

Satellite weather index insurance

A case study for Eastern German farms

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1 Introduction

- Agricultural production prone to impacts of **extreme weather**
- Insurance important risk management tool for farms,
- **Drought insurances** are often lacking

→ We aim to assess potential new insurance solutions based on **soil moisture** and satellite

2 Background

- Extreme droughts are expected to increase under **climate change**
- Traditional indemnity insurances prone to asymmetric information problems
- **Index insurances** as alternative: Payout dependent on index value
- Different indices have been considered:
 - Weather and climate variables¹:
 - Area-yields²
 - Plant measurements (with satellites)³
- **Reliable, high quality, low costs** index with **high correlation** with a farm's agricultural losses
- **Soil moisture** represents the water stock, which is essential for plant growth

➤ including soil moisture potentially improves agricultural insurances

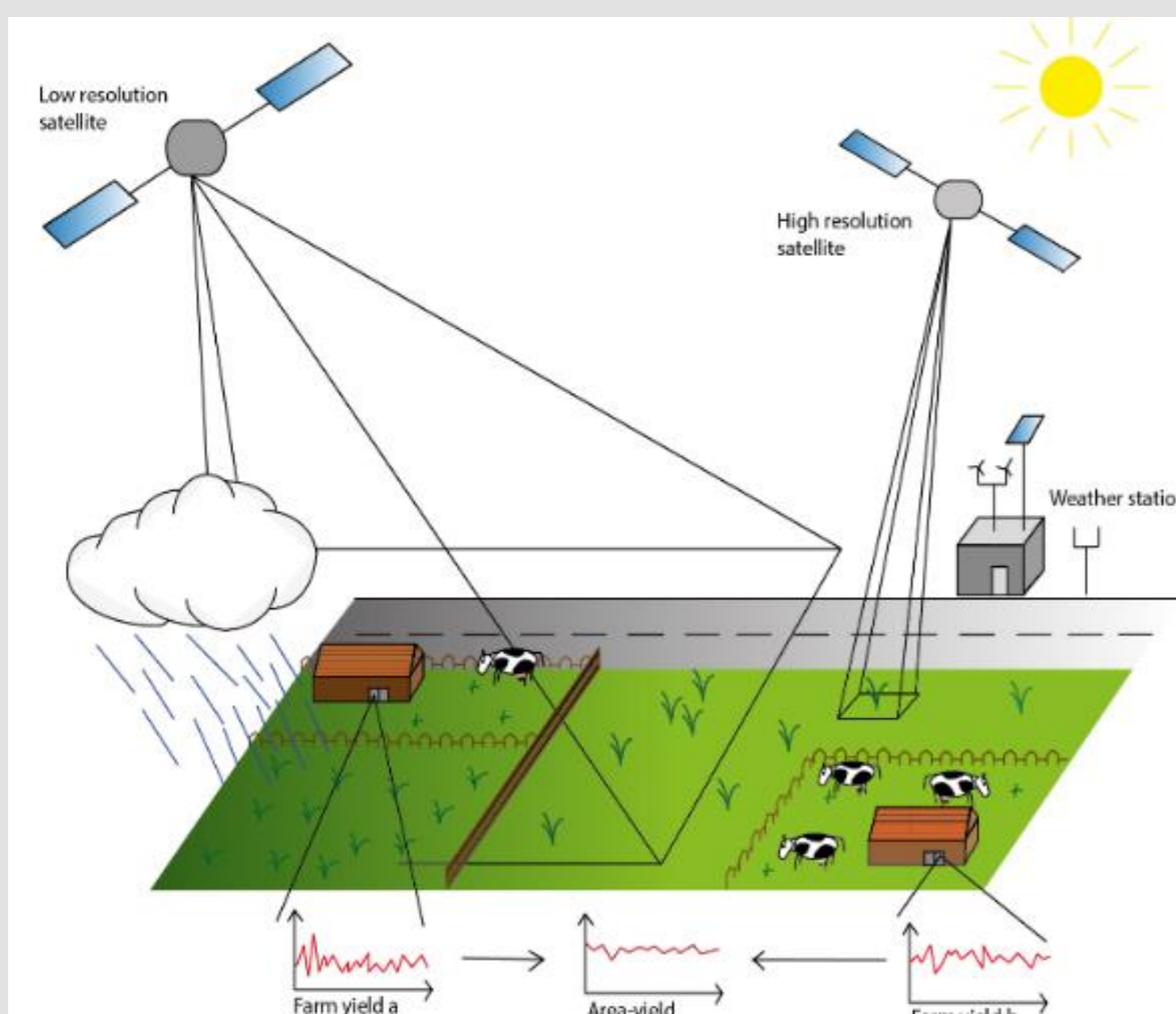


Fig. 1. An overview of data collection for agricultural insurances.

3 Data

We assess the use of soil moisture data provided by the Climate Change Initiative (CCI) program of the **European Space Agency (ESA)**⁴ for insuring **wheat, maize and rape yields**. This long-term, global and harmonized satellite soil moisture product, which is freely available, is compared to the use of gridded soil moisture estimates provided by the **Deutscher Wetterdienst (DWD)**⁵.

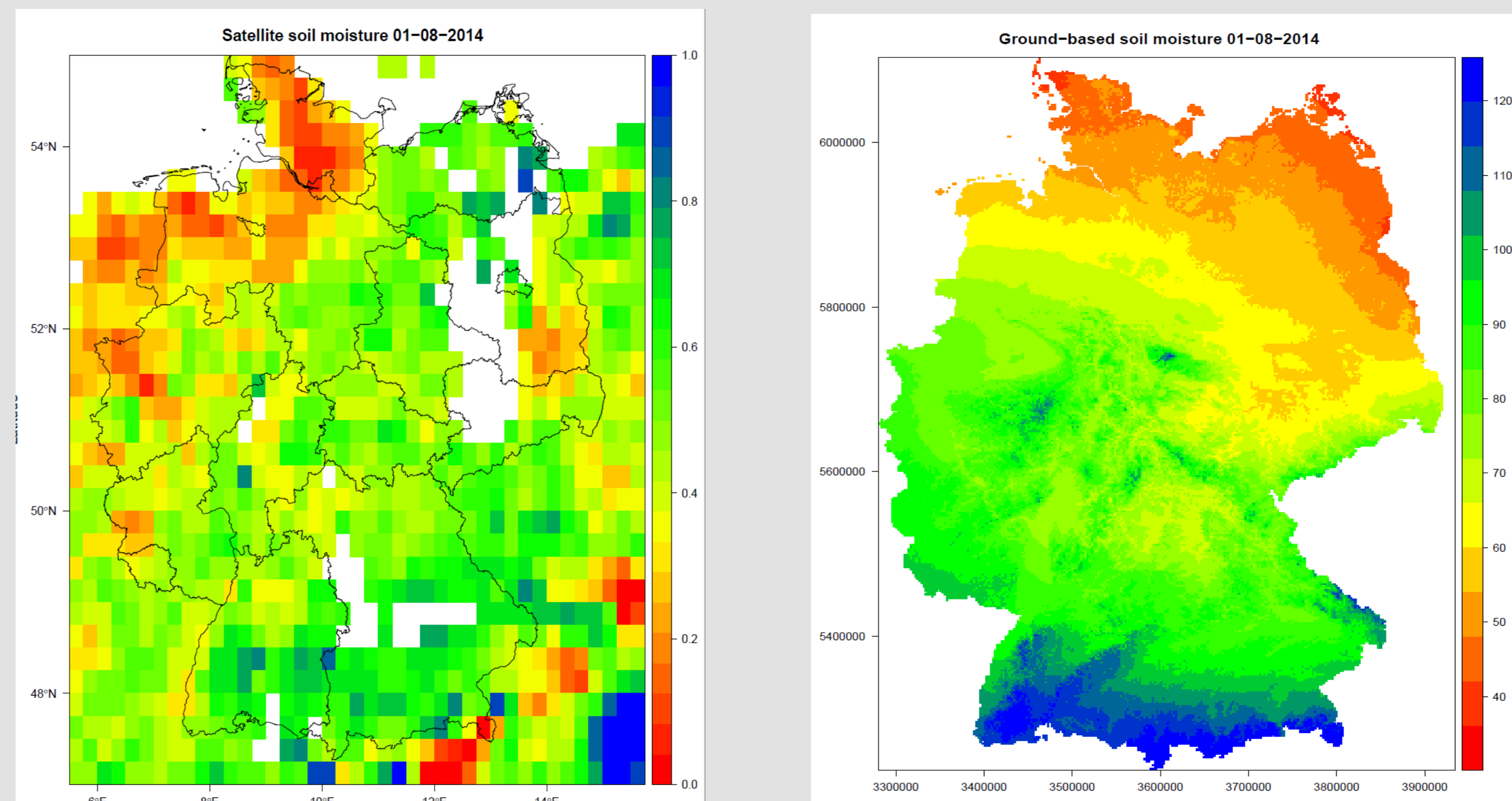


Fig. 2. Left: Soil moisture estimated by satellites as provided by the ESA CCI rescaled to min and max measured values between 1995 and 2015
Right: Soil moisture estimated with the AMBAV model based on ground-based weather measurements provided by the DWD

4 Dataset characteristics

- ESA CCI soil moisture estimates are based on **microwave remote sensing**
- DWD product relies on estimates that are **modelled** based on ground-based **weather measurements**.

Tab. 1. Summary of data characteristics

	ESA CCI	DWD
Spatial resolution	25km ²	1km ²
Temporal resolution	Daily	Daily
Record length	40 years	27 years
Unit	$\frac{m^3(\text{Water})}{m^3(\text{Soil})}$	%nFK
Lag until data available	1-2 years	1-2 months

5 Preliminary results

Soil moisture estimates may differ between the two data sets:

- Soil moisture is estimated by measuring **different characteristics**
- DWD assumes a **standard soil only**
- The ESA CCI measurement are currently re-scaled to 0-1 to represent degree of saturation while the DWD measurements are given in %nFK
- Different **spatial resolutions**

6 References

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