HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

DIGITAL EARTH

Significance and implementation of SMART Monitoring Tools

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SMART Monitoring?

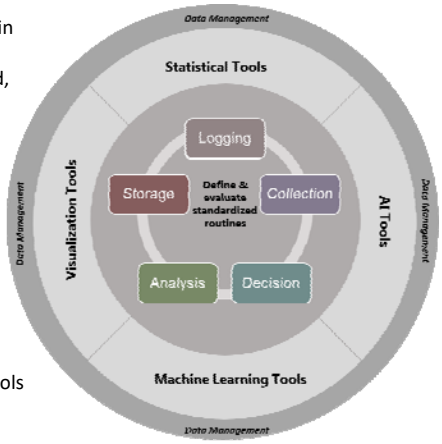
- Term SMART Monitoring has been established within the Digital Earth project
- To better and faster adjust sensor settings and monitoring strategies in time and space in an iterative feedback
- To guarantee the sustainable usability of observation data, all monitoring data collected, in observatories or during individual measurement campaigns, must be **specific, measurable, accepted, relevant and trackable** to meet the **SMART** criteria

Goal?

- Application of state-of-the-art IT technology to enhance traditional monitoring
- Establishment of fully automatic workflows with sufficient data quality control
- Enabling near real time data flow and Q/A routines
- Enabling measurement campaign optimization

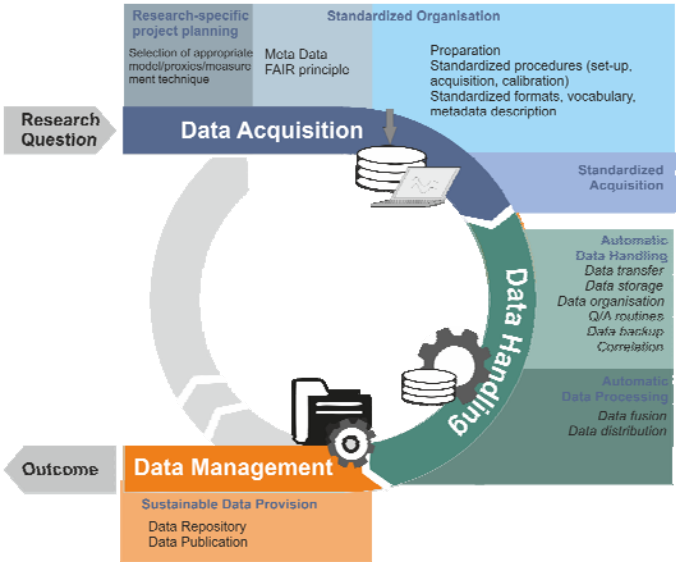
Added Value?

- Improving the interinstitutional and interdisciplinary cooperation
- Establishment of standardized workflows from sensor into database
- Tests of such routines during MOSES Campaigns
- Integrating sophisticated mathematical/ statistical as well as novel machine learning tools into the workflow
- Usage of Git-repository hosting services for sharing and knowledge transfer



SMART Monitoring Workflows (real-time/quasi-real-time)

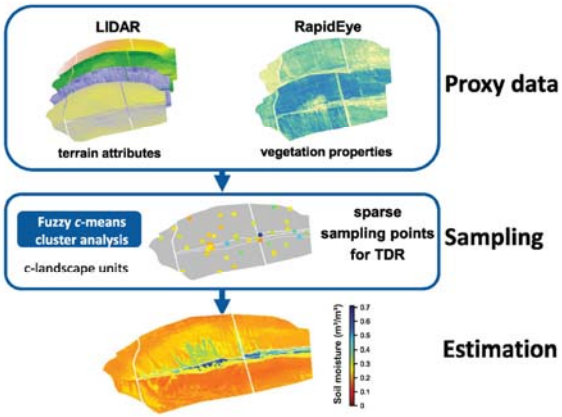
- Development, establishment, and integration of standardized workflows for near-real-time interactive data analyses, data exploration and collaborative measurement campaign optimization



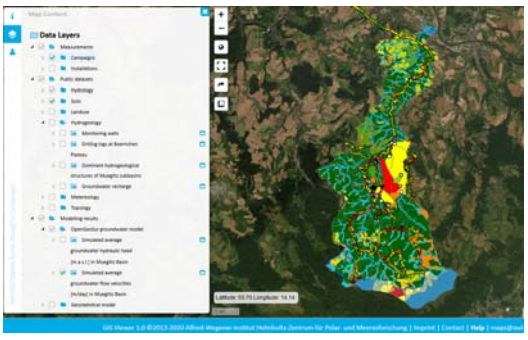
- Development of Near-Real-Time Extract-Transform-Load tools to promptly transfer data from operational databases into data warehouses for near real time data provision
- This data-driven monitoring strategy is based on a **data stream architecture** following the measurement paradigm "Predictive Object Specific Exposure" (POSE) → allows high performance in terms of real-time data provision and enables the usage of AI tools on the data stream
- To ensure manageability and sustainability, important **standardization** concerning formats, procedures and metadata treatment are essential to obtain reliable data for data sharing, data blending and joint data analysis

Towards products with high data coverage, quality and visibility

Mathematical and statistical tools or even fully automated machine learning tools in various steps of data flow support scientists to develop workflows and methods for optimizing and designing observation strategies (sensor layouts, outlier detection, sample rates, parameters needed, etc.).



Simplified flow chart of the fuzzy c-means sampling and estimation approach (FCM SEA) with combined integration of terrain and red-edge based normalized difference vegetation index patterns (Schröter et.al 2017)



WebGIS-Platform provides visualization and data collection methods of all available data

DIGITAL EARTH

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