



Food and Agriculture
Organization of the
United Nations

STOP SOIL EROSION
SAVE OUR FUTURE

Spatio-temporal monitoring of soil erosion events

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GLOBAL SYMPOSIUM ON SOIL EROSION

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INTERGOVERNMENTAL
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Nuclear Techniques in Food and Agriculture

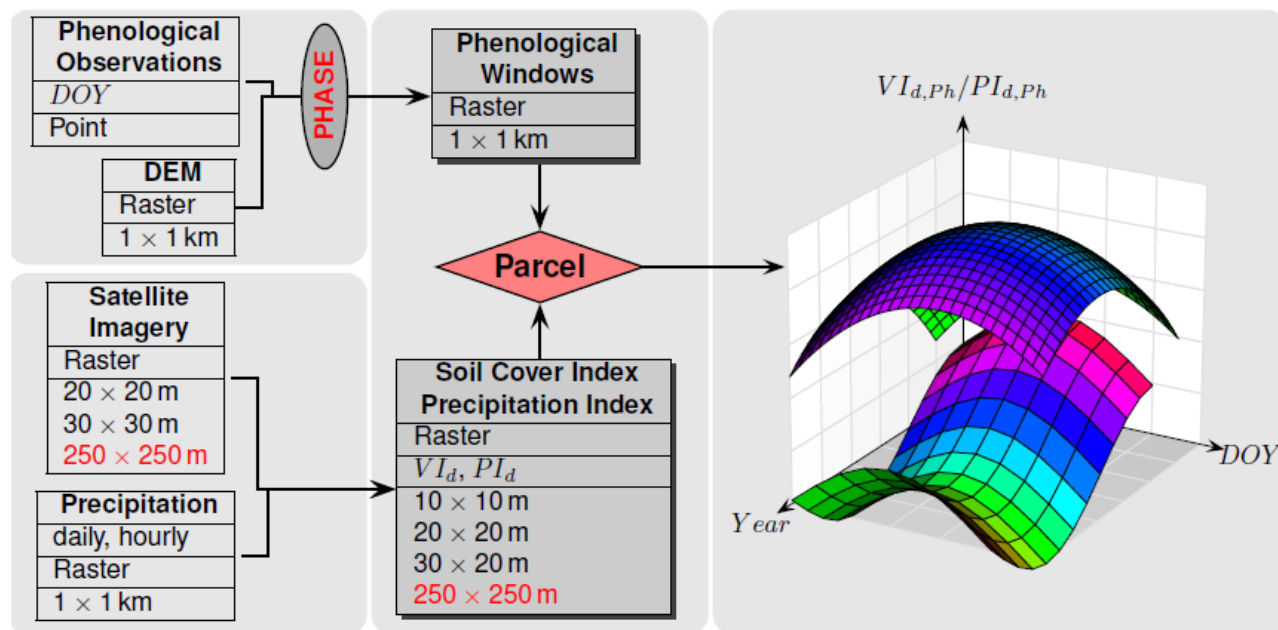
UNCCD **SP** Science - Policy
Interface

Spatio-temporal detection of agricultural parcels affected by soil erosion



- Soil erosion occurs when a heavy rain event coincides with no or sparse vegetation cover on parcels.
- Event-specific information about parcel-specific crop coverage and precipitation on particular development stages/phases are needed.

Parcel-specific time series of phenological soil cover and precipitation

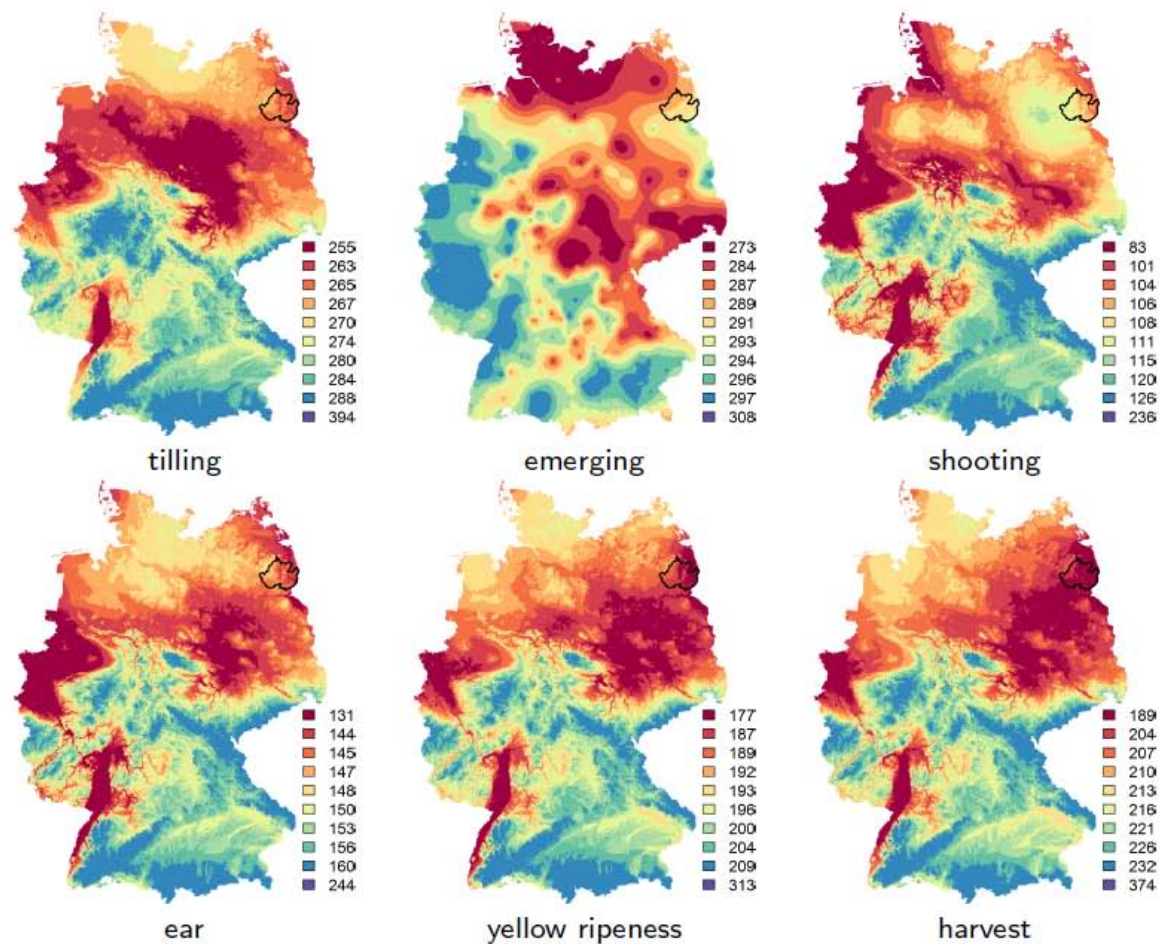


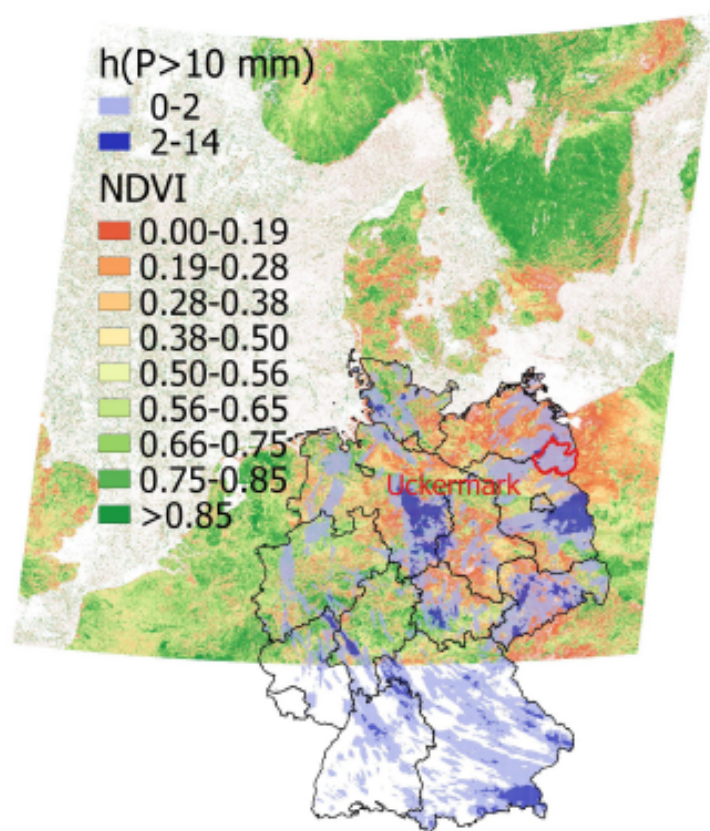
Gerstmann, H., Doktor, D., Gläßer, C. & Möller, M. (2016): PHASE: A geostatistical model for the Kriging-based spatial prediction of crop phenology using public phenological and climatological observations. *Computers and Electronics in Agriculture* 127, 726–738.



Möller, M., Gerstmann, H., Dahms, T.C., Gao, F. & Förster, M. (2017): Coupling of phenological information and simulated vegetation index time series: Limitations and potentials for the assessment and monitoring of soil erosion risk. *CATENA* 150, 192–205.

Beginning phenological phases (Winter Wheat, 2016)



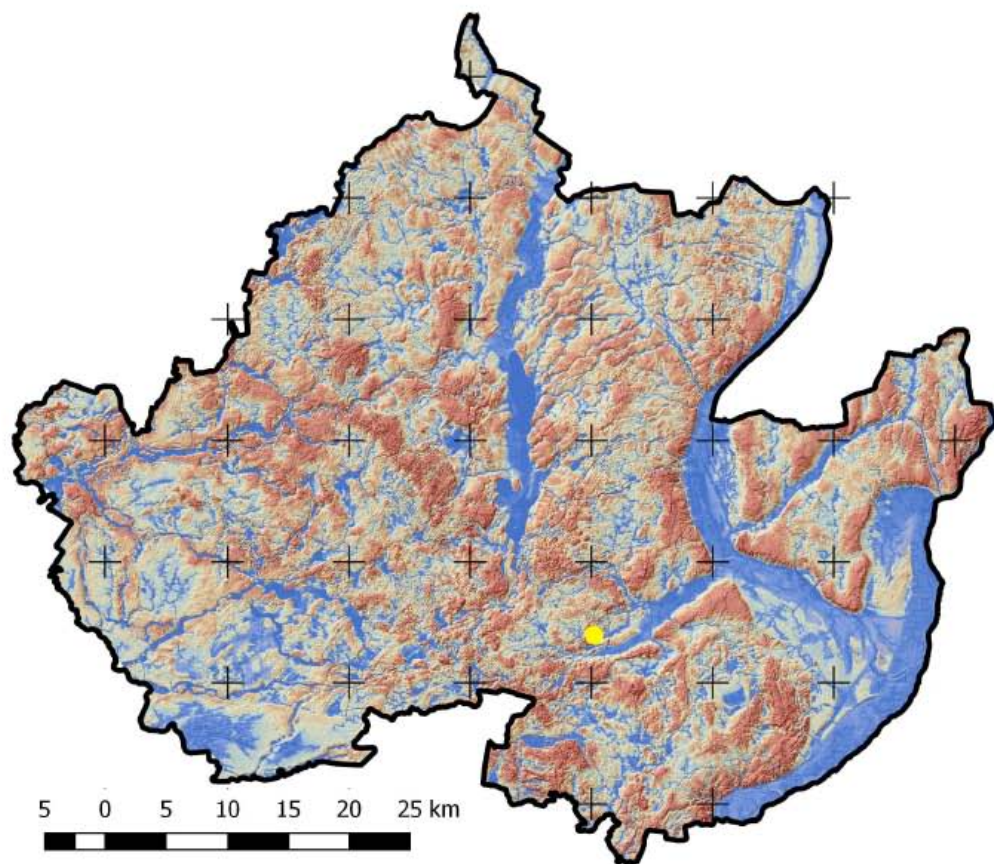


Soil coverage index (7.10.2016 · *DOY* = 281)

- MODIS Terra Surface Reflectance 8-Day L3 Global 250 m SIN Grid V006 (MOD09Q1; © USGS)
- NDVI · SAVI
- 250 × 250 m

(Heavy) Precipitation index (3.10.2016 · *DOY* = 277)

- highly resolved (5 min) and adjusted radar rain data (RADOLAN, © DWD)
- aggregated to hours per day exceeding a threshold of $P > 10$ mm
- 1 × 1 km



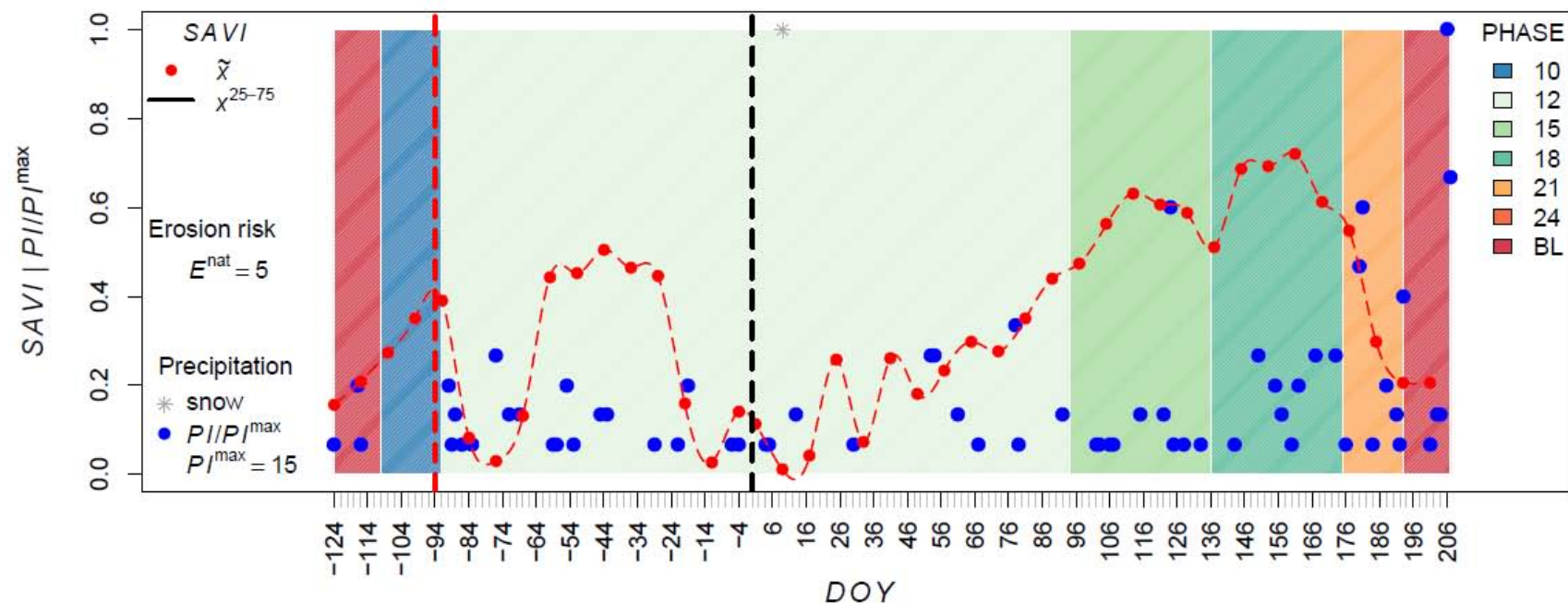
Regional geodata

- DEM & soil erodibility
 - 10 × 10 m
 - © Soil survey of Brandenburg (<https://lbgr.brandenburg.de>)

Parcel DEBBLI0373300339-3901: Google earth image from 26.9.2016
(DOY=270)



Parcel DEBBLI0373300339-3901: SAVI and Precipitation Index profiles for Winter Barley in 2016/2017



10 – tilling | 12 – emerging | 15 – shooting | 18 – beginning of ear | 21 – yellow ripeness | 24 – harvest | BL – bare land

Coupling of current and historical geodata for the Germany-wide and parcel-specific localization of historical/up-to-date soil erosion events of high probability

- phenological observations \Rightarrow phenological windows
- hourly weather data \Rightarrow precipitation index
- satellite imagery \Rightarrow spectral soil cover index

Next steps

- Integration of other explaining dynamic variables (e.g., soil moisture)
- Collecting mapped soil erosion events
- Applying ML techniques to detect pattern of extreme weather risk

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- Integration of other explaining dynamic variables (e.g., soil moisture)
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- **Can AI replace traditional approaches of soil erosion modelling?**
- **When does soil erosion has to be quantitatively modelled?**

Extreme Weather Monitoring and Risk Assessment



Practical decision support system ...

- ... for farms and agricultural advisers
- ... enabling a risk assessment of reference units (e.g., parcels) regarding extreme weather



Agricultural crop types and test sites

- Winter Wheat in the district of Uckermark
- Apple in Altes Land region (district of Stade)

Components

- dynamic geodata integration and risk assessment
- monitoring



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