Monitoring of surface water temperature and turbidity from remote sensing platforms – activities at BfG

Compiled by Björn Baschek

Federal Institute of Hydrology (BfG), Koblenz, Germany
Dr. Björn Baschek, baschek@bafg.de,
Geo-Information and Remote Sensing, GRDC
Contents

- short overview:
  - remote sensing at BfG

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Remote sensing at BfG

- applications for waterways
- new methods
- projects
- [Copernicus](https://www.copernicus.eu/) (M4)

Remote sensing in several departments oriented on applications
R&D as well as operational usage

- inland waters
- coastal waters
- oil spill (M4)
- vegetation (U2)
- geodesy (M5)
- hydrological simulations (M2)
Objectives of R&D-project

- make TIR-applications accessible, e.g.:
  - validation of numerical models
  - distribution of water masses (inflows)
  - representativeness of measurement stations
- investigate uncertainties (e.g. atmosphere, mixing)
- new methods & measurement concepts

TIR-remote sensing + in-situ = spatial RST-distribution for applications

Katharina Fricke (M4)
fricke@bafg.de

Björn Baschek (M4)
baschek@bafg.de
Product example: satellite

- spatial distribution: 60 m (not Sentinel)
- few in-situ-measurements
- atmospheric correction

- comparison in-situ / Landsat-7
  example River Rhine (mixing)
  $\mu = 0.5^\circ C$  $\sigma = 0.7^\circ C$
Product example: Aircraft

- spatial resolution: ~4 m (depending on sensor / altitude)

- comparison in-situ / remote sensing example River Rhine (mixing) with in-situ-calibration:
  \[ \mu = 0 \, ^\circ C, \sigma = 0,2 \, ^\circ C \]
  (without: \( \mu = 0,2 \, ^\circ C, \sigma = 0,4 \, ^\circ C \))
Example product: longitudinal profile

![Graph showing TIR-temperature along the Rhine river kilometrage]
Aim: modell validation

- „Hahnöfer Nebenelbe“ (branch of river Elbe, near Hamburg): Tidal influence
- Are temperature patterns and contrasts realistic? (numerical diffusion)
- Dynamics ➔ frequent, low level overflight needed ➔ best platform?
Monitoring of dynamic processes

- frequent flights
- thermal infrared
- + in-situ measurements of (radiation) temperature
- analysis ongoing

combined usage of gyrocopter and UAS/RPAS

example from gyrocopter (University of applied sciences, Koblenz)

Remote sensing activities at BfG, GEO AquaWatch, June 8th, 2016

Katharina Fricke, Björn Baschek, BfG
Jens Bongartz et. al, Hochschule Koblenz

photo composition: Baschek, BfG
Project example: turbidity: *WasMon-CT*

**Objectives**
- integration of satellite retrieved turbidity (Landsat, Sentinel)
  - proxy for suspended sediments
  - joint picture with in-situ & model
  - application
- spatial monitoring, e.g.
  - position of the turbidity zone (Elbe) vs. run-off
  - mixing at inflows
  - representativeness of measurements
  - dredging

**Cooperation with LUBW**
- (indicative) chlorophyll monitoring in lakes

Cooperation:
BfG:
- Dorothee Hucke (M3/M4)
- Gudrun Hillebrand (M3)
- Axel Winterscheid (M3)
- Björn Baschek (M4)

LUBW:
- Thomas Wolf
- Nathalie Karle

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Application of satellite data

- validation
- derived products in combination with in-situ data

Landsat / Sentinel

Spatial turbidity data

Integration into existing procedures combined with in-situ data

Data storage, metadata, data availability

Transfer on other applications
Status

- project start: January 2016

- data selection
  - Landsat-8 & Sentinel-2
  - python-tool for access of ESA science hub; automatic download of metadata and quicklooks
    - metadata-database, GIS
  - collection of in-situ-data
    - metadata-database, GIS

- tender for processing of satellite data

- exchange with e.g. gemstat
Summary

- applications of remote sensing
  e.g. oil spills, vegetation, geodesy, water quality, sediment management, modelling…

- remote sensing platforms:
  - satellite, aircraft, gyrocopter, UAS/RPAS, in-situ

- interested in exchange

- open for discussion of further GEO cooperation
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Federal Institute of Hydrology (BfG)
Am Mainzer Tor 1
56068 Koblenz, Germany
www.bafg.de

Dr. Björn Baschek
Tel.: 0261/1306-5395
baschek@bafg.de
Geo-Information and Remote Sensing, GRDC