From in situ observations to gridded fields

The A-team

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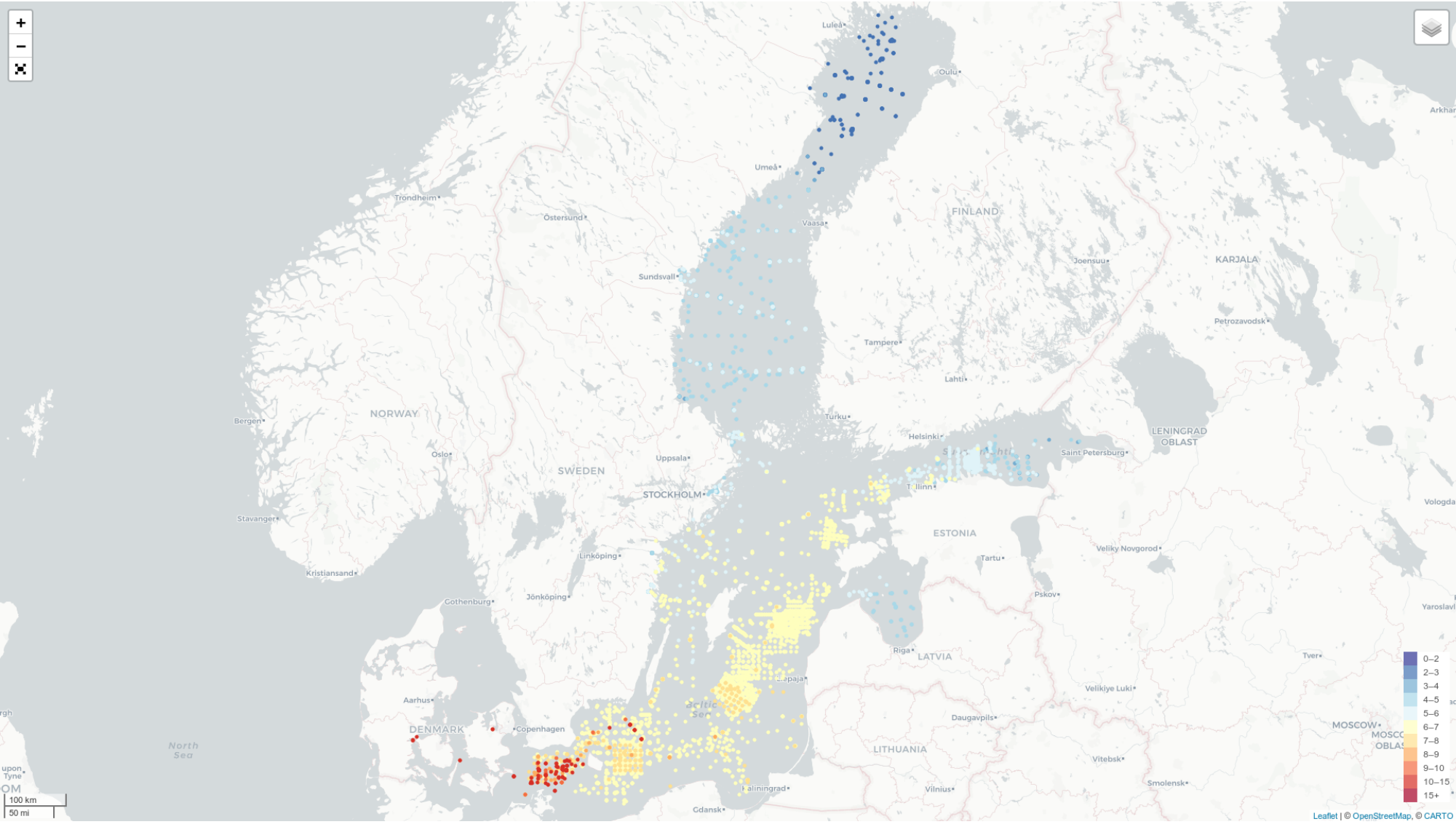
Mikael,
Chris
Krish
Peter
Merret
Alex
Themis
Filip
Sebastian
Fedor

The A-team


Mikael,
Chris
Krish
Peter
Merret
Aurélie,
Yohann
Alex
Themis
Filip
Sebastian
Fedor

Interpolation in oceanography



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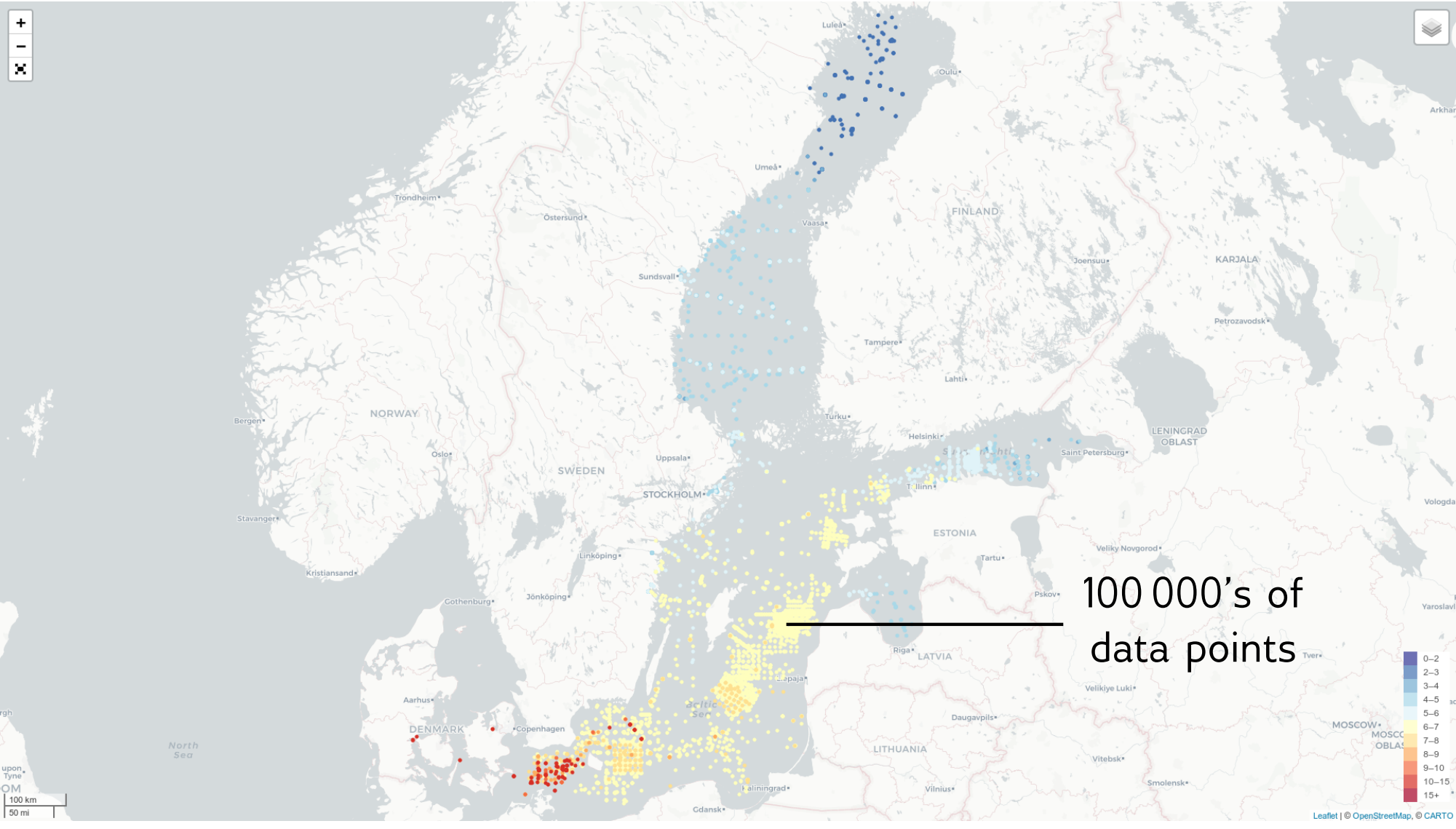

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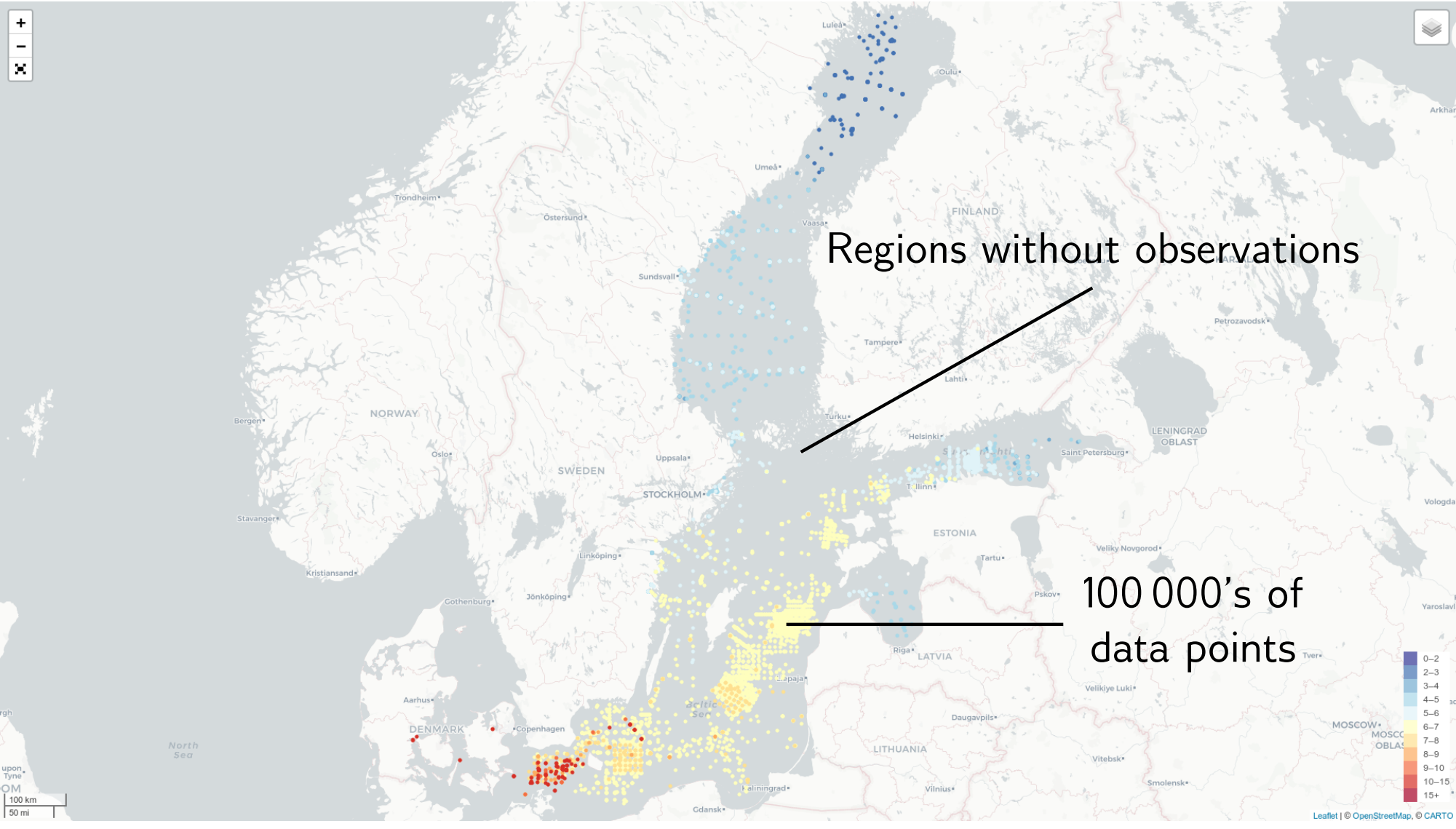

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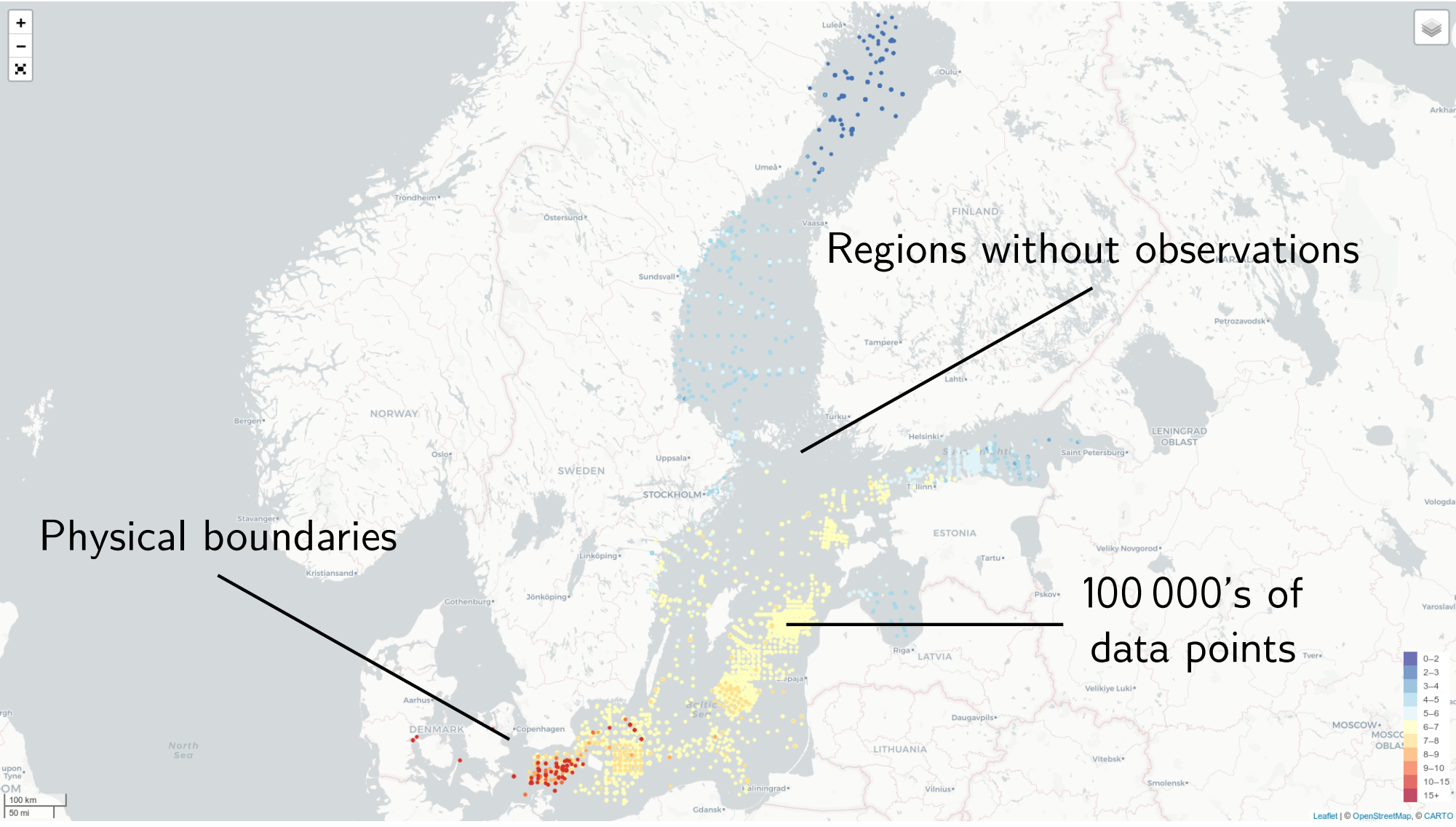
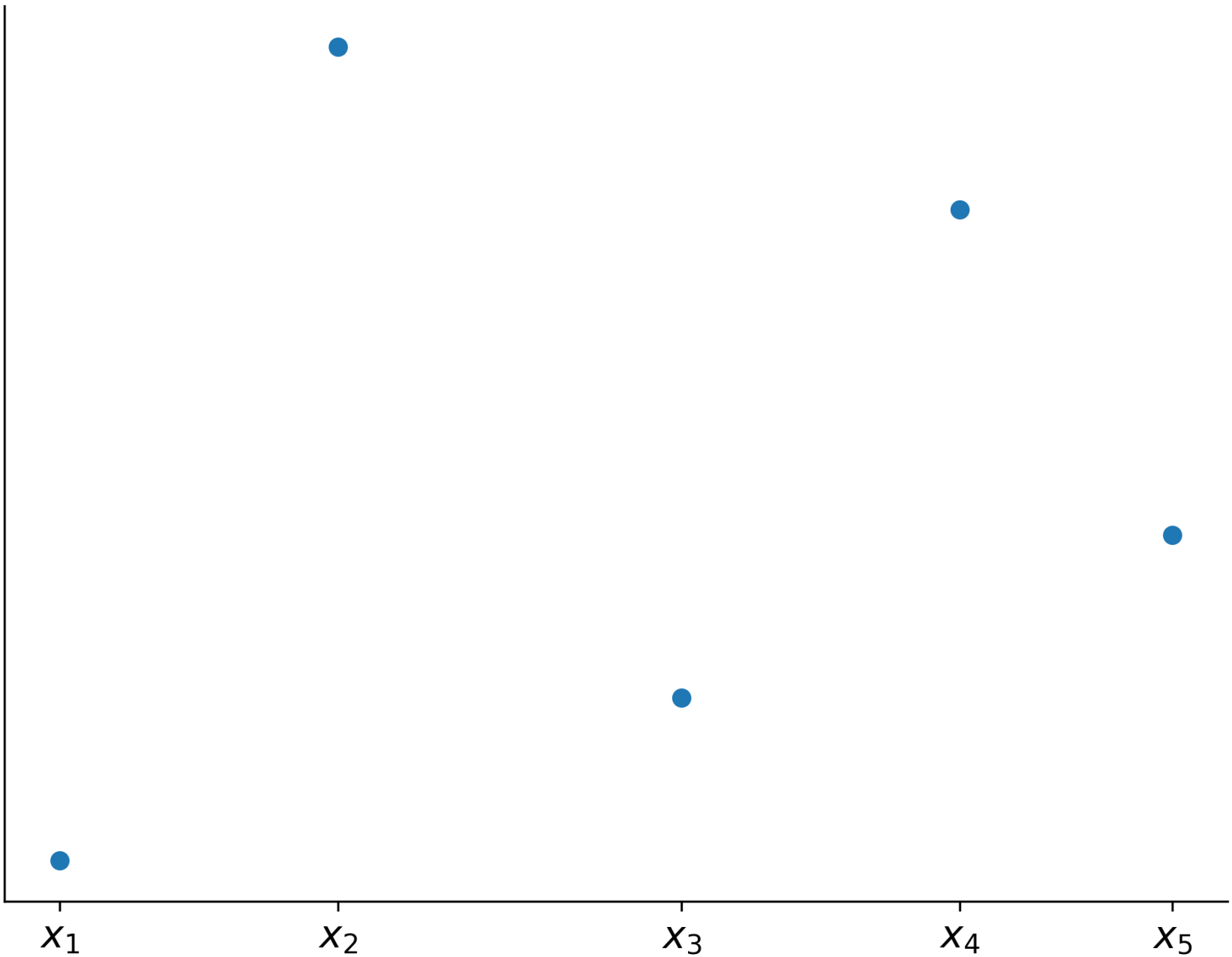


Interpolation vs. approximation



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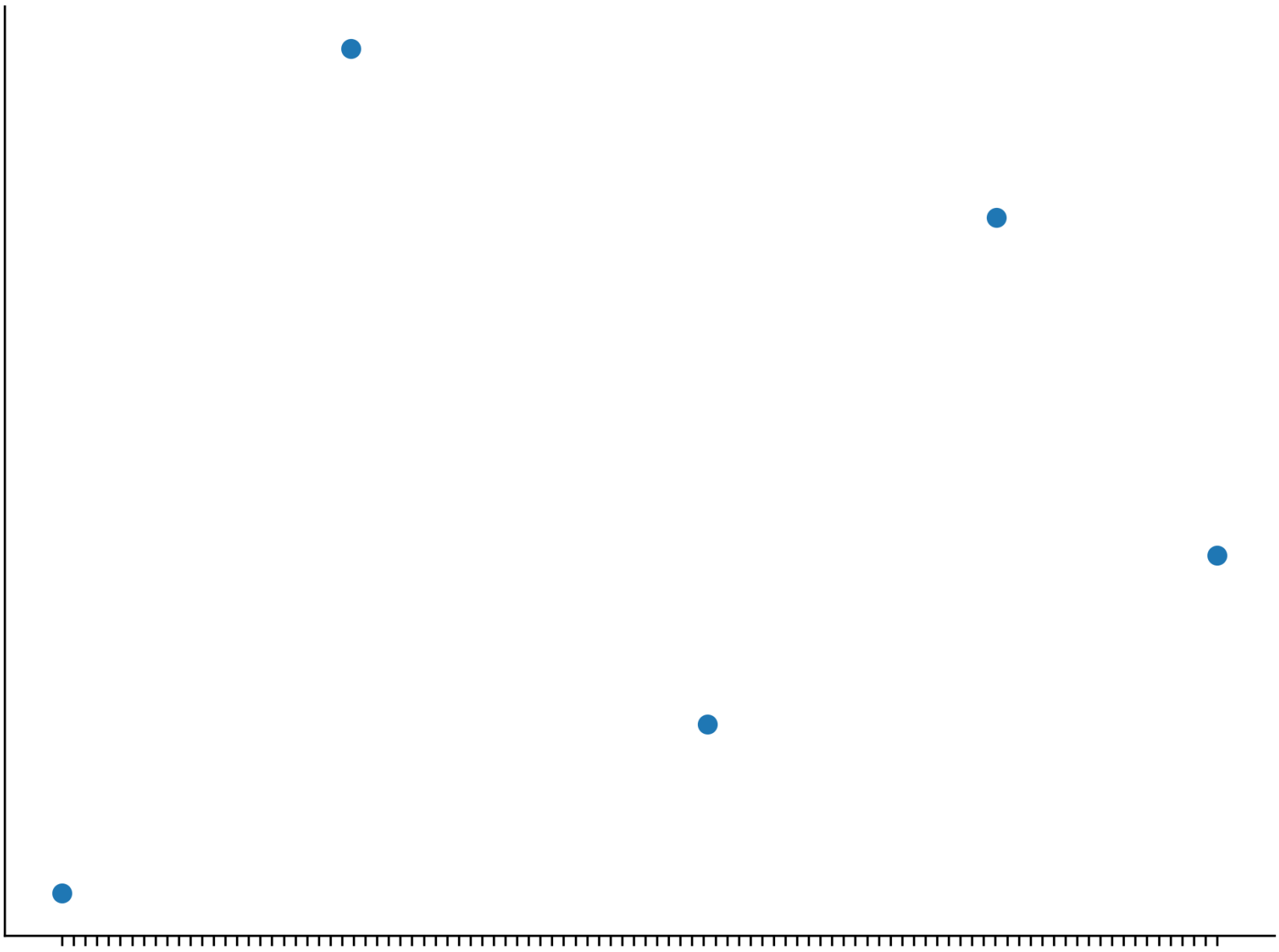
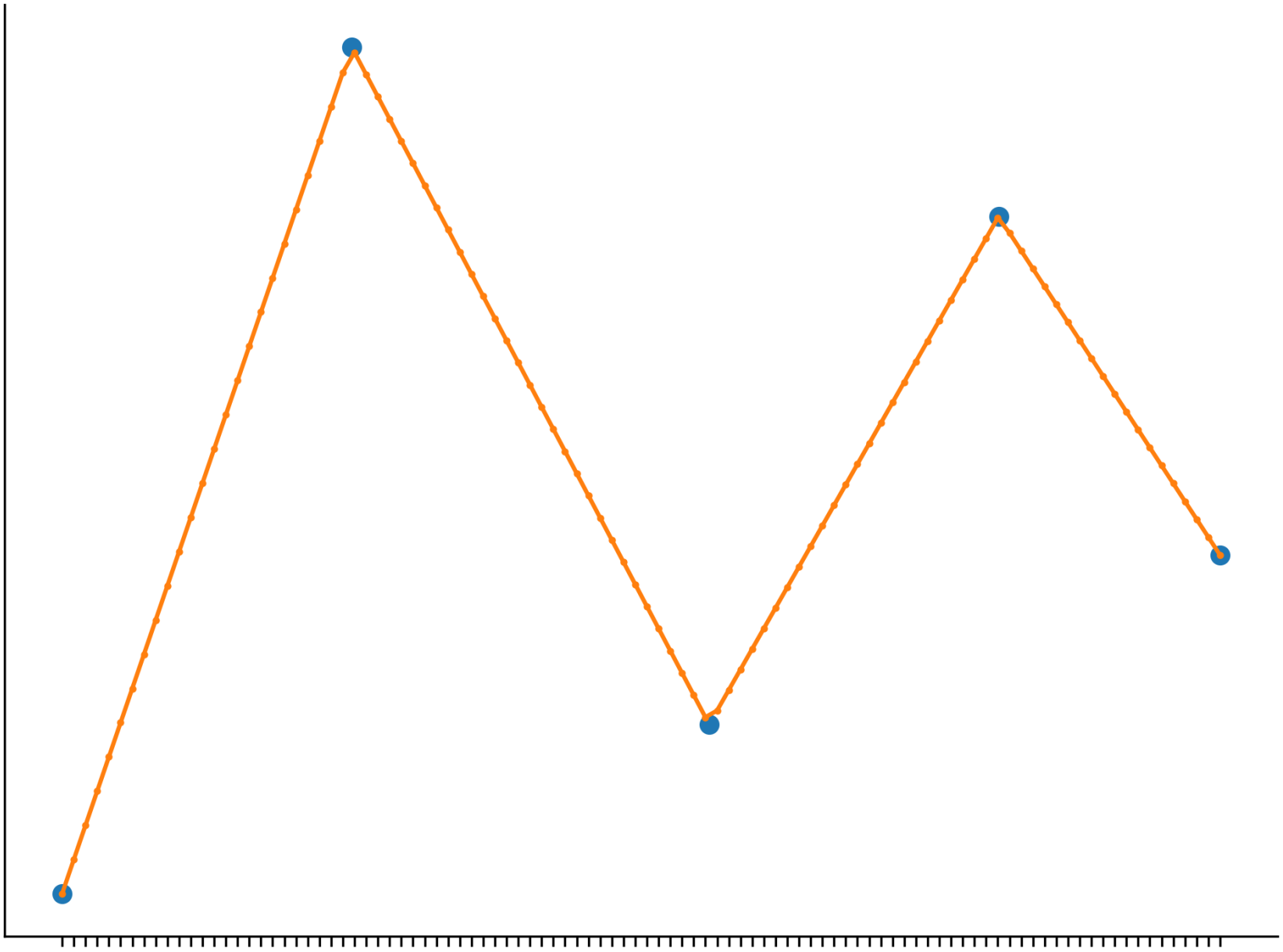
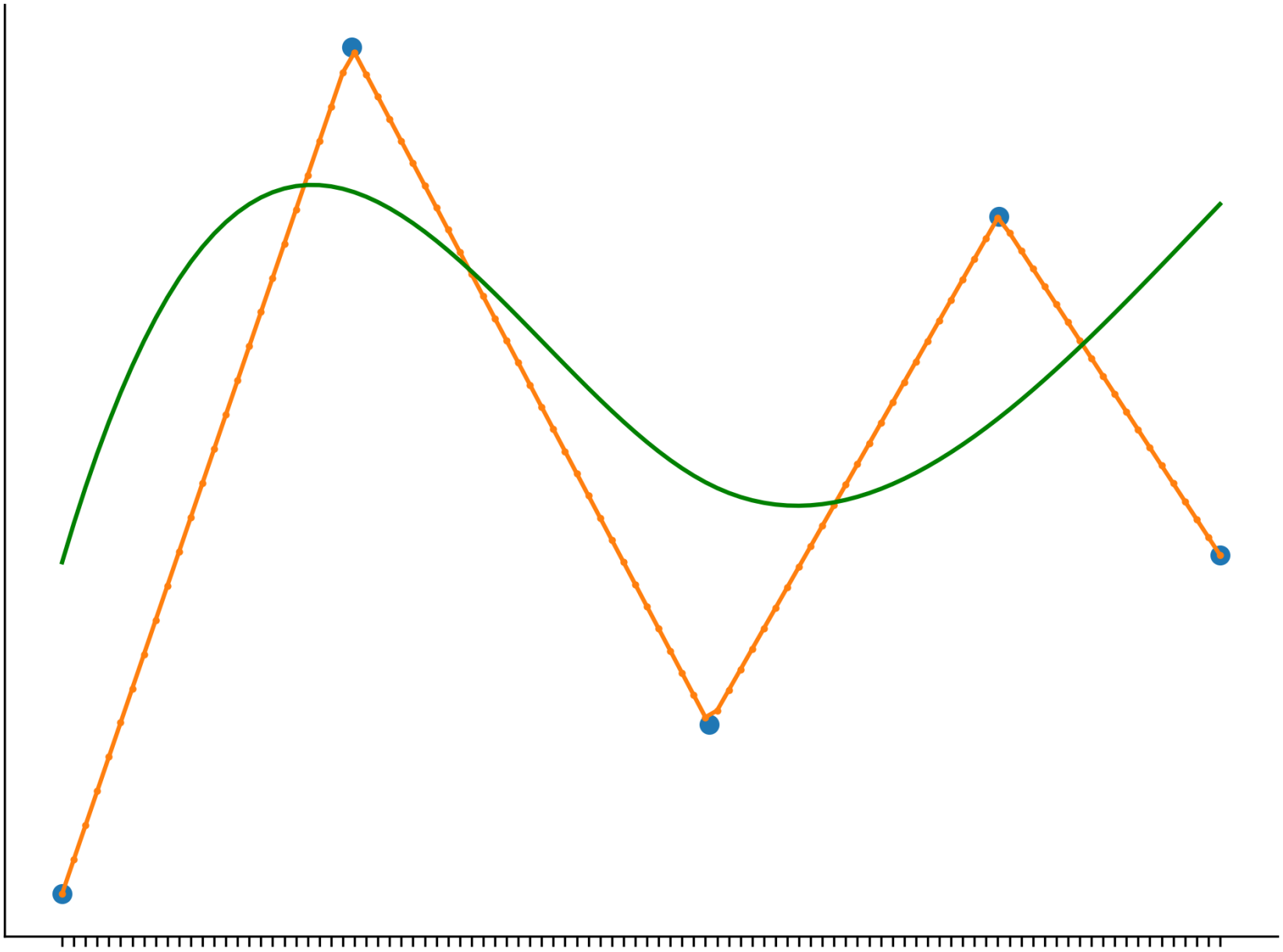


Interpolation vs. approximation



Interpolation vs. approximation



Data-Interpolating Variational Analysis

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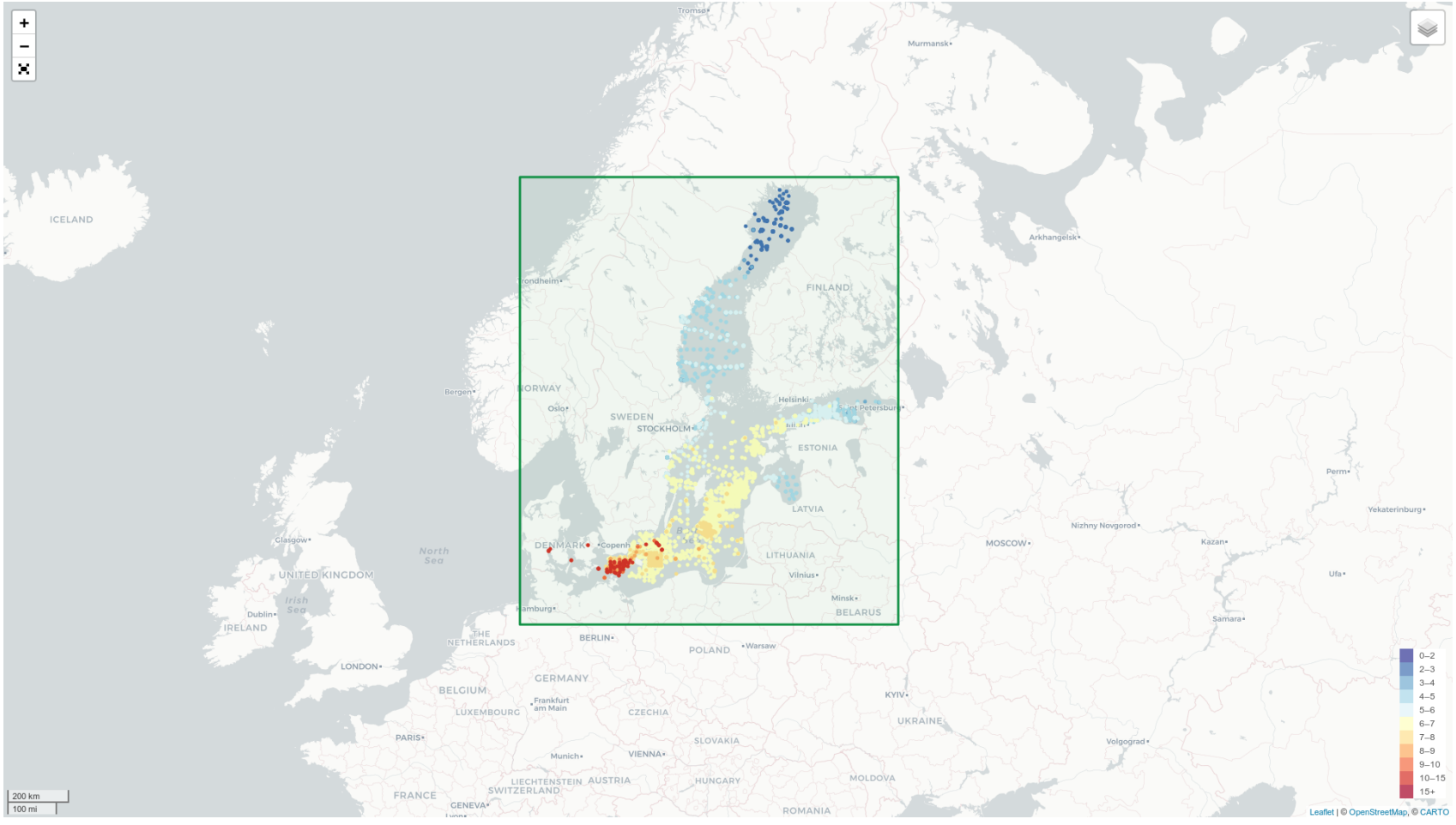
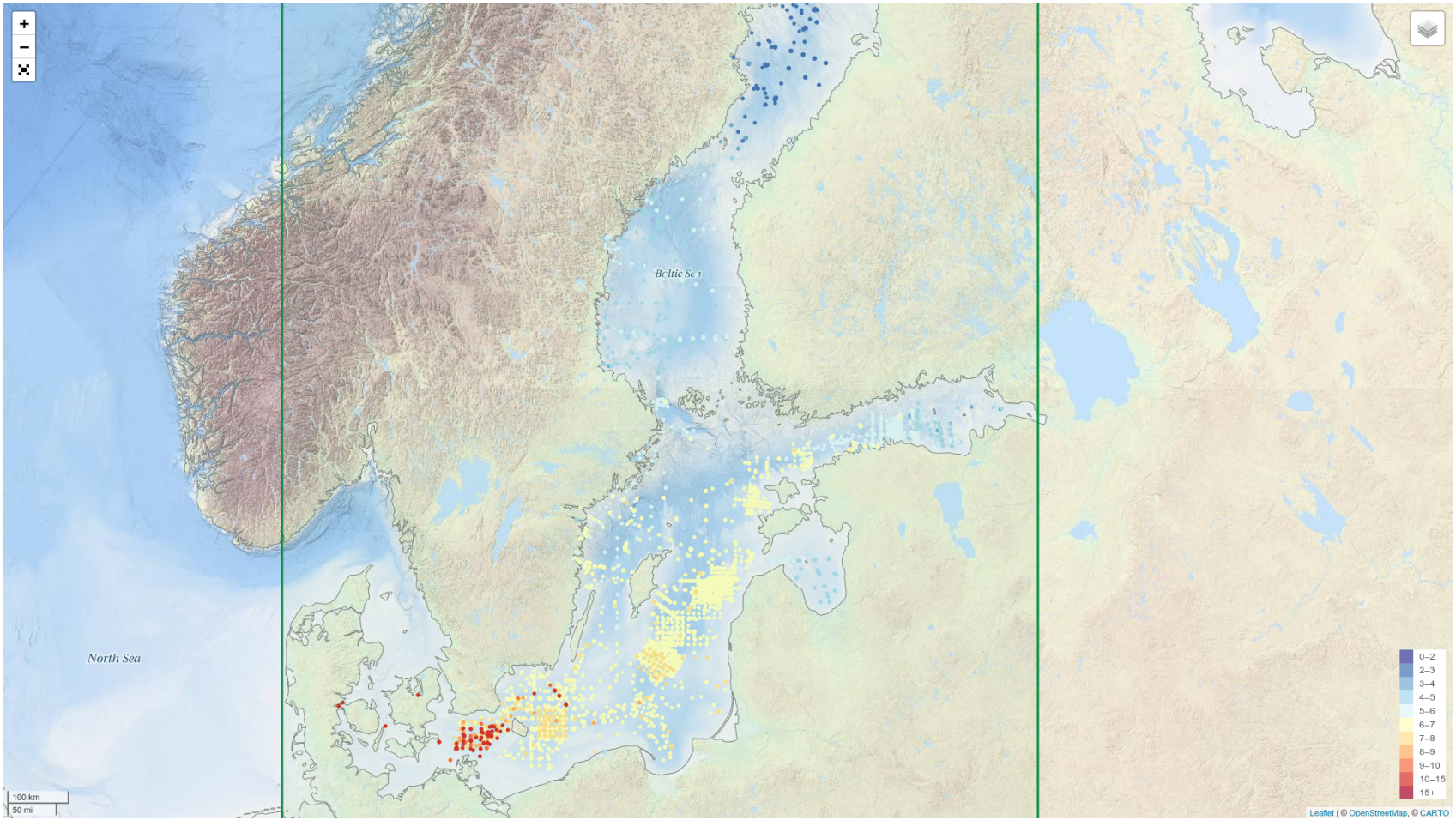


Baltic Sea - Temperature and salinity observation collection V2
https://www.seadatanet.org/Products#/metadata/1610aa44-0436-4b53-b220-98e10f17a2d4

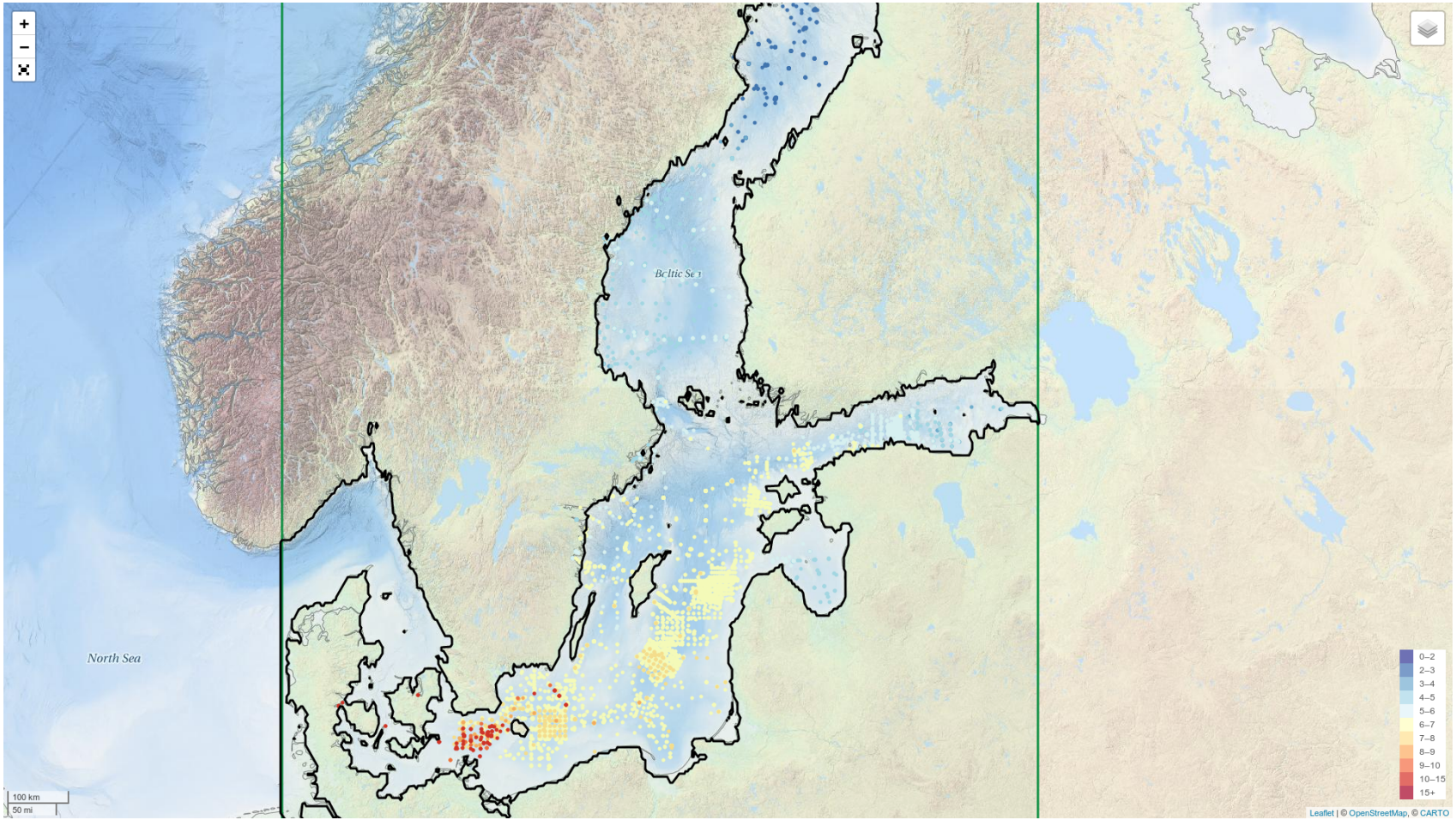
Data-Interpolating Variational Analysis



EMODnet Bathymetry

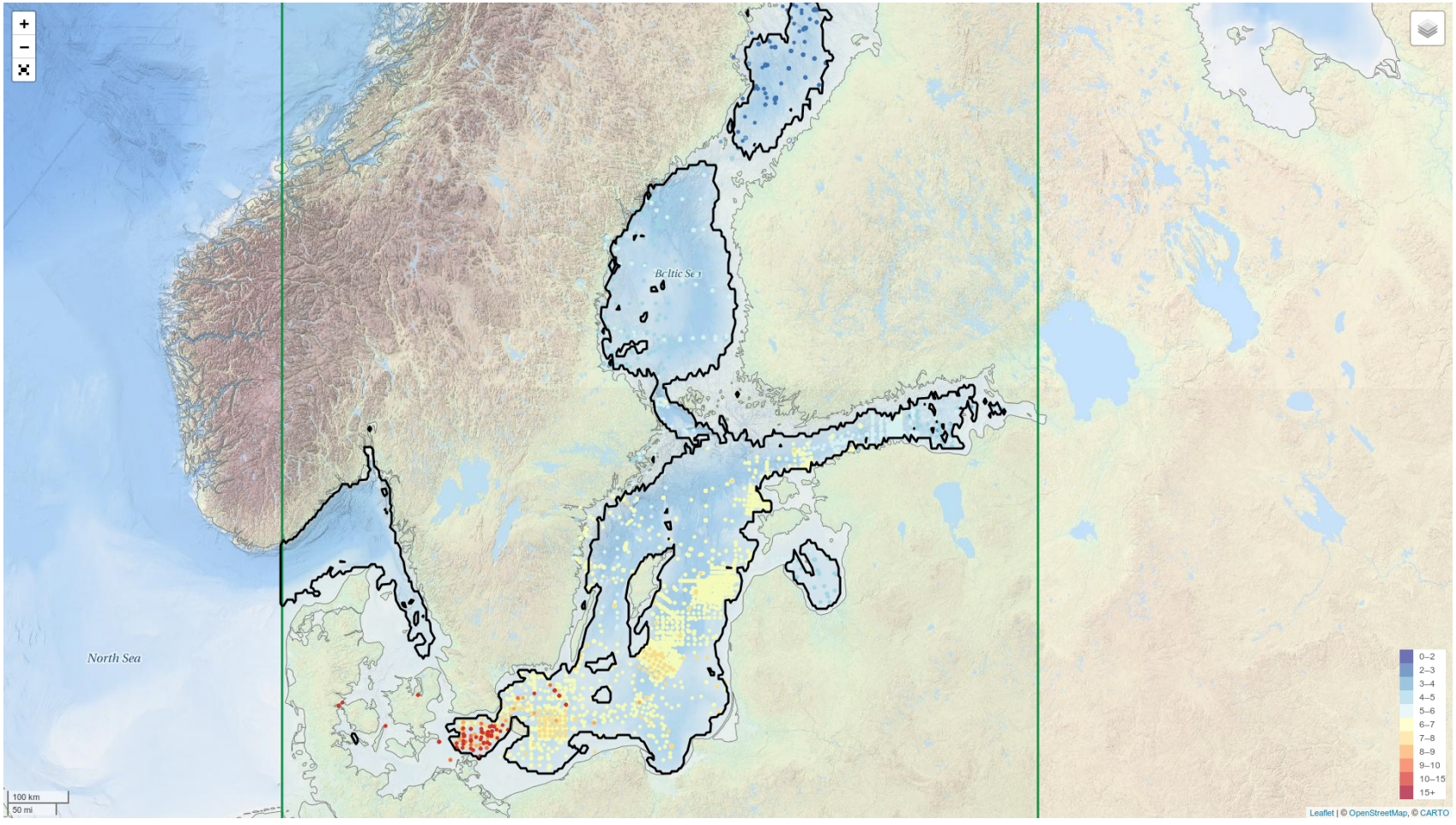
http://www.emodnet-bathymetry.eu/

Data-Interpolating Variational Analysis



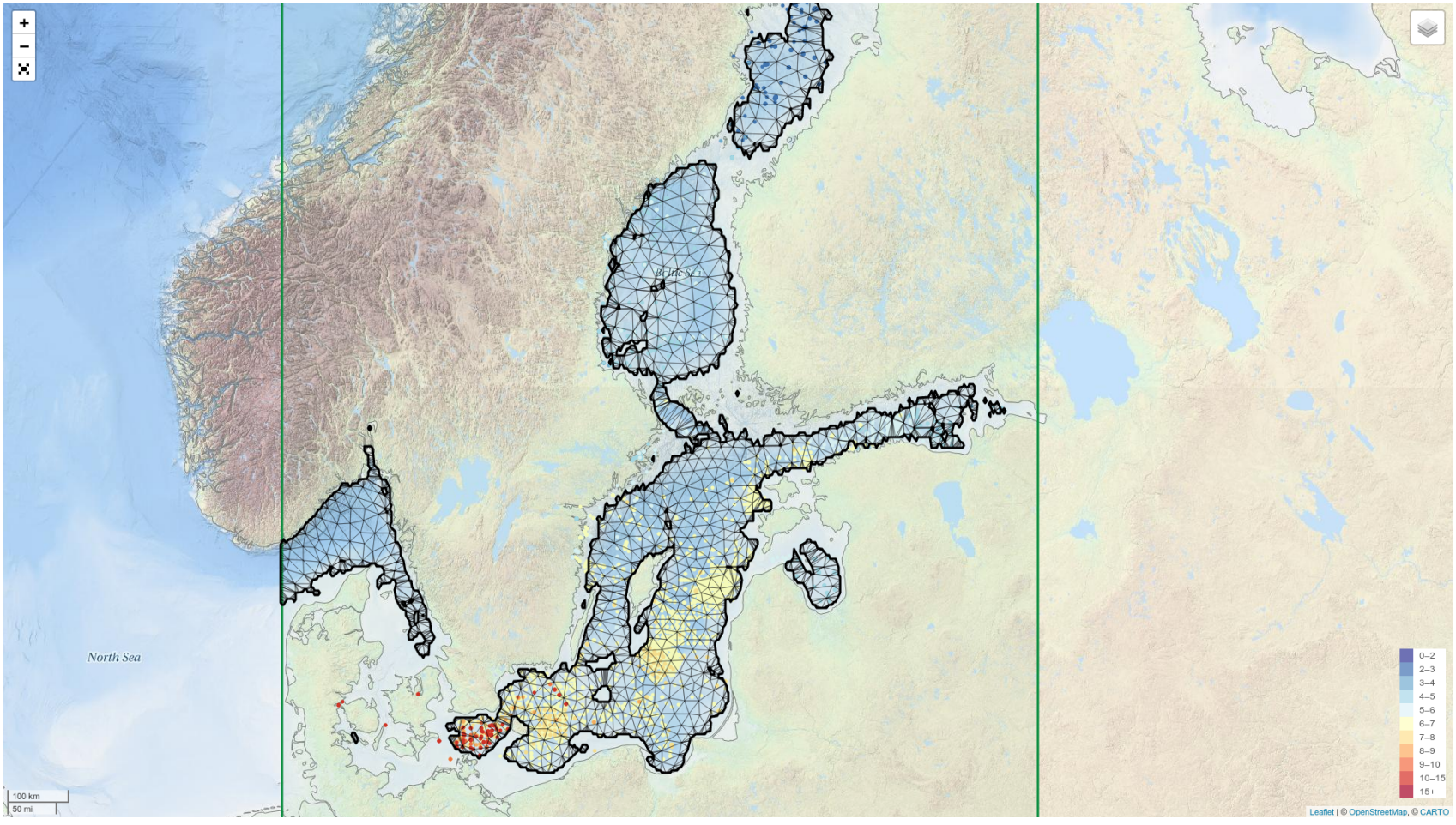
Contour at 0 meter depth

Data-Interpolating Variational Analysis



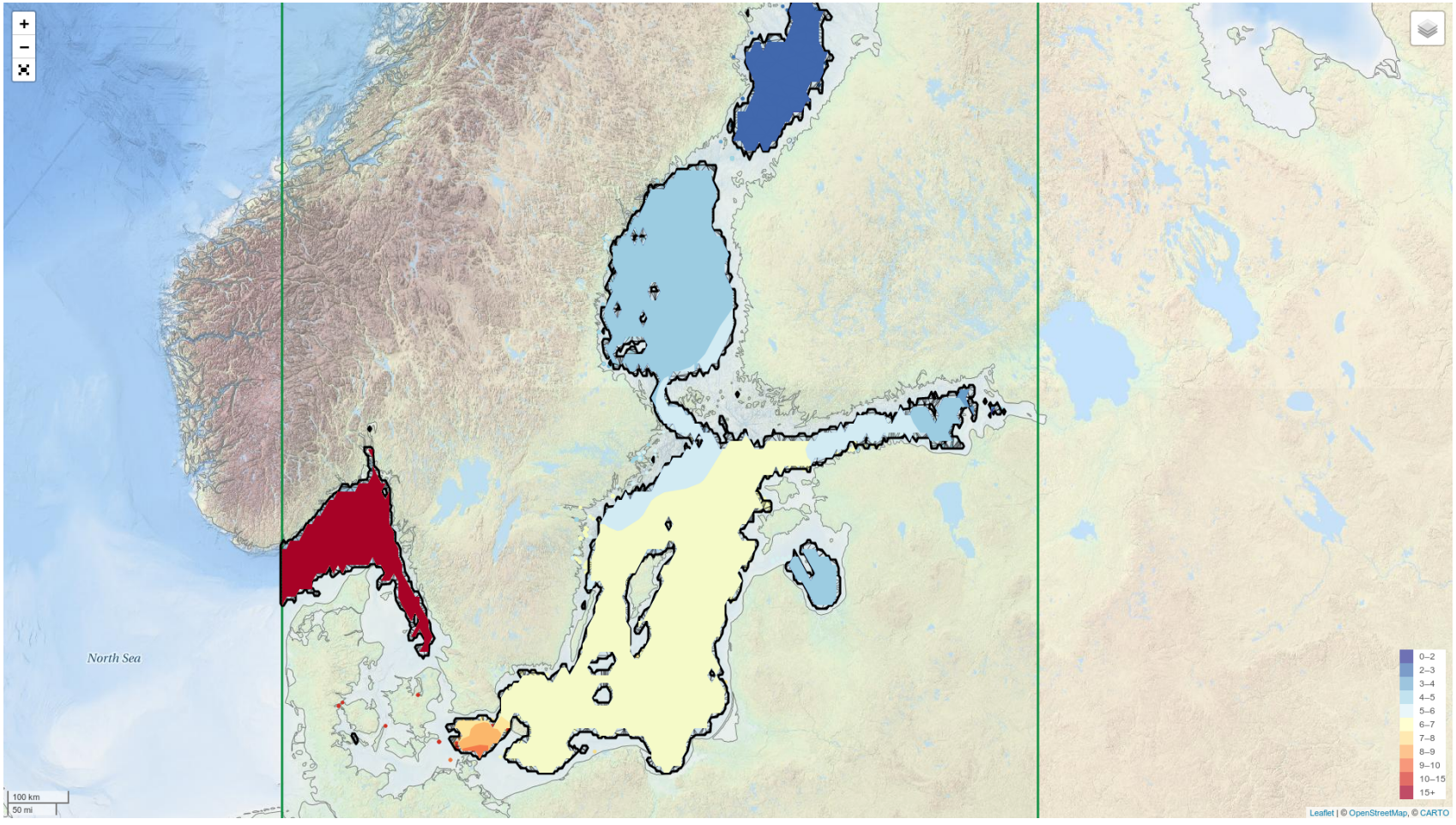
Contour at 30 meters

Data-Interpolating Variational Analysis



Triangular, finite-element mesh

Data-Interpolating Variational Analysis

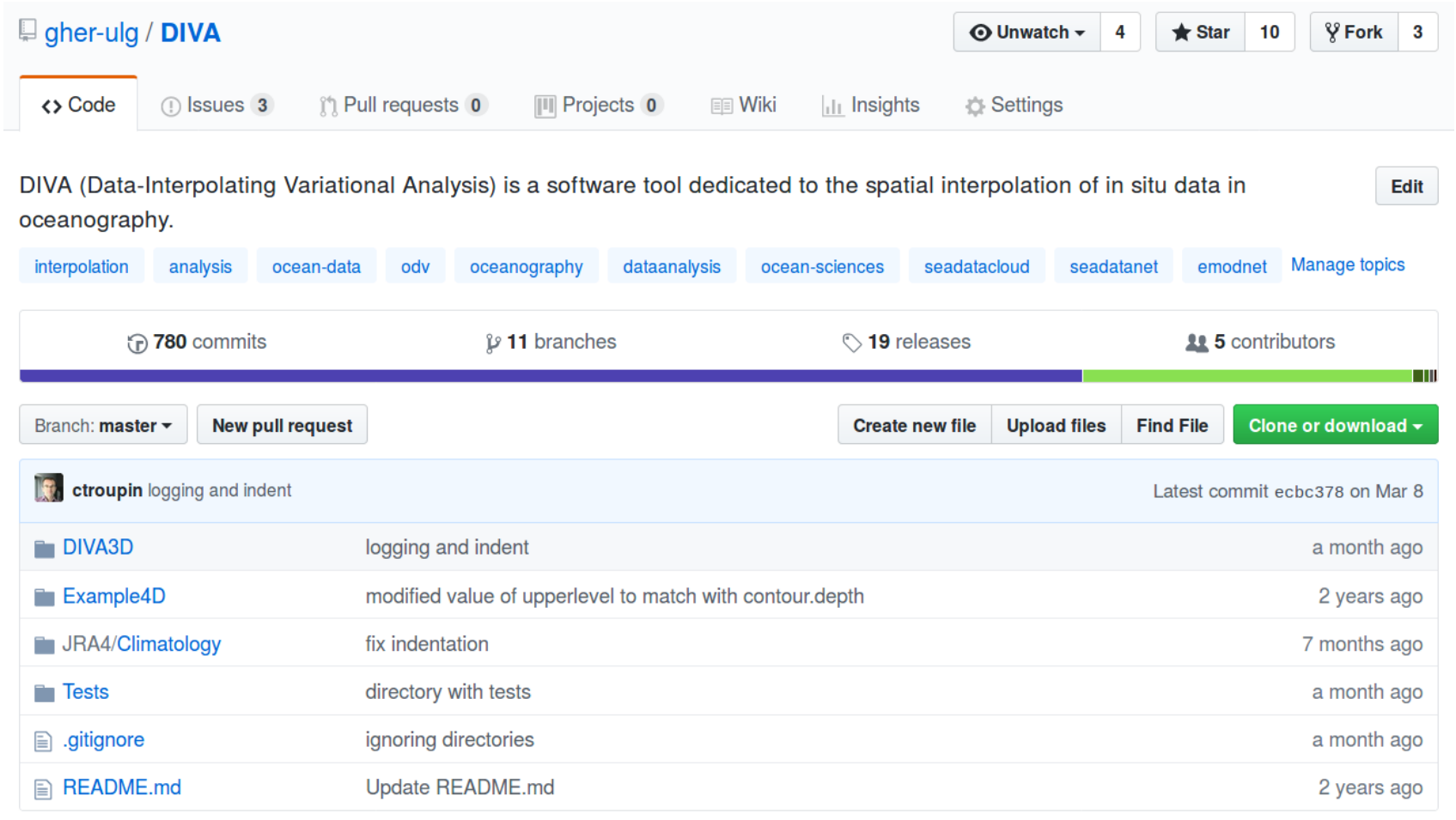


Interpolated salinity field

Data-Interpolating Variational Analysis

https://github.com/gher-ulg/DIVA

10.5281/zenodo.592476



What should we improve?

What should we improve?

What should we improve?

Where should we improve?

1. Code compilation (different O.S., compilers, ...)
2. (Too) many options & input files
3. No graphical interface

Innovation

Going to N dimensions

n-dimensional generalization: DIVAnd

https://www.geosci-model-dev.net/7/225/2014/gmd-7-225-2014.pdf

https://github.com/gher-ulg/divand.jl

Geosci. Model Dev., 7, 225–241, 2014
www.geosci-model-dev.net/7/225/2014/
doi:10.5194/gmd-7-225-2014

Geoscientific Model Development
Open Access

divand-1.0: *n*-dimensional variational data analysis for ocean observations

A. Barth[1,*], J.-M. Beckers[1], C. Troupin[2], A. Alvera-Azcárate[1], and L. Vandenbulcke[3,4]

[1]GHER, University of Liège, Liège, Belgium
[2]IMEDEA, Esporles, Illes Balears, Spain
[3]seamod.ro/Jailoo srl, Sat Valeni, Com. Salatrucu, Jud. Arges, Romania
[4]CIIMAR, University of Porto, Porto, Portugal

[*] *Invited contribution by A. Barth, recipient of the EGU Arne Richter Award for Outstanding Young Scientists 2010.*

Correspondence to: A. Barth (a.barth@ulg.ac.be)

n-dimensional generalization: DIVAnd

https://github.com/gher-ulg/DIVAnd.jl

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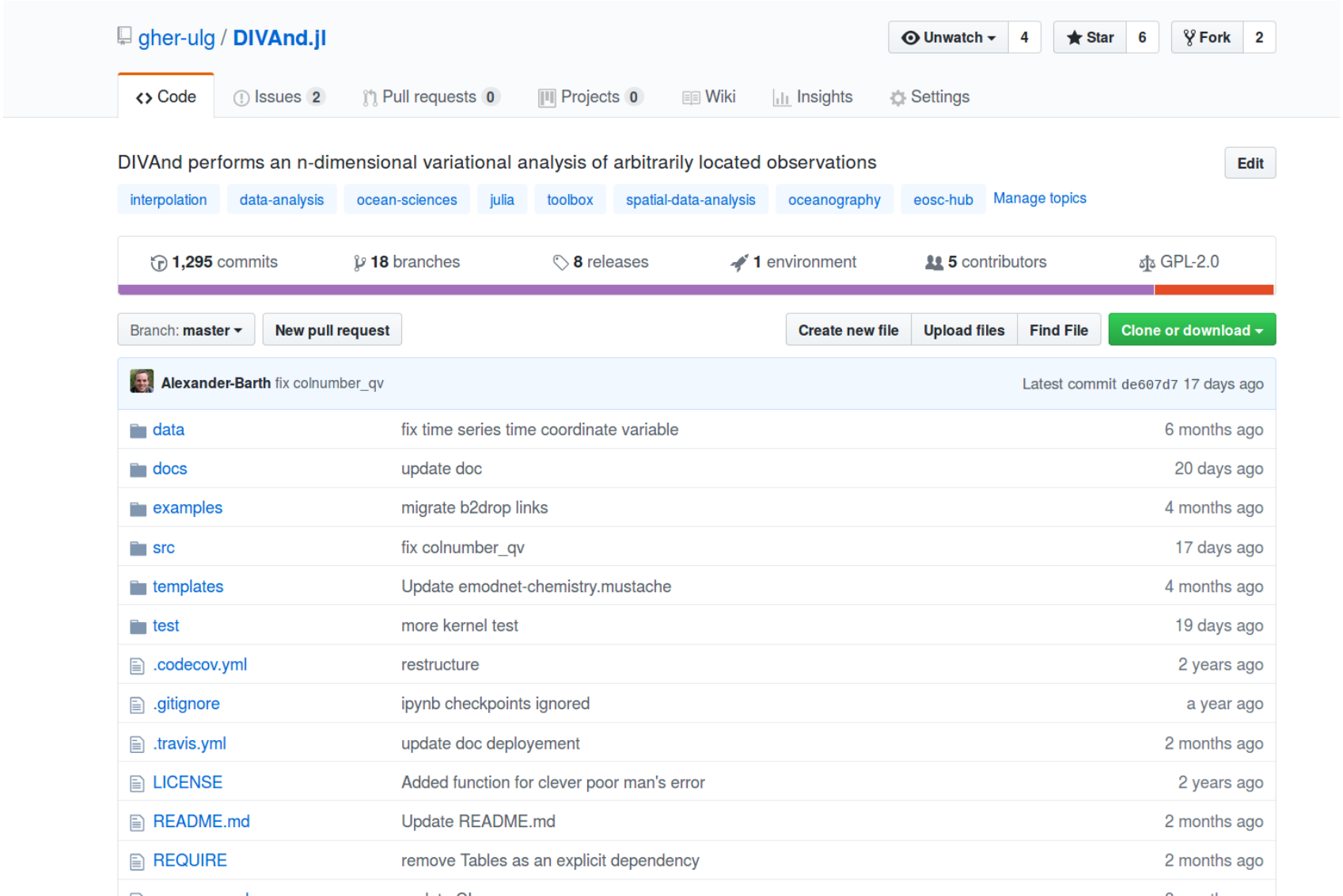


gher-ulg / **DIVAnd.jl**

Unwatch 4 | Star 6 | Fork 2

Code | Issues 2 | Pull requests 0 | Projects 0 | Wiki | Insights | Settings

DIVAnd performs an n-dimensional variational analysis of arbitrarily located observations — Edit

interpolation | data-analysis | ocean-sciences | julia | toolbox | spatial-data-analysis | oceanography | eosc-hub | Manage topics

1,295 commits | **18** branches | **8** releases | **1** environment | **5** contributors | GPL-2.0

Branch: **master** | New pull request | Create new file | Upload files | Find File | Clone or download

Alexander-Barth fix colnumber_qv — Latest commit de607d7 17 days ago

data	fix time series time coordinate variable	6 months ago
docs	update doc	20 days ago
examples	migrate b2drop links	4 months ago
src	fix colnumber_qv	17 days ago
templates	Update emodnet-chemistry.mustache	4 months ago
test	more kernel test	19 days ago
.codecov.yml	restructure	2 years ago
.gitignore	ipynb checkpoints ignored	a year ago
.travis.yml	update doc deployement	2 months ago
LICENSE	Added function for clever poor man's error	2 years ago
README.md	Update README.md	2 months ago
REQUIRE	remove Tables as an explicit dependency	2 months ago

What have we improved?

1. New mathematical formulation — Barth et al. 2014
2. Julia language — instead of Fortran
3. Only 2 input files — data & bathymetry
4. Applications as Jupyter notebooks — all in one

What have we improved?

Founder Collective
@fcollective

Follow

Congrats to the @JuliaLanguage team on their 1.0 release! We look forward to watching the @JuliaComputing team use it to smash the competition like so much bœuf à la Bourguignonne! github.com/JuliaLang/juli … #ProudInvestor

11:59 PM - 8 Aug 2018

Jupyter notebooks as guidelines

jupyter 90-full-analysis Last Checkpoint: 02/20/2019 (unsaved changes) Logout

File Edit View Insert Cell Kernel Help Trusted Julia 1.0.3

Markdown

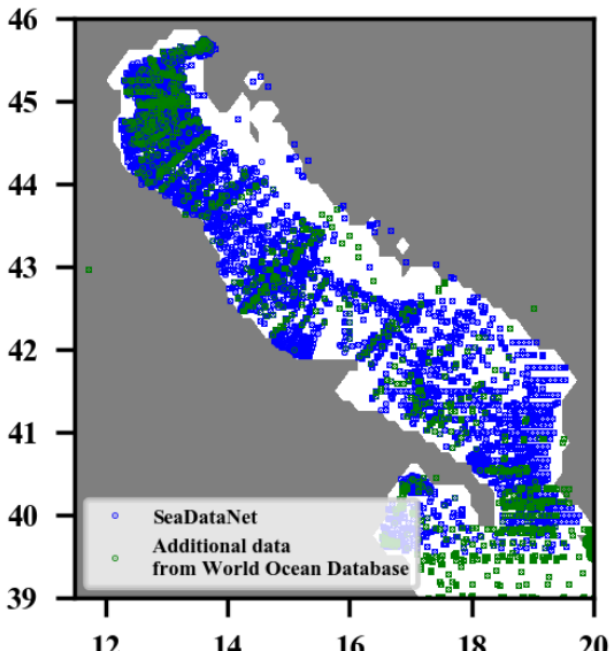
Slide Type Sub-Slide

Create a plot showing the additional data points:

In [27]:

Slide Type Fragment

```
figure("Adriatic-Additional-Data", figsize=(2,2))
ax = subplot(1,1,1)
ax[:tick_params]("both",labelsize=6)
ylim(39.0, 46.0);
xlim(11.5, 20.0);
contourf(bx, by, permutedims(Float64.(mask_edit[:,:,1]),[2,1]),
    levels=[-1e5,0],cmap="binary");
plot(obslon, obslat, "bo", markersize=.2, label="SeaDataNet")
plot(obslonwod[newpoints], obslatwod[newpoints], "go",
    markersize=.2, label="Additional data\nfrom World Ocean Database")
legend(loc=3, fontsize=4)
gca()[:set_aspect](aspect_ratio)
```



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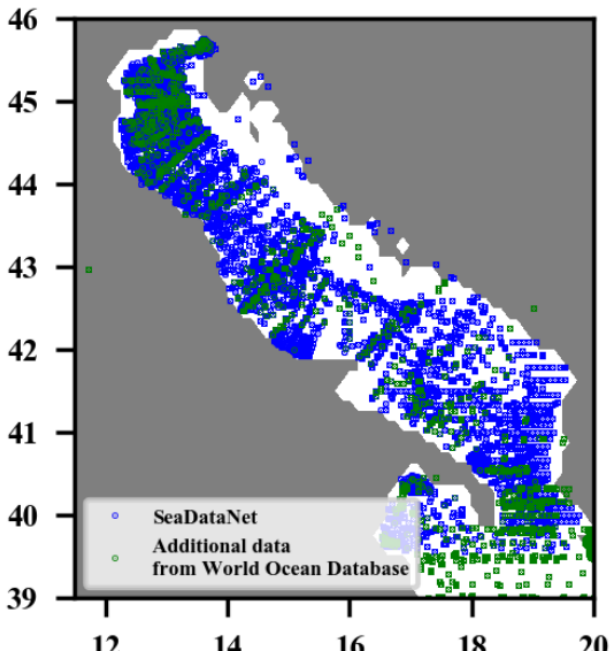

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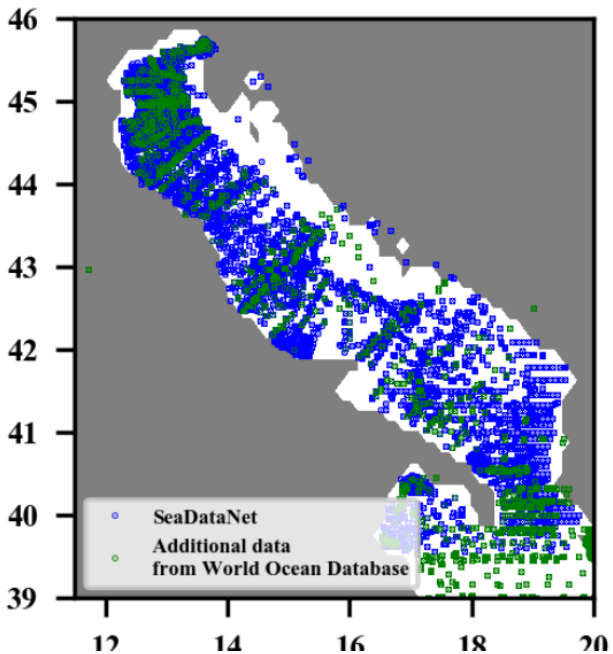

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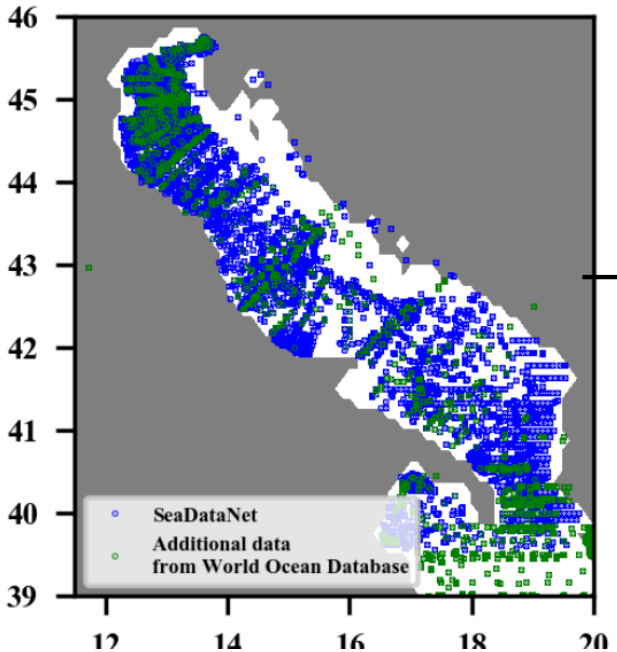

Results or figure

Jupyter notebooks as guidelines

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Markdown

Kernel (language)

Slide Type Sub-Slide

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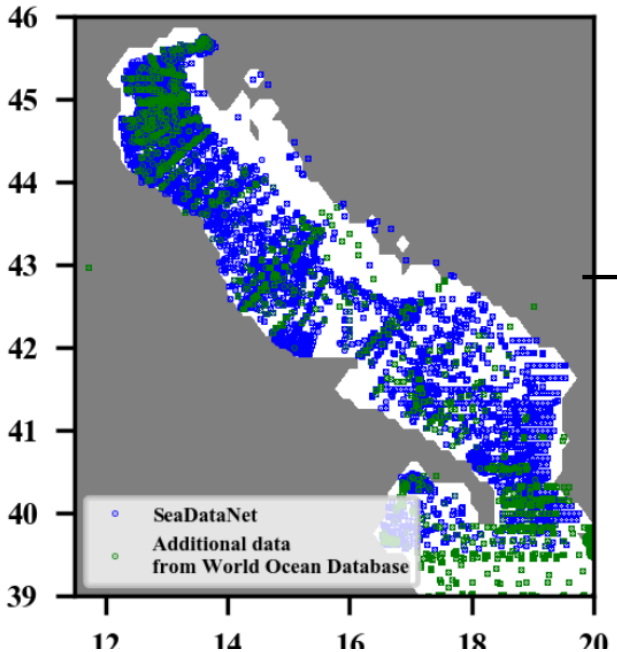

Results or figure

What should we improve?

What should we improve?

1. Access to computing power
2. Data availability
3. Documentation

Toward the Virtual Research Environment

Principles (simplified)

1 User login	using Marine-ID
2 Upload of personal data	(optional)
3 Pre-process and quality control	using Ocean Data View
4 Interpolate using DIVAnd	configuring the notebook
5 Dynamic visualization	using Deltares tools
6 Publish results and notebooks	

How do we do it?

https://www.docker.com/
applications deployed as Docker containers

https://kubernetes.io/
management and scaling of containers

Want to know more?

DIVA interpolation using neural networks

Thursday, 11 April 2019, 08:30–10:15 Hall X1 – Poster X1.46

Geophysical Research Abstracts
Vol. 21, EGU2019-14104, 2019
EGU General Assembly 2019

Combining variational interpolation (DIVAnd) and neural networks to generate ocean climatologies from in situ observations

Alexander Barth (1), Peter Herman (2), Charles Troupin (1), Aida Alvera-Azcárate (1), Jean-Marie Beckers, and (1)

(1) University of Liege, AGO/GHER, Liege, Belgium (a.barth@uliege.be), (2) Delft University of Technology, Department of Hydraulic Engineering, Delft, The Netherlands

Ocean Data View on the web

Thursday, 11 April 2019, 08:30–10:15 Hall X1 – Poster X1.48

Geophysical Research Abstracts
Vol. 21, EGU2019-6596, 2019
EGU General Assembly 2019

Bringing the *Ocean Data View* Software to the Web

Reiner Schlitzer and Sebastian Mieruch-Schnülle
Alfred Wegener Institute, Bremerhaven, Germany (reiner.schlitzer@awi.de)

SeaDataCloud user workshop

Splinter meeting SMP28

Thu 11 April 2019 - 10:45–12:30 Room 0.16

More data = better products

EMODnet Data Ingestion:

https://www.emodnet-ingestion.eu/

General conclusion

1. Interpolation of oceanographic data
   requires specifically designed techniques
2. DIVA & DIVAnd are open software
   made available to the scientific community
3. A Virtual Research Environment
   is being set-up to remove hurdles

Personal conclusion

The devil is in the detail

Thanks for your attention