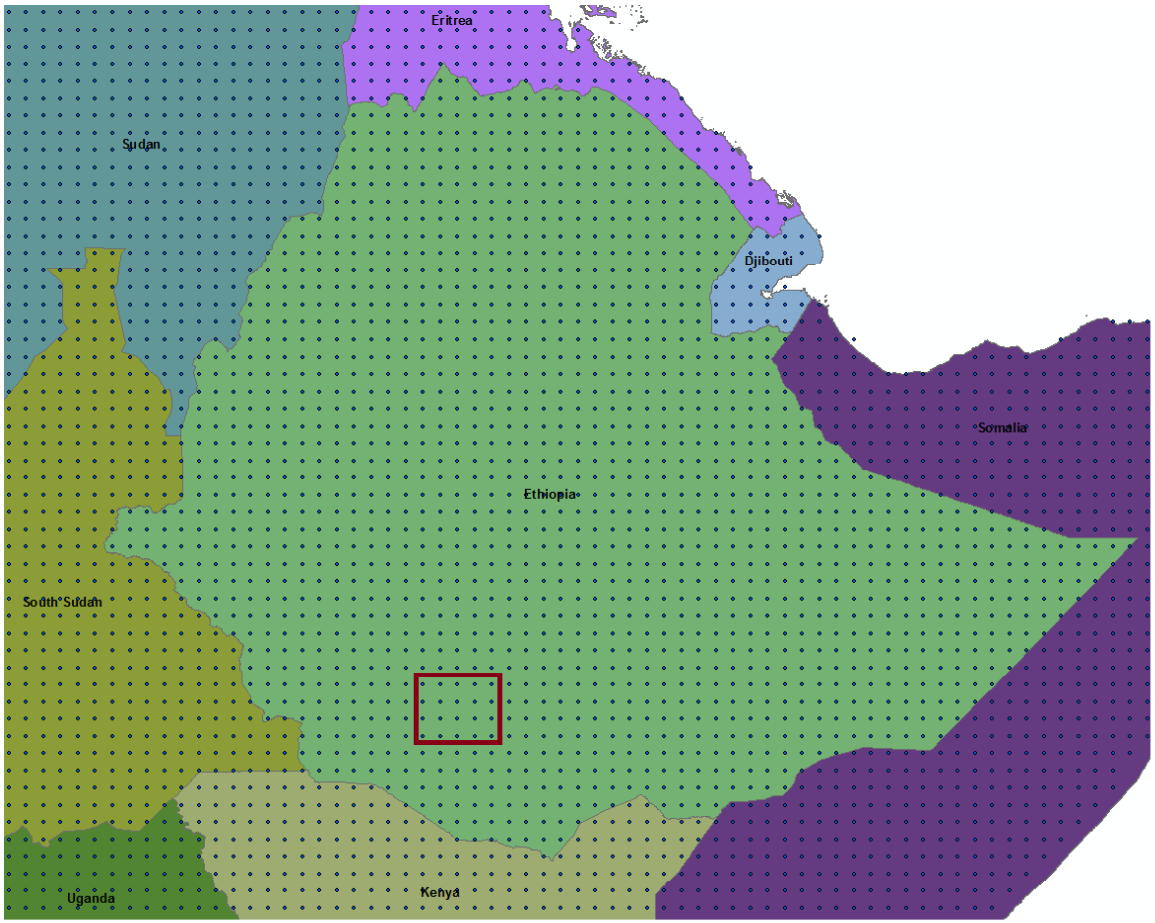
- Improve a drought index that is already used in East Africa
- Replace point measurements by remote sensing data
- Process the new index for the entire African continent at a temporal resolution of 10 days
- Add a soil moisture component (both surface and profile soil moisture)
- Relate seasonal forecasts to actual conditions

Source: ESA

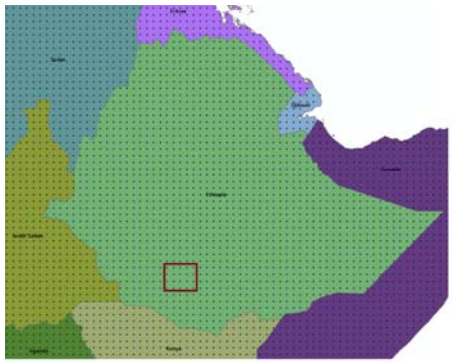
Method - Generations

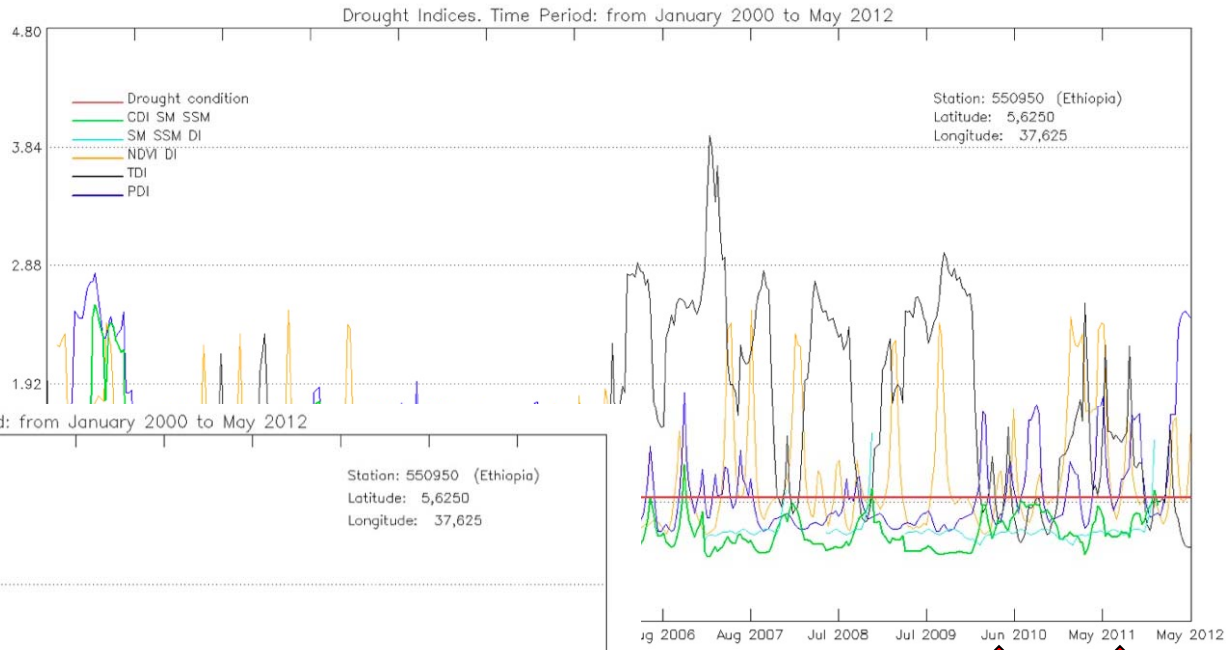


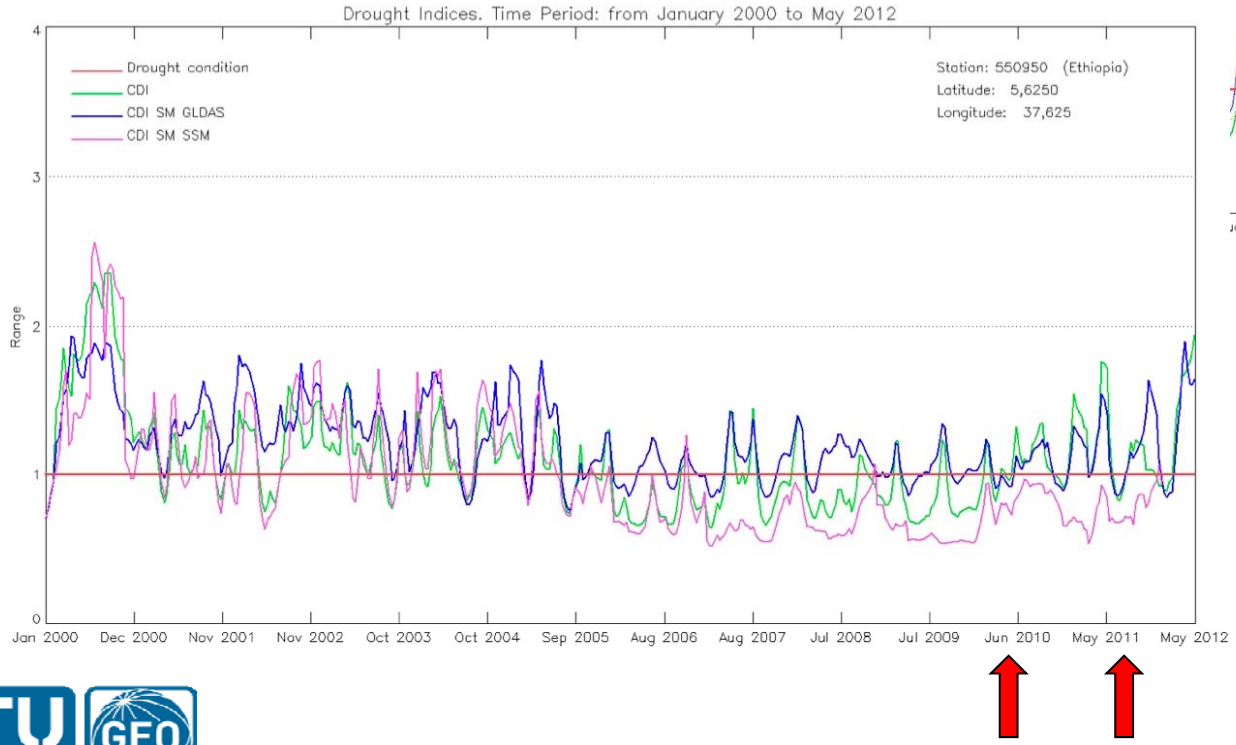
Results – ROI 1



Results – ROI 1



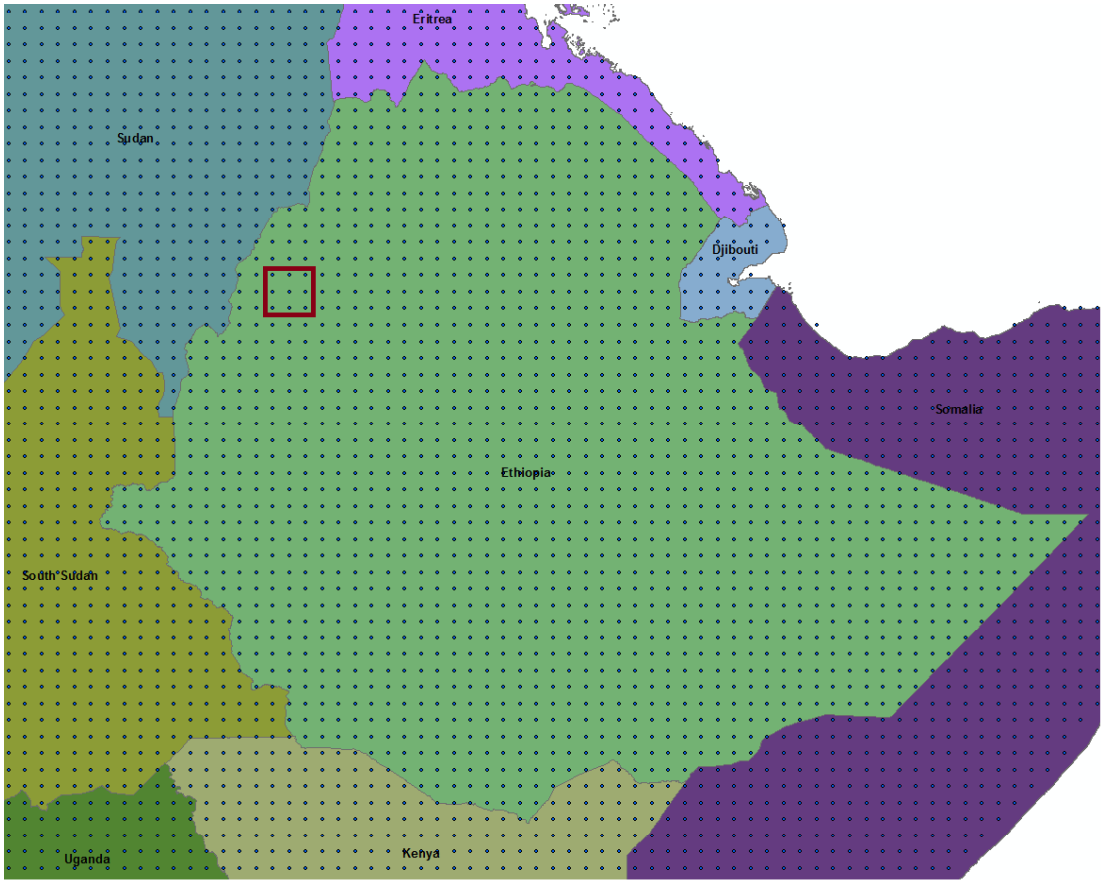




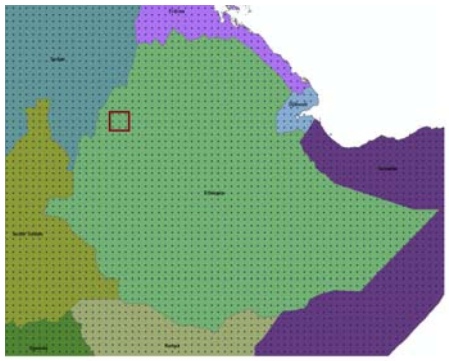
Critical rates of acute malnutrition reported

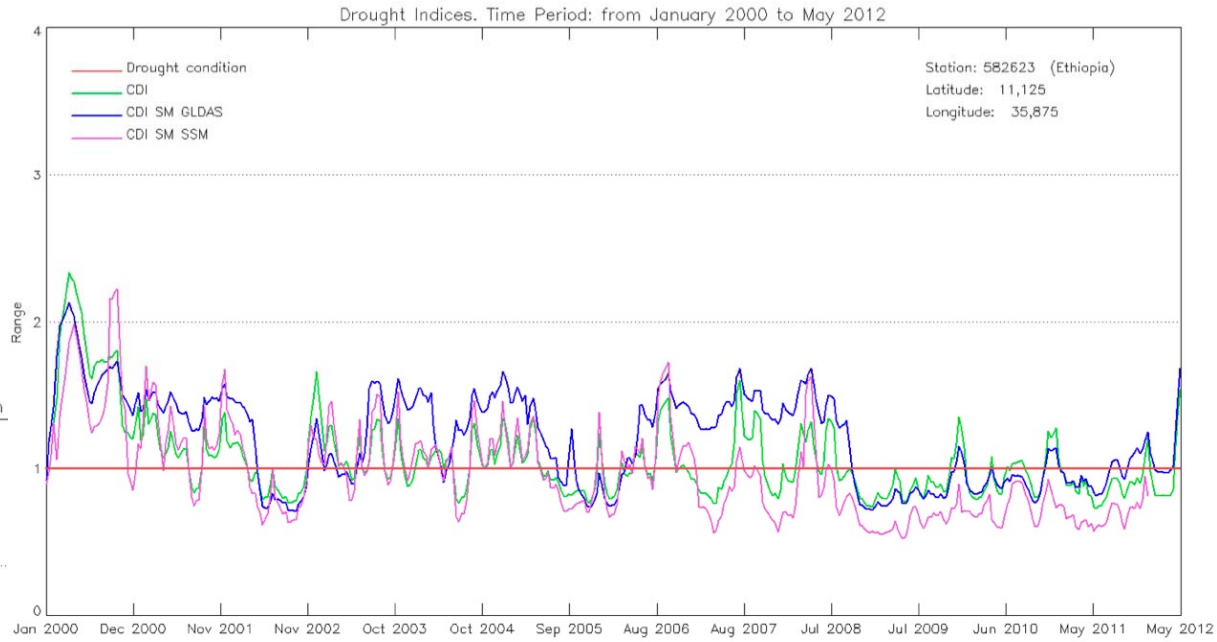
Famine declared

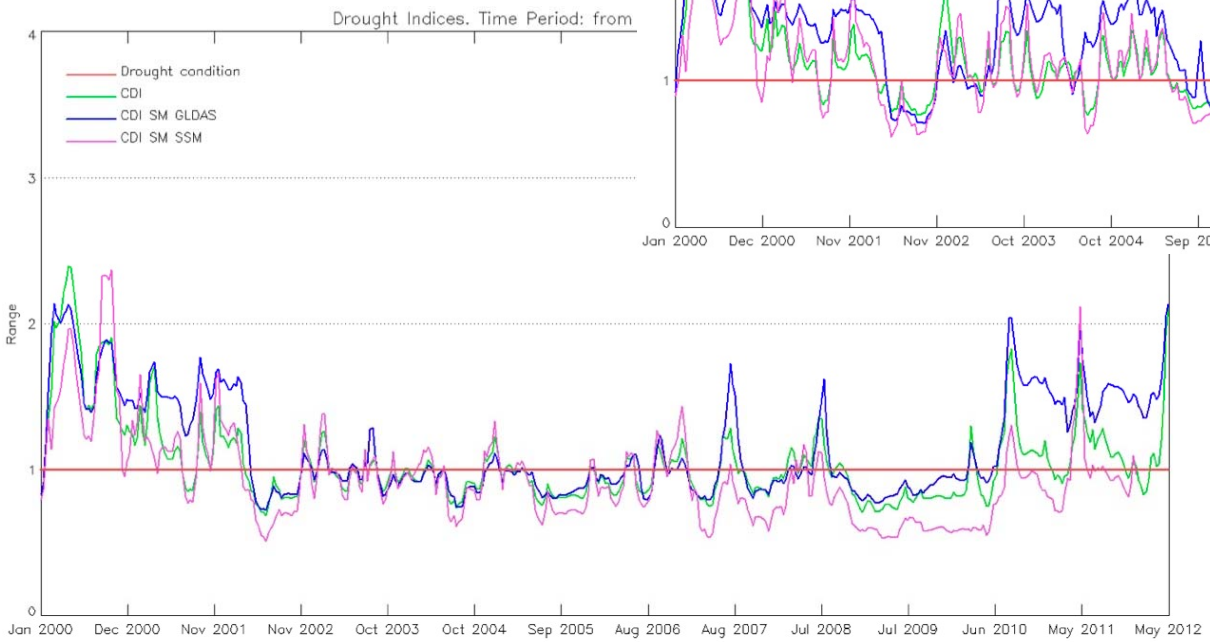
Results – ROI2



Results – ROI2







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The Mobile Phone App

- Response based on level of food insecurity (IPC)
- Local assessments often too slow
- Local knowledge subjective, but important
- Humanitarian aid organizations and decision-makers already on site

Main purposes:

1) Validation of the index
2) Integration of socio-economic vulnerabilities in NRT

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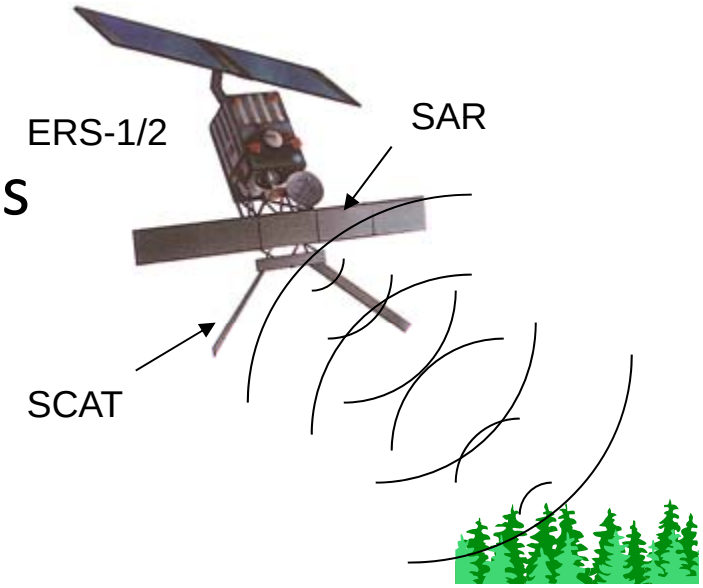
Next Steps

- Use the index to “track” forecasts
- Consider evapotranspiration
- Identify which parameter describes the drought condition best
- Test the mobile phone application in the field



Links

- Department of Geodesy and Geoinformation: http://www.ipf.tuwien.ac.at/radar/
- Soil Moisture Data Viewer: http://www.ipf.tuwien.ac.at/radar/dv/ipfdv/index.php?dataviewer=ascat
- ESA Climate Change Initiative – Soil Moisture Climatology from 1978-2010: http://www.esa-soilmoisture-cci.org/
- International Soil Moisture Network: http://www.ipf.tuwien.ac.at/insitu/
- FAO SWALIM: http://www.faoswalim.org/