STAMP
Spatio-Temporal Analysis, Maps and Processing

Dr. Frank Ostermann
GIP Portfolio Research

UNIVERSITY OF TWENTE.
FACULTY ITC

Trends and challenges

Organizations, scientists, practitioners, general public,….
need spatial and temporal information about their environment

Trends and challenges

(Geo)Data flows at unprecedented rates and in various forms.
We urgently need to solve the puzzle of integrating heterogeneous data.

STAMP

- **Focuses on societal problems** dealing with **changes in space and time**
  - Public health (e.g., epidemiology of whooping cough, Lyme's disease), food supply and climate change (e.g., droughts, invasive species, phenology)
- **Develops methods and techniques** to produce **actionable geo-information** that supports informed decision-making and generates new domain knowledge
  - New sensors and Internet of Things, citizen science, agent-based modelling, deep learning, networks, information visualization
- **Provides modern and fit-for-purpose geo-information products and services** for many different user contexts
  - Registering land rights, geodata and location-based services, accessibility of infrastructure

ITC

UNIVERSITY OF TWENTE.

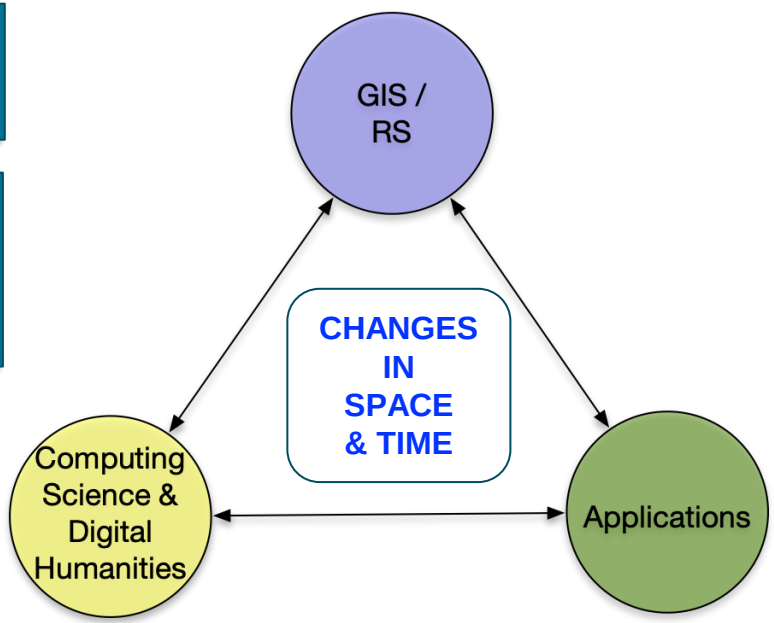
STAMP – some keywords

Cloud & distributed computing

Machine learning & data mining (GeoAI)

Linked data

Data Models



Agent-Based Modelling

Virtual/Mixed Reality

Crowdsourcing & Citizen science

Eye Tracking

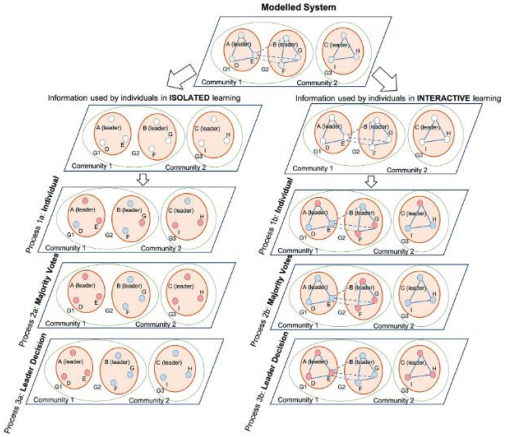
3D & dynamic geovisualizations

Reproducible Workflows

Big geo-data

STAMP on geohealth

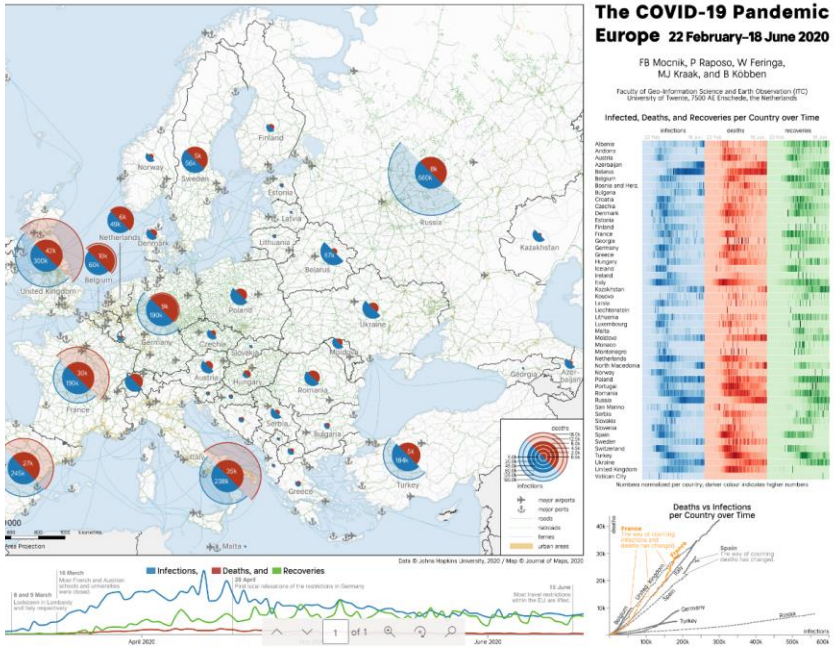
Risk perception and behavioral change during epidemics



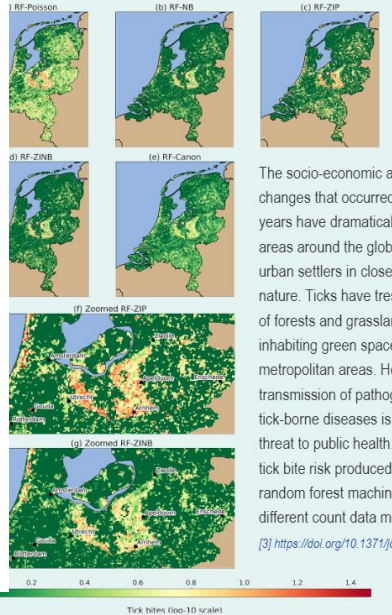
Modern societies are exposed to a myriad of risks ranging from disease to natural hazards and technological disruptions. Exploring how the awareness of risk spreads and how it triggers a diffusion of coping strategies is prominent in the research agenda of various domains. We use agent-based modeling (ABM) enhanced by machine learning to address this topic. The figure shows different learning types in a cholera ABM.

[2] https://doi.org/10.1371/journal.pone.0226483

Covid-19 Pandemic



Ticks and invasive species



The socio-economic and demographic changes that occurred over the past 50 years have dramatically expanded urban areas around the globe, thus bringing urban settlers in closer contact with nature. Ticks have trespassed the limits of forests and grasslands to start inhabiting green spaces within metropolitan areas. Hence, the transmission of pathogens causing tick-borne diseases is an important threat to public health. The maps show tick bite risk produced by combining random forest machine learning with different count data models.

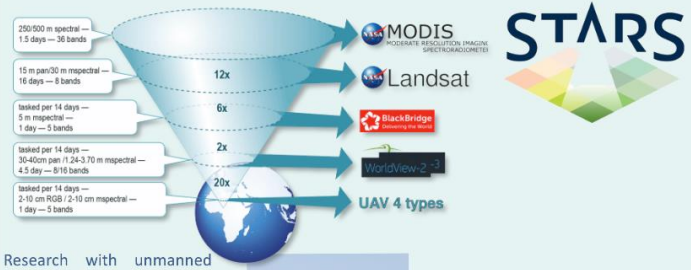
[3] https://doi.org/10.1371/journal.pone.0216511

ITC

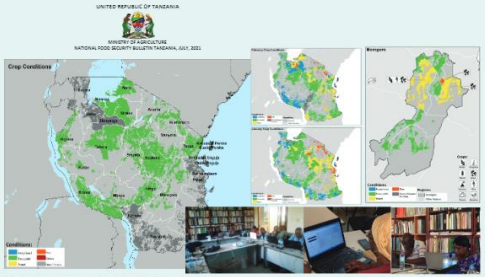
UNIVERSITY OF TWENTE.

STAMP on food security

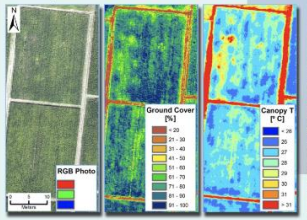
STARS



STARS



Research with unmanned aerial vehicles (**UAVs**) to estimate crop water use and detect plant stress



STARS, a Gates Foundation-funded project on four continents, with five global partners

Research question

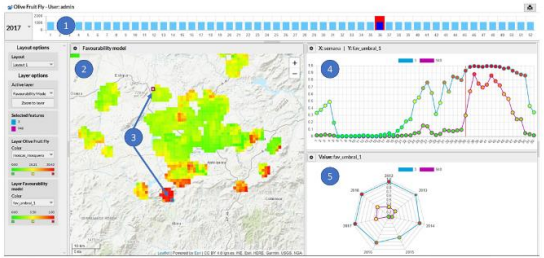
How can current remote sensing systems feed the often data-poor smallholder food production systems in sub-Saharan Africa and southern Asia with actionable information?

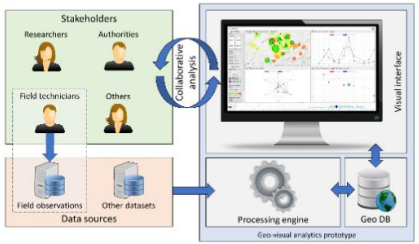
Topics

- soil nutrients at the square meter level (Mali)
- national monitoring of crop health and yield forecasting (GeoGLAM Tanzania)
- irrigation scheduling using variable salinity surface water (Bangladesh)
- global public goods in smallholder farmer monitoring.

[1] https://www.stars-project.org/en/

Collaborative pest management





A collaborative geovisual analysis system supports stakeholders in decision-making about applying countermeasures against the olive fruit fly (OFF). A timeline(1) displays available data over the selected year; the map (2) displays the OFF spatial distribution for a chosen week; two locations of interest are selected 3), and detailed information is shown in (4) and(5). *[2] https://doi.org/10.1111/tgis.12714*

ITC

UNIVERSITY OF TWENTE.

STAMP on Big Geodata / GeoAI

Machine Learning Techniques

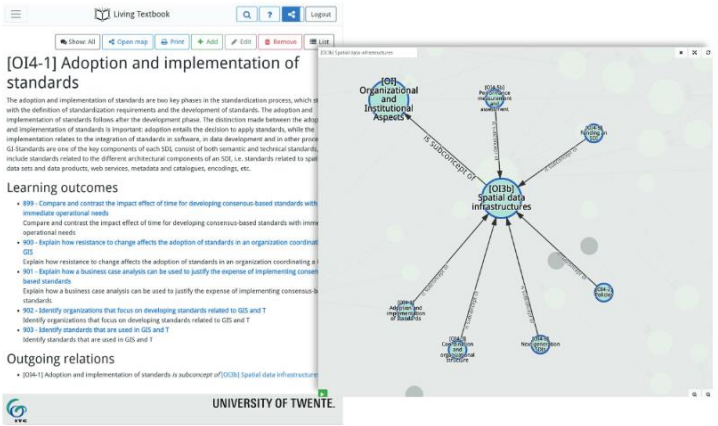
To explore spring onset at continental scales, the computations flow from Jup
to the processing layer through Spark jobs (orange arrow); data is then retrie
storage layer for in-memory distributed processing, and results are fetched b
visualization (green arrow).

[1] https://ieeexplore.ieee.org/document/8753619/

Engaging Citizens

Involving stakeholders in citizen science with the aim to record and preserve indigenous and traditional place names in Indonesia

[4] https://doi.org/10.3390/ijgi7060222.



Organizing information and knowledge

ITC

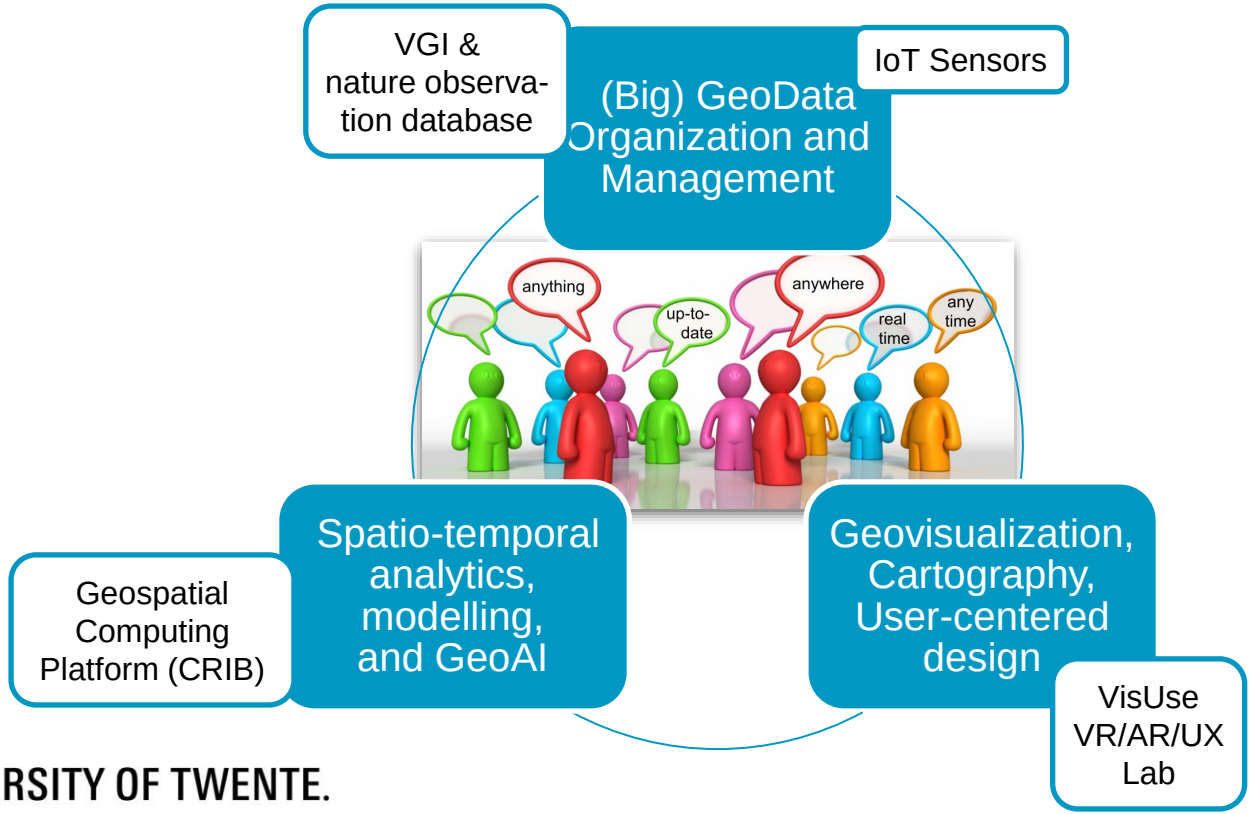
UNIVERSITY OF TWENTE.

STAMP is open

With Open Science
we now have the opportunity to discuss the roles and functions of
science in society

Twin-win model
FAIR principles
Open data and code
Reproducible research
Privacy & ethics

STAMP is team science



ITC

UNIVERSITY OF TWENTE.

STAMP uses a wide range of software