



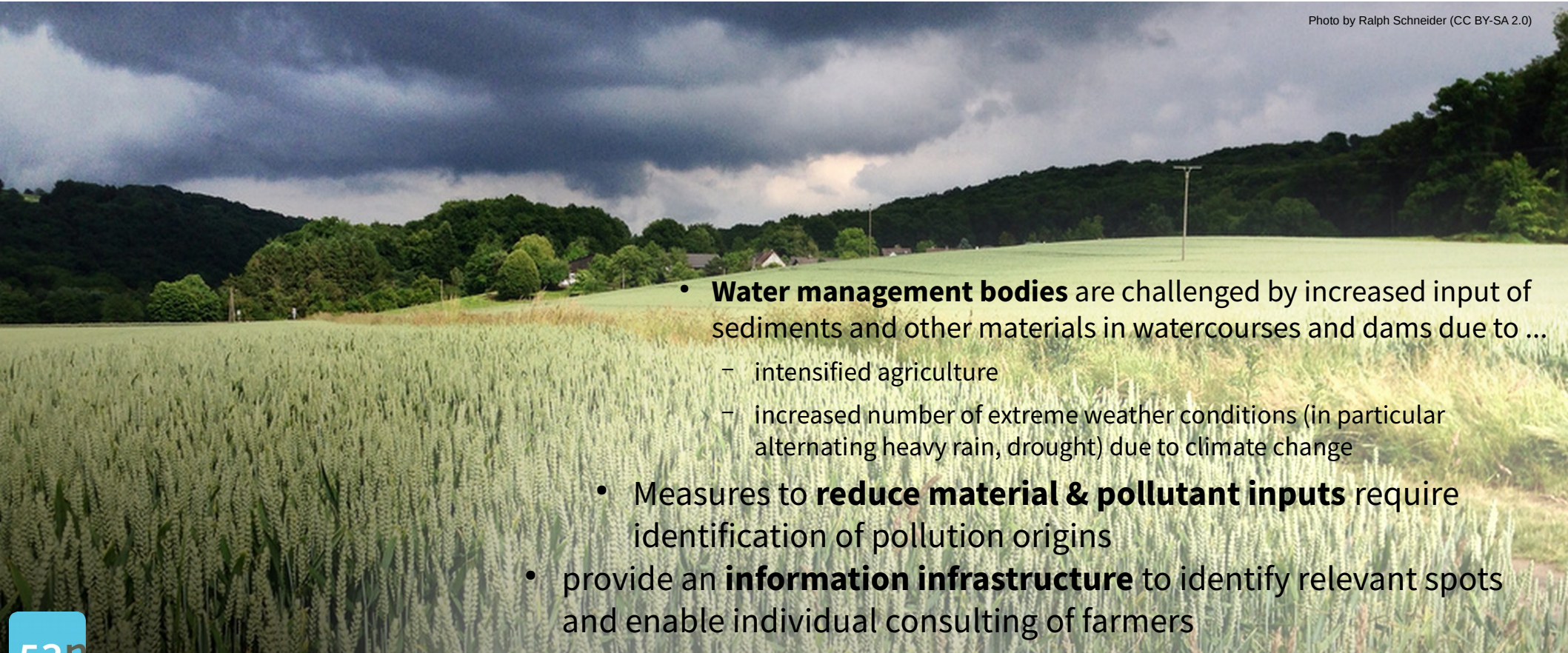
Federal Ministry
of Transport and
Digital Infrastructure

Automated Creation of Earth Observation Products for Water Resource

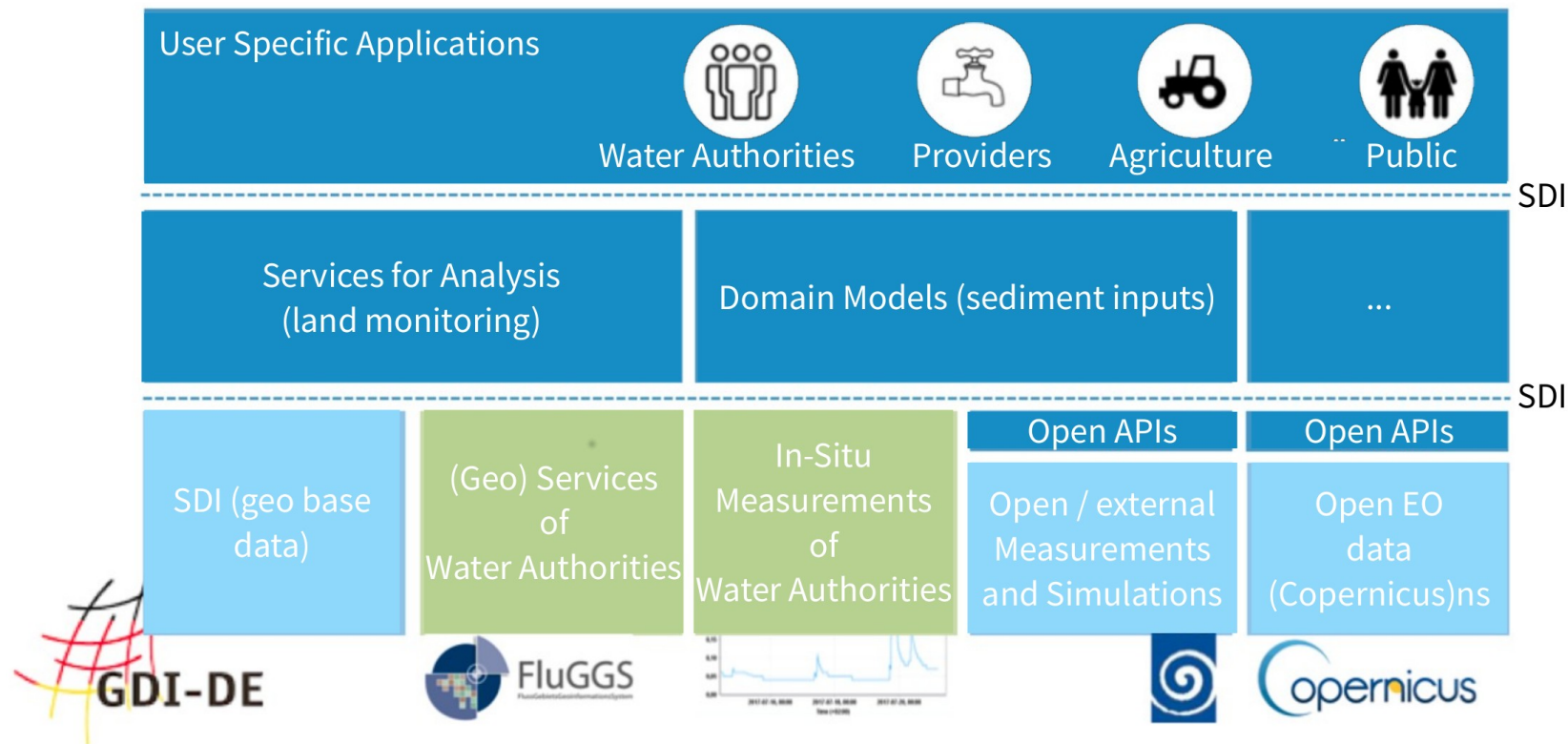
Matthes Rieke

MOTIVATION

Photo by Ralph Schneider (CC BY-SA 2.0)

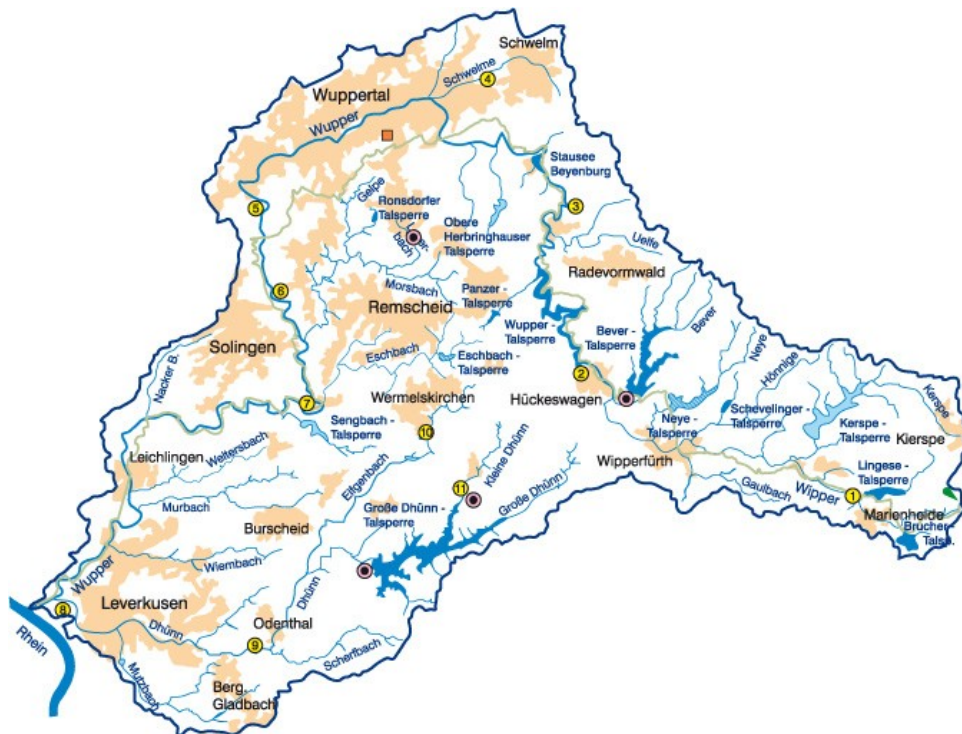
- 
- **Water management bodies** are challenged by increased input of sediments and other materials in watercourses and dams due to ...
 - intensified agriculture
 - increased number of extreme weather conditions (in particular alternating heavy rain, drought) due to climate change
 - Measures to **reduce material & pollutant inputs** require identification of pollution origins
 - provide an **information infrastructure** to identify relevant spots and enable individual consulting of farmers

CONCEPTUAL OVERVIEW



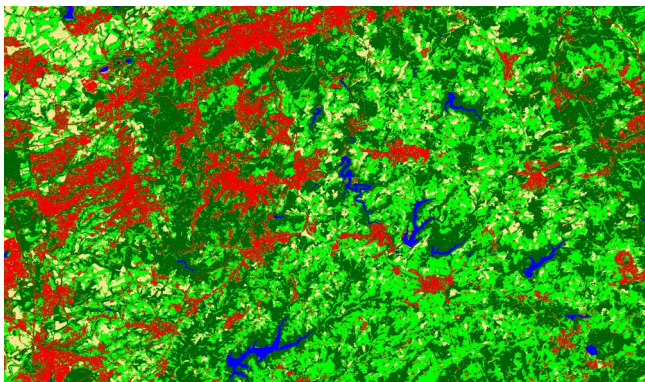
PROJECT OVERVIEW

- Wupper region in North-Rhine Westfalia, Germany
- Wupperverband is the responsible water authority
 - Operation of river dams, clarification plants
 - Water network monitoring (gauges, temperature, precipitation)

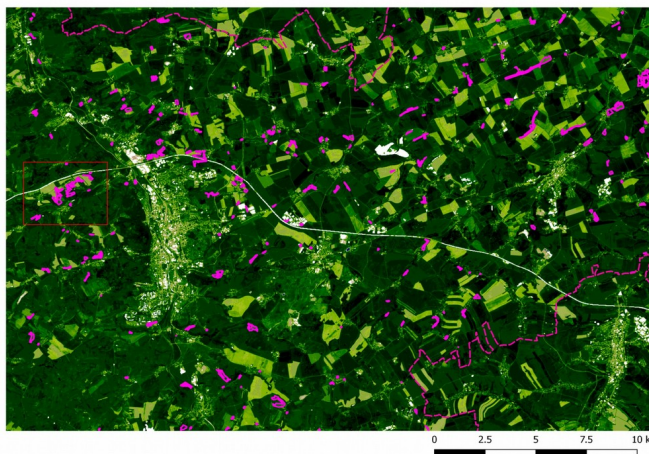


PRODUCTS FROM EARTH OBSERVATION

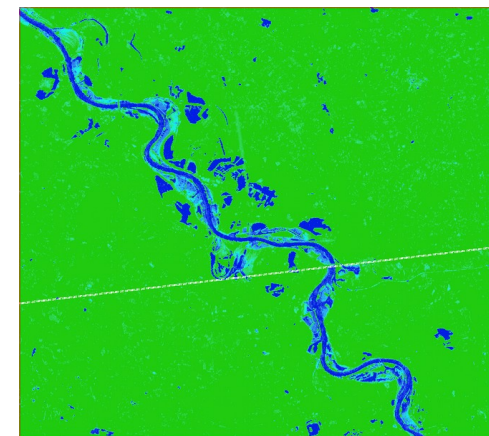
- Overall goal: Increasing the efficiency of environmental monitoring by **combining** various **geo- and sensor** data and **model components** for
 - Structure of a dynamic land register (vitality of the vegetation, actual crop rotations, types of sealing and use etc.)
 - Optimized modeling of **inputs in rivers and reservoirs**
 - Quantification and localization of **sediment and pollutant inputs**



Detailed land use classification



Intra-annual monitoring of agriculture



Change of water-land borders

PRODUCTS FROM EARTH OBSERVATION

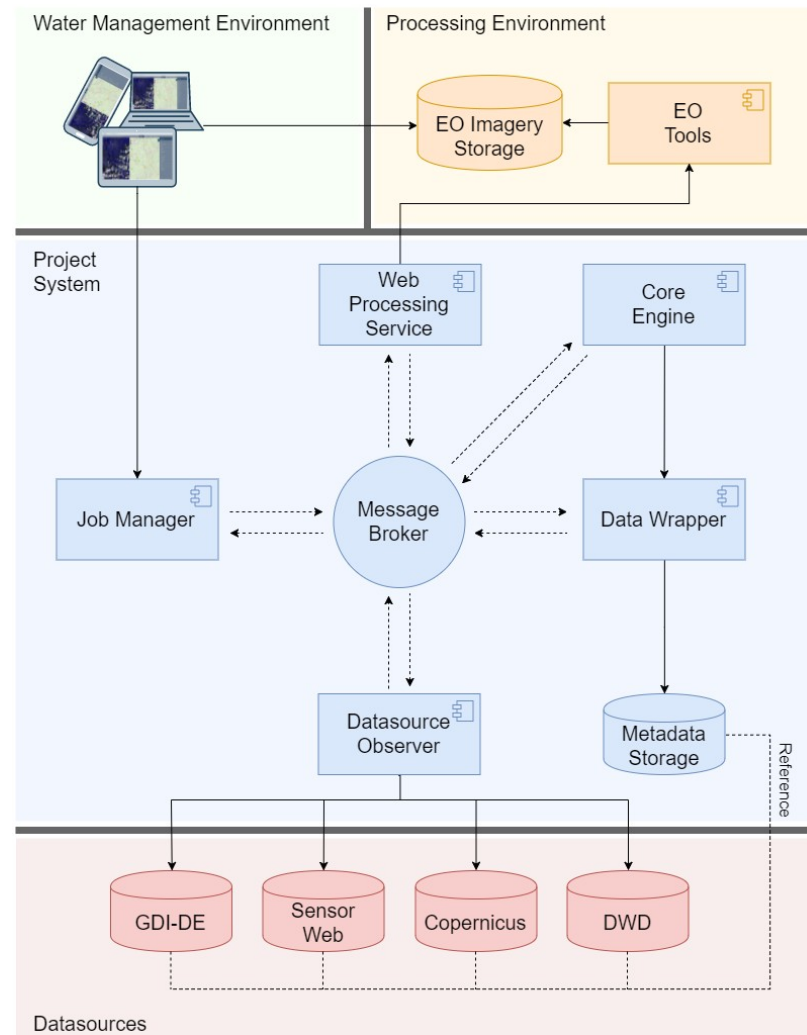
Group	Product
Land use classification	<ul style="list-style-type: none"> - Differentiation of sealed and unsealed surfaces - Detailed classification of land use - Intra-annual change analysis of land cover / use
Monitoring of vegetation	<ul style="list-style-type: none"> - Determination of the vegetation density - Intra-annual monitoring of grassland and field grasslands - Determination of forest damage / vitality caused by pests - Analysis of vitality changes of woodlots
Water vegetation monitoring	<ul style="list-style-type: none"> - Detection of Macrophyte Hotspots (in shallow waters) - Identification of vegetation structures in rivers
Water network monitoring	<ul style="list-style-type: none"> - Observing the change of water-land borders - Monitoring the water level of reservoirs
Damage monitoring	<ul style="list-style-type: none"> - Determination of forest damage (wind break, snow break) after storms

DESIGN APPROACH

- **Problem:** EO data to be used for processing must fulfill certain requirements
 - Minimal cloud coverage
 - High percentage of spatial overlap
 - Available as “time series” (e.g for training or intra-annual monitoring)
- **Approach:** Offering EO products “*on availability*”
 - Integration of models for sediment and pollutant inputs into river systems and dams
 - Information processing as soon as required data becomes available
 - event-driven processing of **EO data, in-situ measurements** etc.
 - Re-use of existing EO processing tools
 - Remote use of proprietary services
 - Deployment in “Copernicus Cloud Environments” (e.g. DIAS platforms, national infrastructures such as CODE-DE)

SYSTEM ARCHITECTURE

- Publish/Subscribe architecture
 - Start a process when new data is available
- Dedicated components **observe the data centres**
 - Sensor Web, Copernicus Open Access Hub, DWD
- Two-layered approach
 - Integrate **legacy EO tools via WPS**
 - Use state of the art processing
 - based on **Spark, Geotrellis**
 - Assess **Machine Learning** algorithms
 - for specific tasks (e.g. land classification)

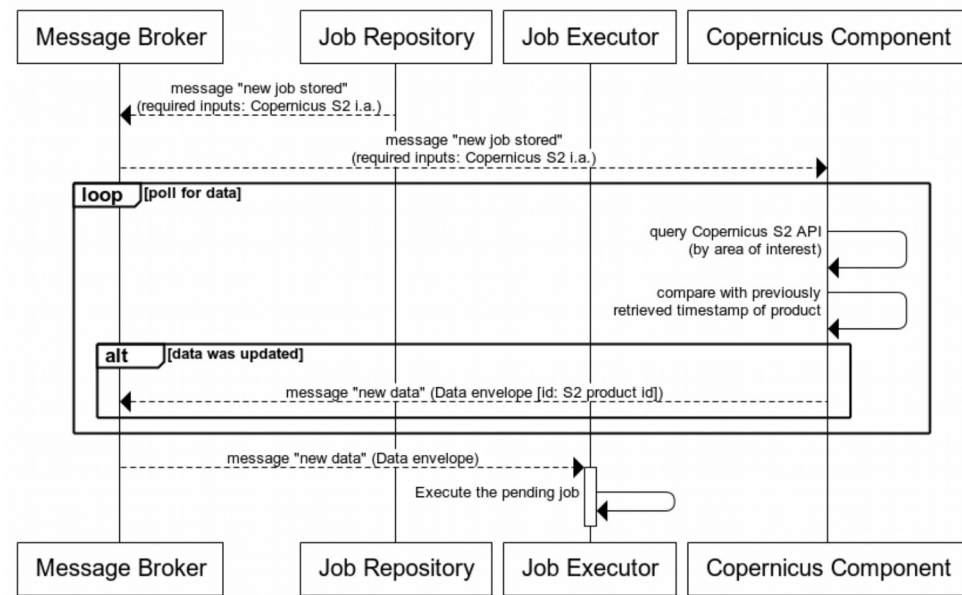


APPROACHING INTEROPERABILITY

- OGC Web Processing Service 2.0
 - Standardized interface for synchronous and asynchronous **processing jobs**
 - Allows the definition of **inputs** and **outputs**, and processing **parameters** (e.g. output resolution)
- WPS is used for
 - Wrapping of already existing EO processing tools
 - Execution environment for newly developed tools
- Standardized interface allows the lightweight introduction of additional tools → flexible and **extensible architecture** with broad processing capabilities

EVENT-DRIVEN WORKFLOWS

- The system is designed to **observe data centres** (Sentinel Hub, Sensor Web of Wupperversband, ...)
 - Configurable observation cycles (e.g. every hour)
- Data of interest is identified
 - **Metadata** (by a specific domain data model) is published on the internal Message Broker
 - Interested components (e.g. the Job Execution) catch up
 - Achieves **automatic execution**





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WaCoDiS
Wasserwirtschaftliche Copernicus-Dienste zur Bestimmung von Stoffeinträgen in Gewässer und Talsperren im Rahmen des Umweltmonitorings
<https://wacodis.fbg-hsbo.de/>

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config-server
centralized configuration server for WaCoDiS components.
Java Updated 22 days ago

core-engine
Java Updated 22 days ago

datasource-observer
Java Updated on Dec 6, 2018

data-access-api
WaCoDiS Data Access
Java Updated on Nov 27, 2018

job-definition-api
The WaCoDiS job repository service
Java Updated on Oct 17, 2018

javaps-wacodis-backend
javaPS backend for WaCoDiS processing tools
Java 1 Apache-2.0 Updated on Sep 24, 2018

Top languages
Java Shell Python

People 5
Invite someone

<https://github.com/wacodis>

OUTLOOK

- Implementation of first prototype planned for mid 2019
 - Components ready (as seen in the architecture overview)
 - Integration of one EO tool (for intra-annual land use classification)
- Feedback round with special departments of Wupperverband
- Product storage
 - As-is storage (e.g. GeoTIFFs) vs. Raster-optimized services (e.g. WCS)
- Development of a system dashboard
 - When did an EO tool execute? Where was the product stored?
 - Management of Jobs
- Investigation on the deployment options
 - DIAS (e.g. Mundi Web Services, Sobloo, WEkEO, ...)
 - CODE-DE
 - Distributed components (e.g. WPS and tools running remotely)

52north

exploring horizons

Thanks for your attention!
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Matthes Rieke



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funding from:



Federal Ministry
of Transport and
Digital Infrastructure

September 2–4, 2019 Münster, Germany

Geospatial Sensing
Conference 2019



Deadline extended!

Geospatial Sensing – from sensing
to understanding our world

Submission Deadline: April 28th
<https://52north.org/conference>