MOSES
Modular Observation Solutions for Earth Systems

Events and Trends: Impact of Disturbances on Earth Systems

Julia Boike
Alfred Wegener Institute for Polar and Marine Research
Potsdam Germany
Scientific Case

Overarching Research Question
Interactions of short-term EVENTS and long-term TRENDS

Events
- Heatwaves
- Hydrologic Extremes
- Ocean Eddies
- Thaw Events Permafrost

Event-driven Observation Concept
Captures processes and impacts by an “event chain” approach

Evaluation Concept EVENTS & TRENDS
Integrates MOSES event data into large-scale and long-term monitoring networks which serve as reference systems
THAW EVENTS: BATAGAIKA CRATER

Thaw events: thermo erosion & thaw slumps
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MOSES Reference Systems

Helmholtz Observatories: Cape Verde, COSYNA, Lena River Delta, TERENO

- Central sites for MOSES implementation phase
- Target areas for MOSES operation phase

International Monitoring Networks: ICOS, FLUXNET, LTER, EuroGOOS, ...

- Long-term monitoring data
- Target areas for MOSES operation phase
- MOSES extends and complements the existing observation capabilities by event-oriented observation systems

Satellite Missions: MODIS, Sentinels, EnMAP, GRACE-FO, TANDEM-L, ...

- Large scale monitoring data
- Multi-parameter monitoring data
- ACROSS + HGF Alliance “Remote Sensing” link in-situ with satellite data
MOSES infrastructure—Permafrost thaw events

- Greenhouse gas (GHG) emission
- Permafrost
- Thaw event
- Wetland
MOBILE INSTRUMENTS

- **GFZ-1**: GHG flux measurements using UAV
- **GFZ-2**: Development of mobile autonomous passive seismic sensor platform (aquatic and land)
- **GEOMAR**: WaveGlider, AUVs
- **FZ Jülich**:
  - GHG: 2 x Picarro G2508 N₂O, CH₄, CO₂, NH₃, H₂O Analyzer, N₂O
  - Isotopes: Aerodyne N₂O Isotopic Monitor or Picarro G5131
  - Miniaturization of N₂O & CH₄ isotopic analyzers
  - Trailer for mobile terrestrial system measurements
- **AWI**: GPS subsidence units, drone for aerial imaging (SfM), terrestrial and aquatic sensors (physical state, permafrost subsidence, GHG concentrations)

**Total Funding**

- 28 Mio.€, 8 centres + DLR, 5 years for implementation
- ~1 Mio.€, AWI permafrost
MOSES Goals

societal

- Improve early warning and direct actions
- Improve forecasts and scenarios on Global Change

building capacity

- Offer a transdisciplinary and cutting edge research infrastructure

technical and scientific

- Implement a novel observation system for dynamic events: highly mobile, flexible, high resolution, along and across compartments
- Complement and extend the existing international monitoring networks
- Improve process knowledge: Impacts auf distinct events on regional to global Earth- and Environment development
- Improve models and forecasts: Integration of highly dynamic events and their feedbacks in Earth System Modelling
DATA FLOW FRAMEWORK

SENSOR
Manage platform, sensor metadata

STREAM
Near real-time streaming of large data volume

DASHBOARD
Monitoring of near real-time data

DATA ACQUISITION

NEAR REAL TIME DATA

WORKSPACE
Solutions for data storage, processing and long-term preservation
DATA FLOW FRAMEWORK

DASHBOARD
Monitoring of near real-time data

WORKSPACE
Solutions for data storage, processing and long-term preservation

ANALYSIS
Data viewing and analysis solutions; Map-based visualization services

STORAGE ARCHIVE

PORTAL
One-stop-shop framework Interoperability services

REPOSITORIES
Data and data products Publications, presentations, field reports

IMPROVE DATA
Timetable

Project duration: 2017-2021

2018: Expedition NWT/Mackenzie; use new road (Inuvik → Tuktoyaktuk) for access to areas and testing of sensors

2020: Lena River Expedition

Challenge: Finding money for research on the data!