Mecklenburg-Vorpommern
Ministerium für Klimaschutz, Landwirtschaft, ländliche Räume und Umwelt

Water quality and alert system based on daily high-res Planet satellites

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Overview

– Useful facts about the waters in Mecklenburg-Western Pomerania

– Obligations for water monitoring and health care at bathing areas

– Previous experiences in water monitoring with remote sensing

– Motivation for using SuperDove data - goals of the project

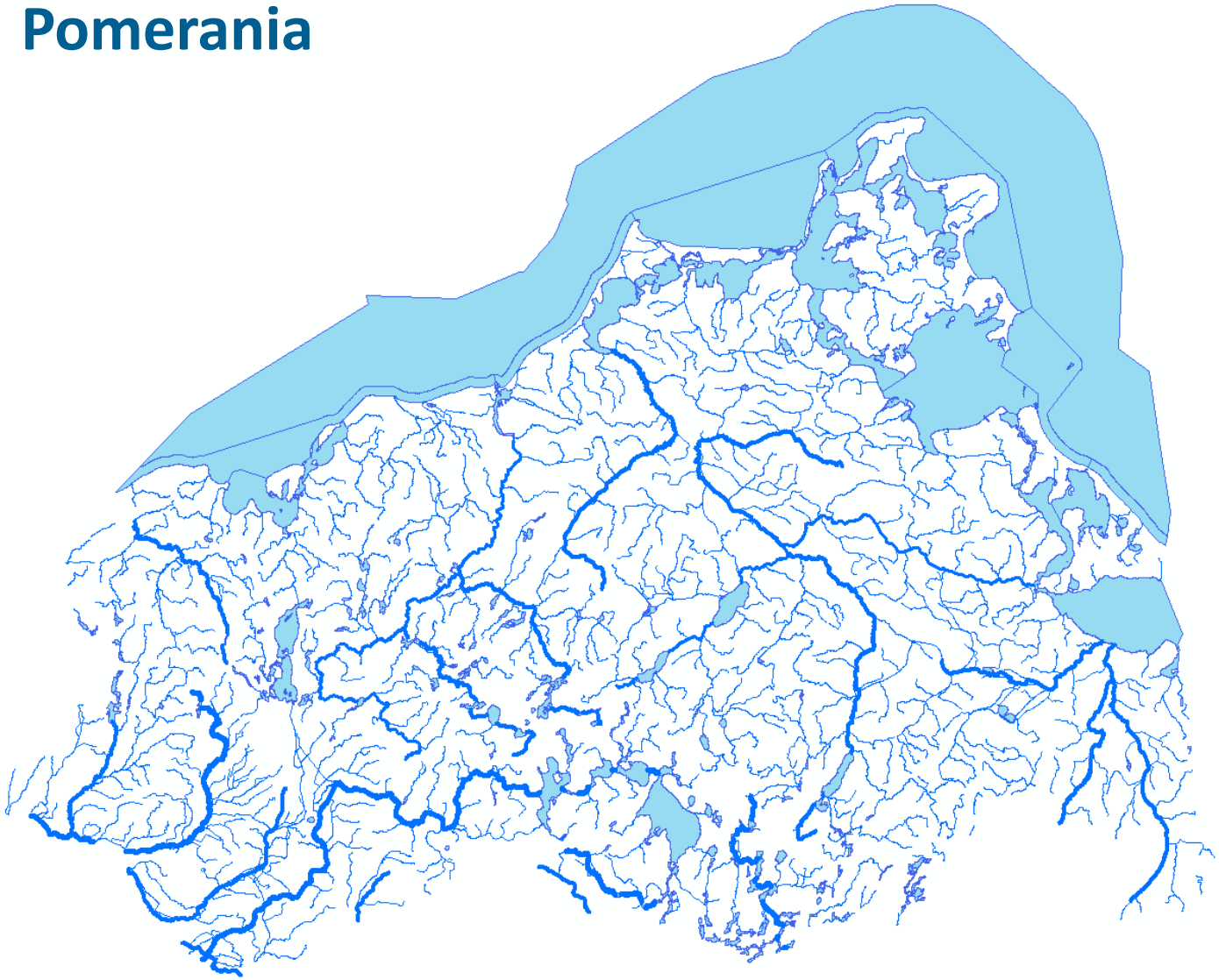
– Components of the eopPortal Mecklenburg-Vorpommern

– Examination of the received data

– Validation (first) results

– Conclusions

Usefull facts about the waters in Mecklenburg-Western Pomerania



Source: LUNG M-V

Rivers and streams

1st order 1.450 km

2nd order 31.611 km

Lakes

> 1 acres 2.205

> 10 acres 576

> 50 acres 176

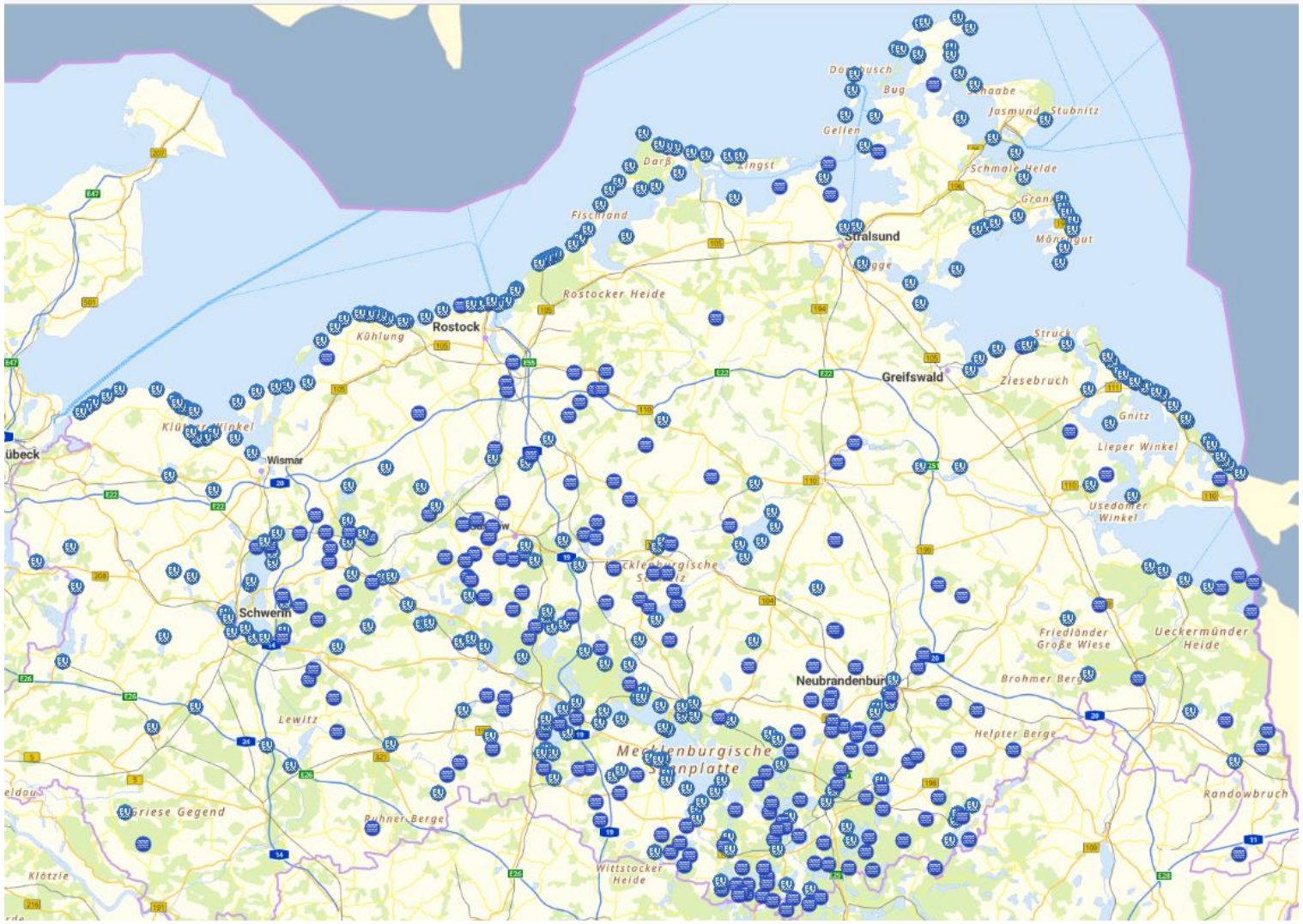
Baltic Sea

Coastline 1.700 km

Sea area 7.640 km^2

The inland water surface takes up six per cent of the total area

450 Bathing spots



Monitoring obligations

– 850 running water-bodies: every two years
– 202 lake water-bodies: every three years
– 21 coastal water-bodies: every year
– 450 bathing spots: every year

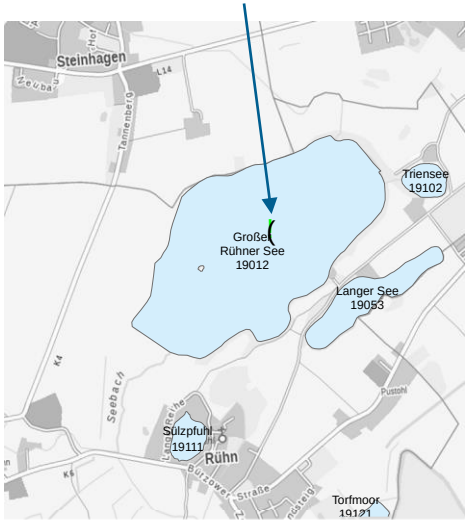
not enough resources for

– country-wide monitoring (i.e. smaller lakes)
– every-year monitoring (lakes and streams)
– shorter time intervals (daily/weekly)
– findings offside the measuring point

possible solution: remote sensing?

equipment for sampling

measuring point
sampling once a month



Experiences from a previous project (2019)
Used data: Landsat, Sentinel 2&3, WorldView

Comparison of in-situ data in lakes and rivers with satellite-based results

good:

- Chlorophyll: trophic level is correct in 63% of the cases, greater scatter in shallow lakes, EO overestimated in deeper, nutrient-poor lakes
- Visibility depth: generally good agreement. EO underestimated in deeper rather nutrient-poor lakes; overestimated in shallow, nutrient-rich lakes
- Temperature: often too little data (only Landsat), good agreement with simultaneous measurements (after correction)
- high-resolution satellite data (WorldView) is also suitable for rivers

not good:

- the bottom resolution and return frequency of Copernicus-data were not suitable for sufficiently resolving smaller water-bodies and short-term phenomena such as algal blooms
- high-resolution data generates high costs and is not widely available

Motivation for the trial with SuperDove data – goals of the project

Motivation

– high resolution data

– (allmost) daily overflight

– spectral & radiometric compatibility with Sentinel-2

Goals

– examine the possibilities and limits of surface water monitoring for chlorophyll, visibility depth, and harmful algae

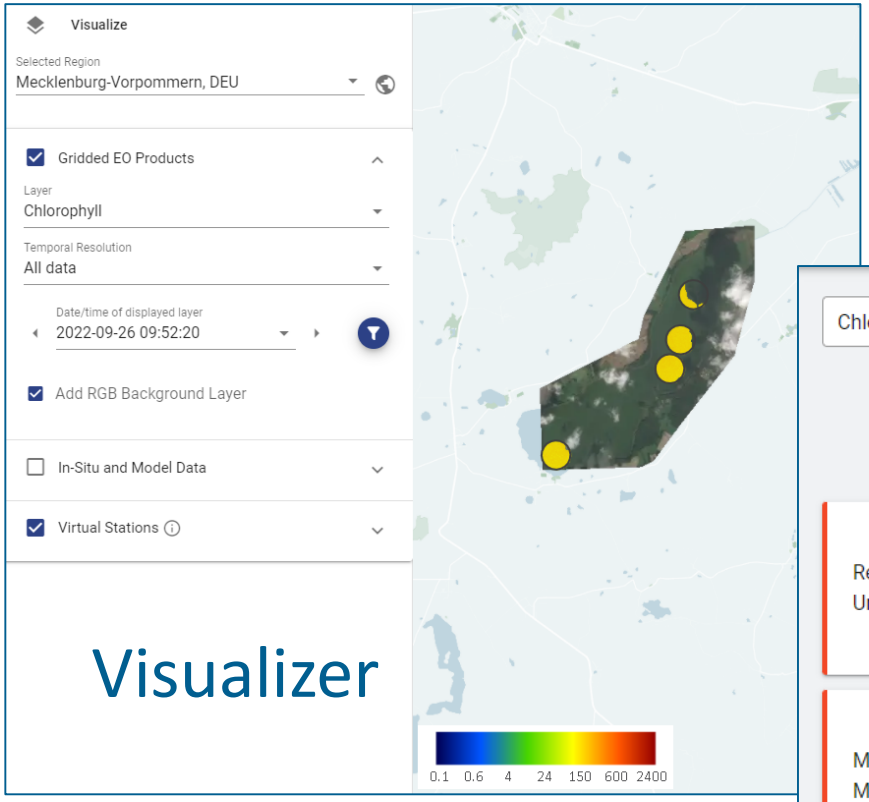
– find out of the synergy effects between health surveillance and surface water monitoring

– development of an easy-to-use alarm system for harmful algae

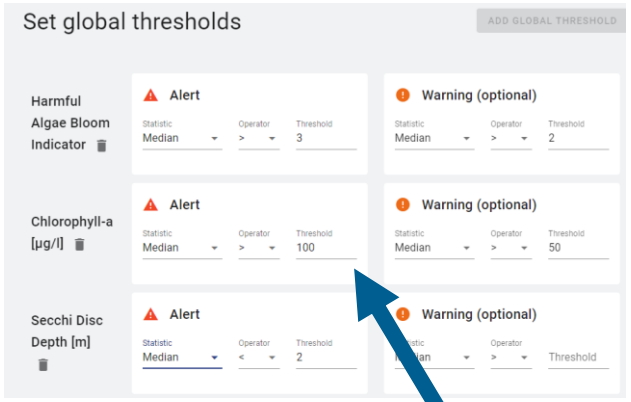
– verification of the satellite-based with in-situ measurement results

– first step towards comprehensive monitoring of surface waters?

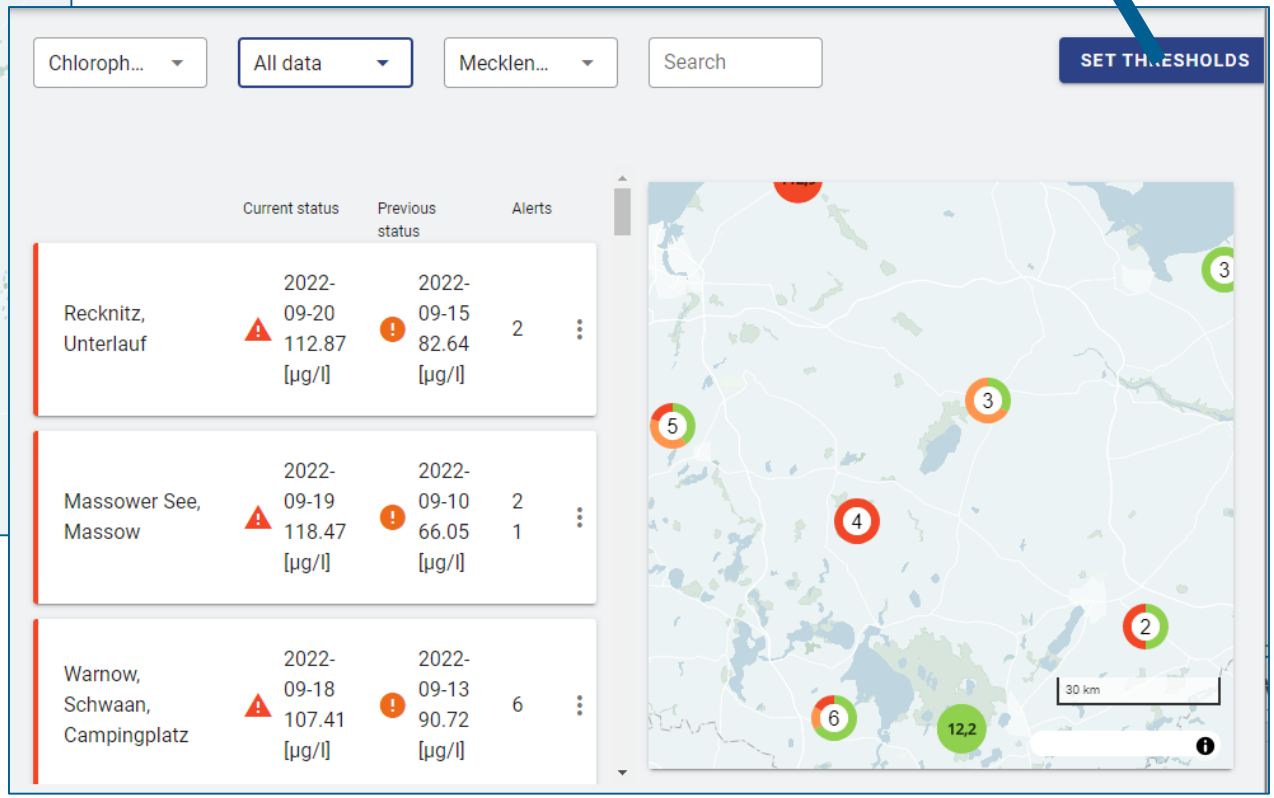
Components of the eoPortal Mecklenburg-Vorpommern (1)



Visualizer



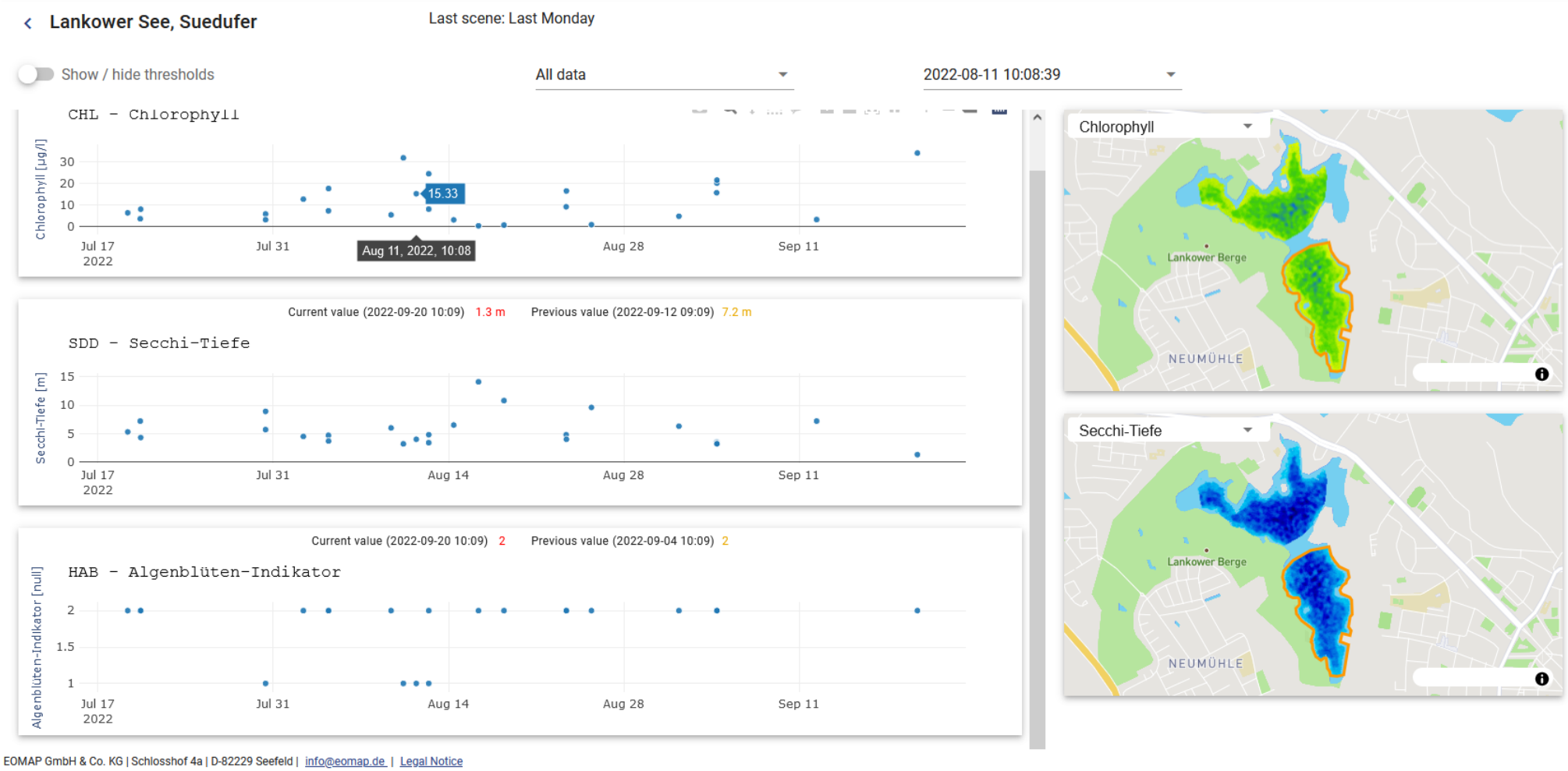
Dashboard



Email to user with warnings and alerts

Components of the eoPortal Mecklenburg-Vorpommern (2)

Browser for data and maps



data examination – more than one scene a day

3 scenes a day

210,1 µg/l

210,1 µg/l

10,7 µg/l

6,2 µg/l

4 scenes a day

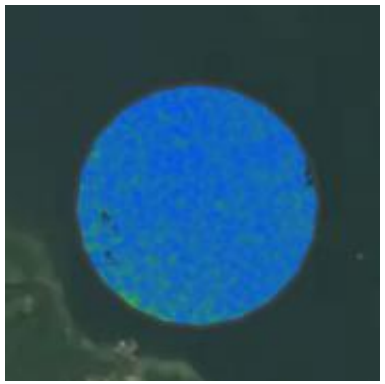
2022-07-31T09:49:59	14.11
2022-07-31T09:50:02	58.78
2022-07-31T09:59:17	15.65
2022-07-31T09:59:23	49.46

10,7 µg/l
6,2 µg/l

data examination - mysterious phenomena?

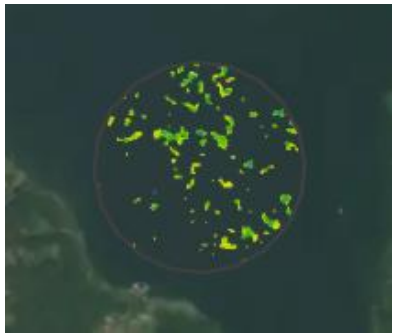
Kummerower See, Gravelotte
8.8. 9:16:59

Plauer See, Dresenower Muehle



19.7. 9:49:05

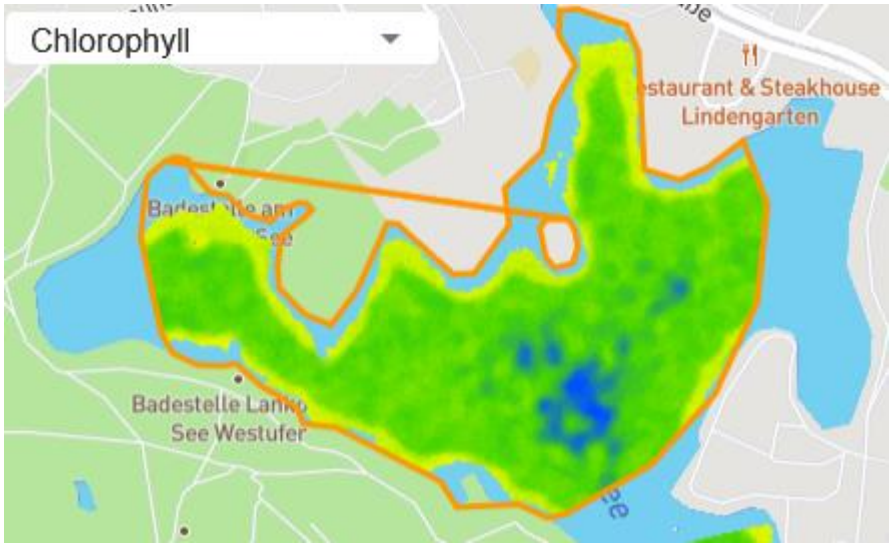
?



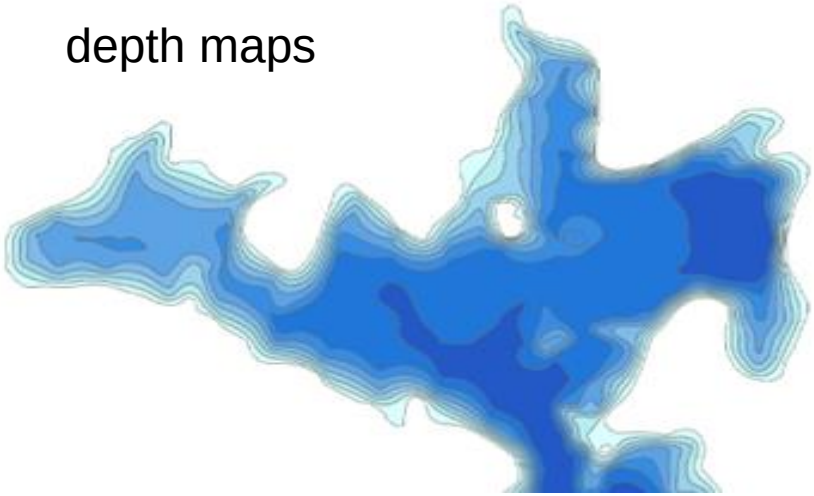
19.7. 9:49:09
four seconds later

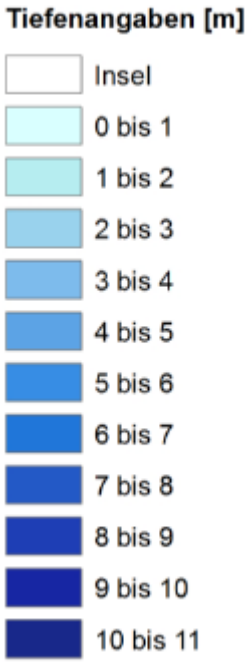
data examination – shallow water, tree shadow?

Lake Lankow

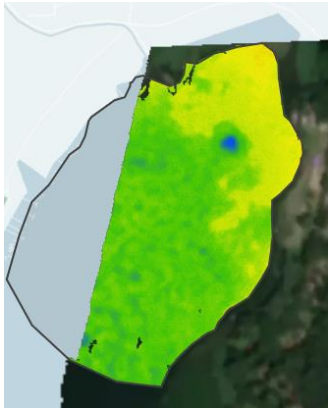


depth maps



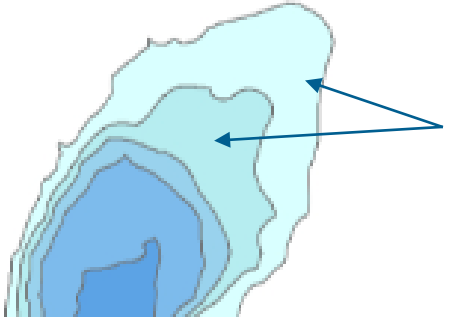


Island Lake



scene
02.08.2022

in-situ visual depth
12.07.2022: 1,9 m
16.08.2022: 1,9 m



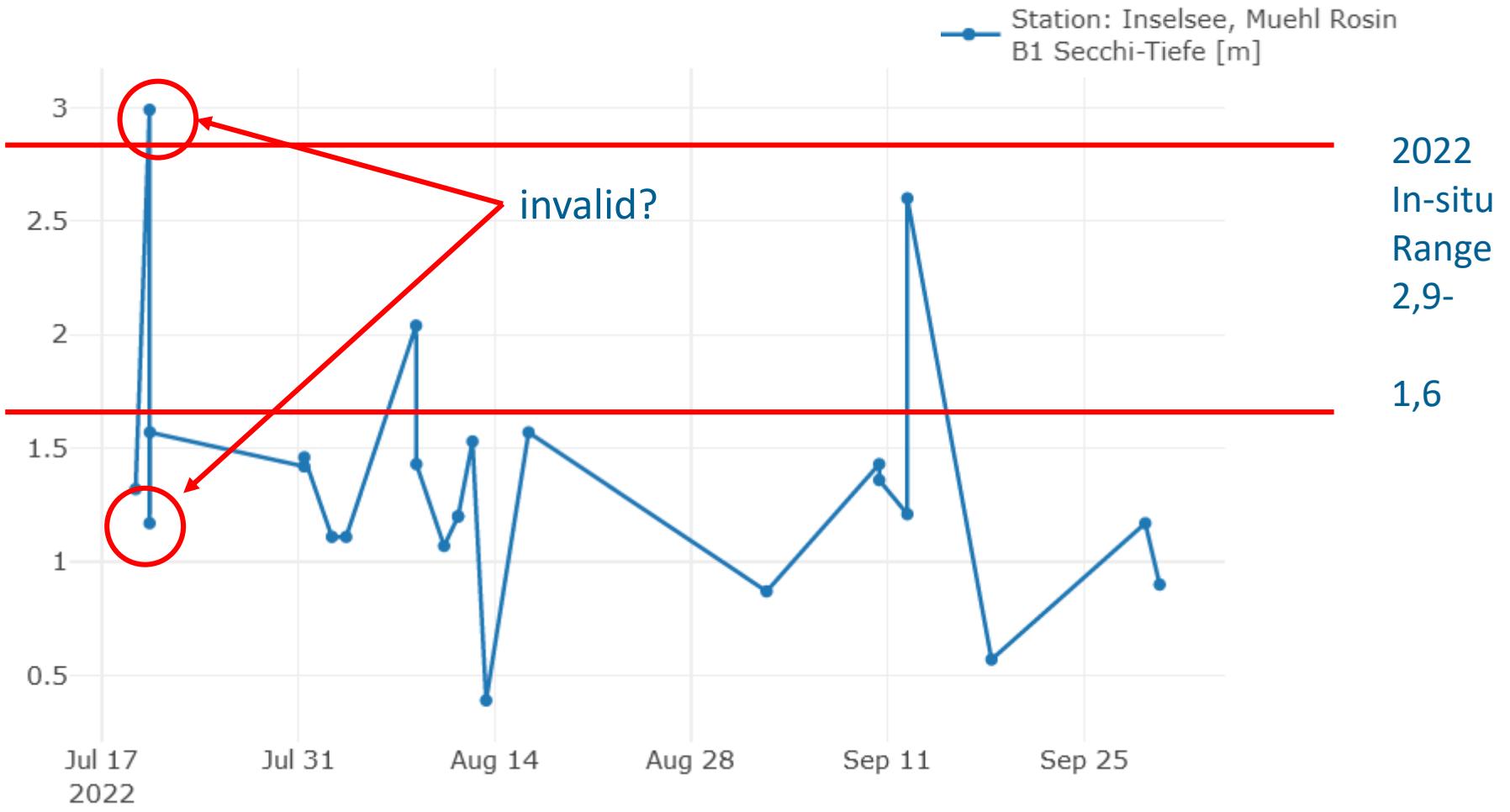
less than
2 m deep

data validation - chlorophyll

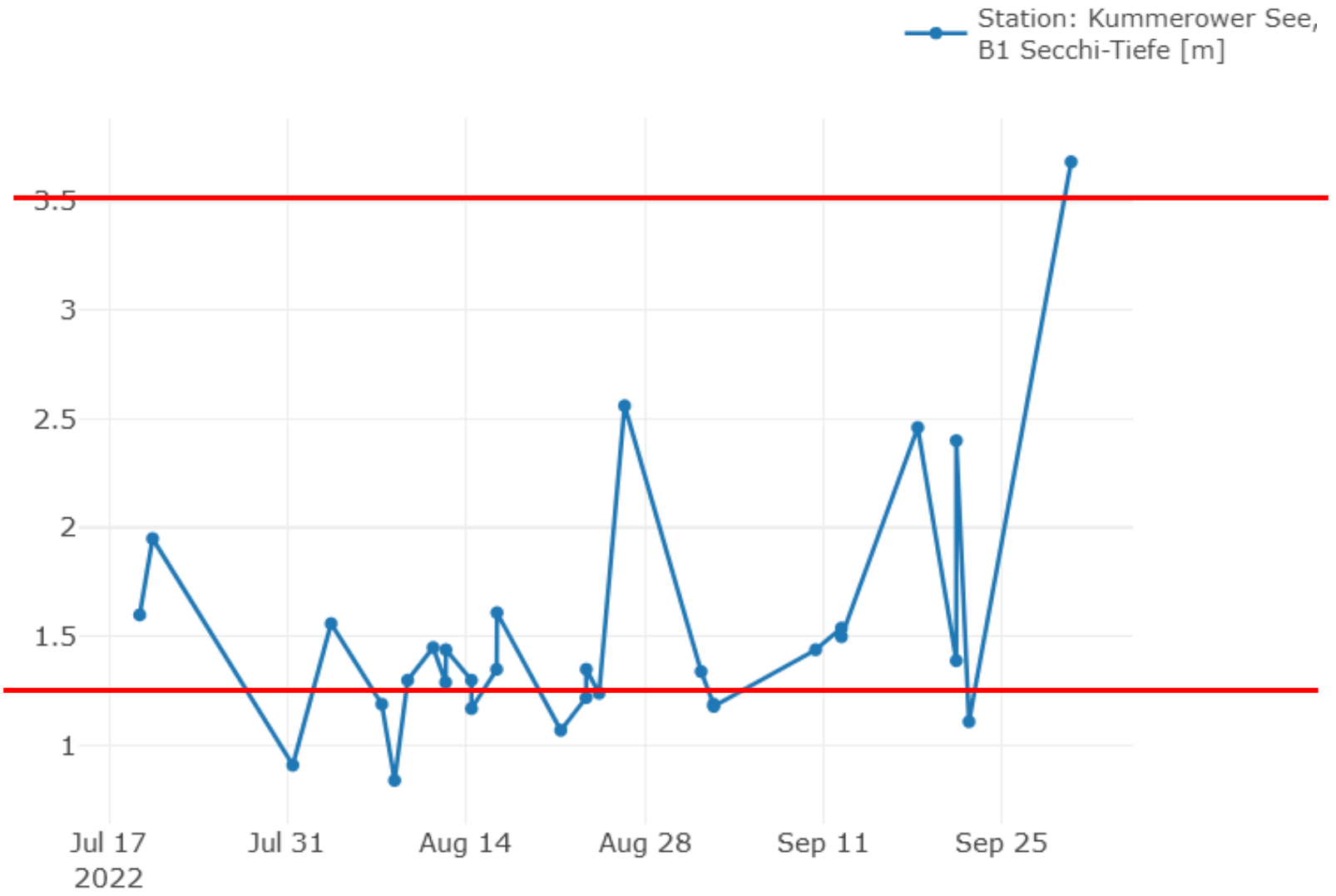
In-situ season average Chl(a) [µg/l]															
	Plauer See	Tollense-see	Kummerower See	Müritz Seemitte	Müritz Sietow	Müritz Roebeler Bucht	Müritz Klink	Kleine Müritz	Binnen-müritz	Lankower See	Barniner See	Wariner See	Gr. Rühner See	Inselsee	Malchiner See
2011	8,7	5,2	15,2	7,0	7,0	50,2	6,0	37,3	5,7	7,1	88,9		108,1	7,2	
2012	7,8	7,5	12,9	5,9	5,0	53,7	4,3	32,4	4,6			31,5			91,9
2013	5,8	6,0	10,3	3,4	3,1	48,1	2,8	29,6	3,0	7,5					
2014	4,6	7,8	11,4	1,9	2,5	46,1	2,5	32,5	2,5		73,7		61,9		
2015	3,9	5,8	7,0	1,7	1,6	24,9	1,9	37,3	1,7			34,3		11,0	
2016	2,7	5,3	5,1	2,4	2,2	24,7	2,2	35,3	2,3						
2017	3,1	7,0	7,1	2,3	2,4	17,7	2,2	28,6	2,1	18,3	82,3				61,7
2018	4,1	9,5	13,9	3,7	2,5	25,5	2,7	27,1	3,4				111,0		
2019	3,6	5,0	3,7	2,6	2,6	41,4	2,7	42,2	2,9					9,8	
2020	3,6	3,9	4,5	2,7	2,2	27,0	2,2	41,3	2,4	13,8					
2021										12,2					
2022EO	3,2	1,8	5,5	1,3	1,6	1,8	1,5	14,7	2,7	11,3	103,3	16,9	72,5	5,8	89,4

- In general, there is good agreement between the satellite-based seasonal mean and the available in-situ data
- the final evaluation can be done after receiving the in-situ data from 2022 (in 2023)
- some results are implausible and need to be checked more closely

data validation – lake with common visual depth



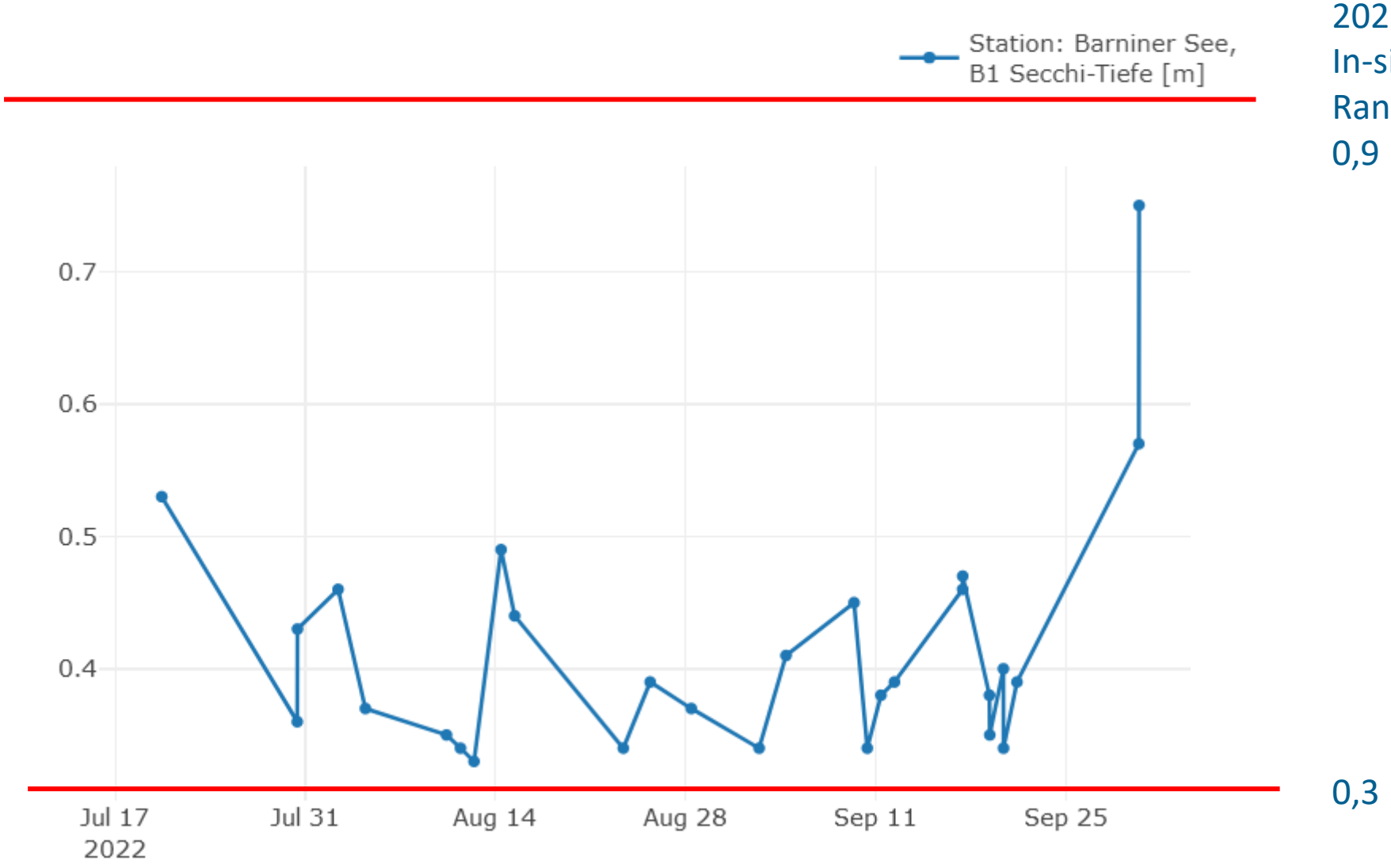
data validation – lake with higher visual depth



2022
In-situ
Range
3,5

1,3

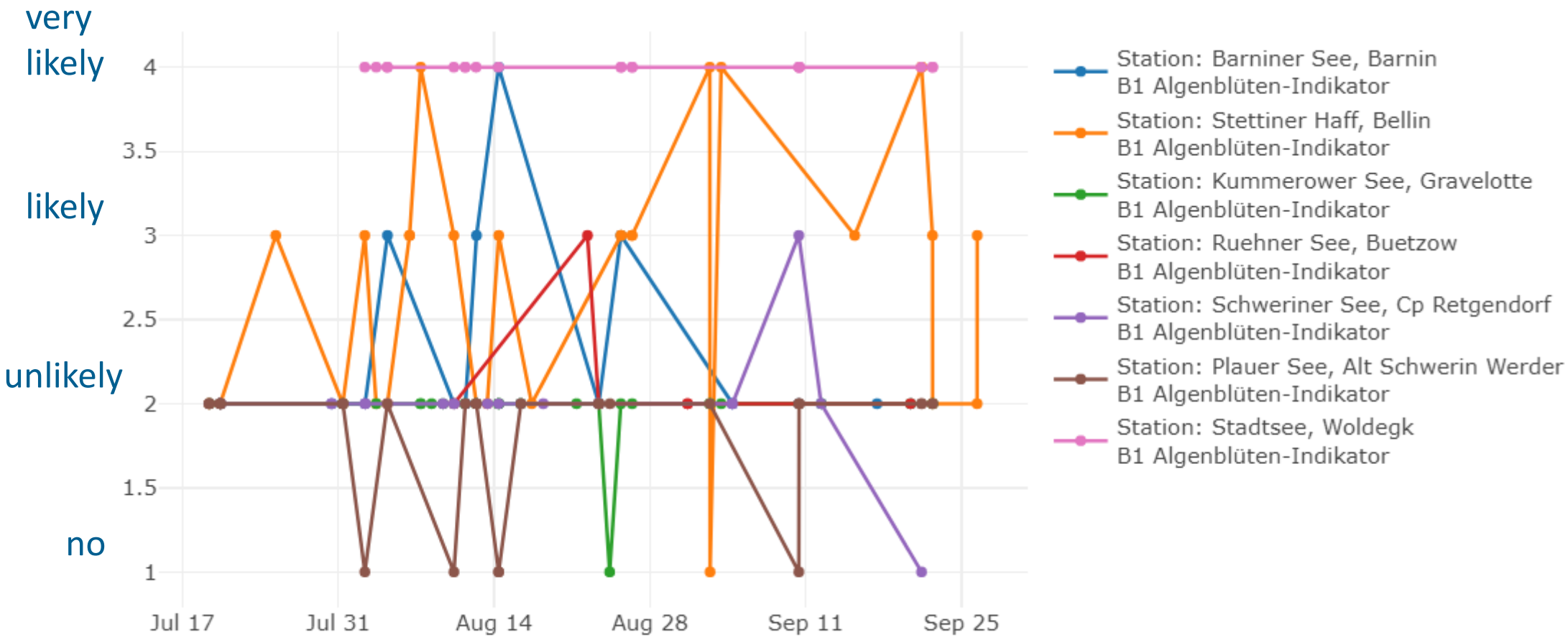
data validation – lake with very low visual depth



2022
In-situ
Range
0,9

0,3

data validation - indicator for „harmful algae“ (HAB)



- the usual suspects are represented in „very likely“ and „likely“
- bathing ban in Stadtsee Woldegk and Stettiner Haff
- no in-situ concentrations of cyanobaceria available
- subjekt of further research

Conclusions:
Possibilities and limits of surface water monitoring

- the eoPortal is a powerful and user-friendly tool (with still some bugs)
- the process chain to make yesterday's data available was established (but didn´t always work proberly)
- the results for chlorophyll, HAB and visual depth are satisfactory but:
  - the virtual stations have to be chosen more accurate
  - some more input data must be discarded
  - the processing algorithms still need to be improved
- to get one or more measurement results a week it is a quantum leap in monitoring of lakes and coastal waters
- too few suitable results for the selected rivers

Conclusions:
Synergy effects with health surveillance, alarm system for harmful algae

– the employees of the health service were enthusiastic about the new possibilities

– they suggested further developing the indication of cyanobacteria

– both for water body monitoring and for health surveillance, the entire water body must be evaluated for a proper assessment of the data

– this would also open up new possibilities for the development dynamics of the plankton in the respective lake
example: Timing of algal blooms in spring

Conclusions:
First step towards comprehensive monitoring of surface waters?
YES!

necessary improvements

- further development of the eoPortal into an analysis and data management tool
  - plausibility check based on existing, checked data
  - discard invalid measurements
  - import and export of data from and to the water quality database
- nationwide coverage required
- the current price model for the raw data should be adapted to the possibilities of a state administration

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Thank you for your attention!

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