

DIVA & DIVAnd interpolation tools

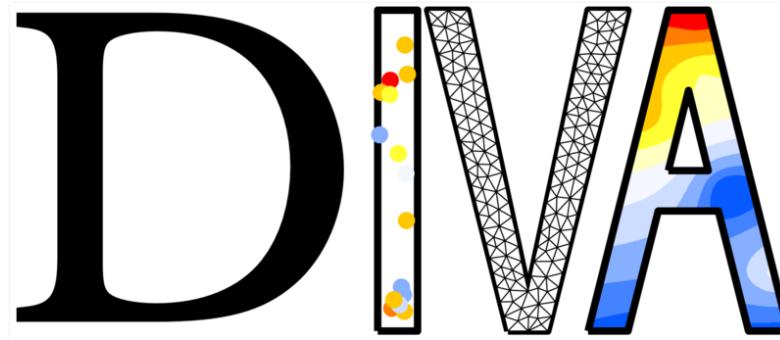
All you need to know about them

gher-ulg
@GHER_ULiege
0000-0002-0265-1021



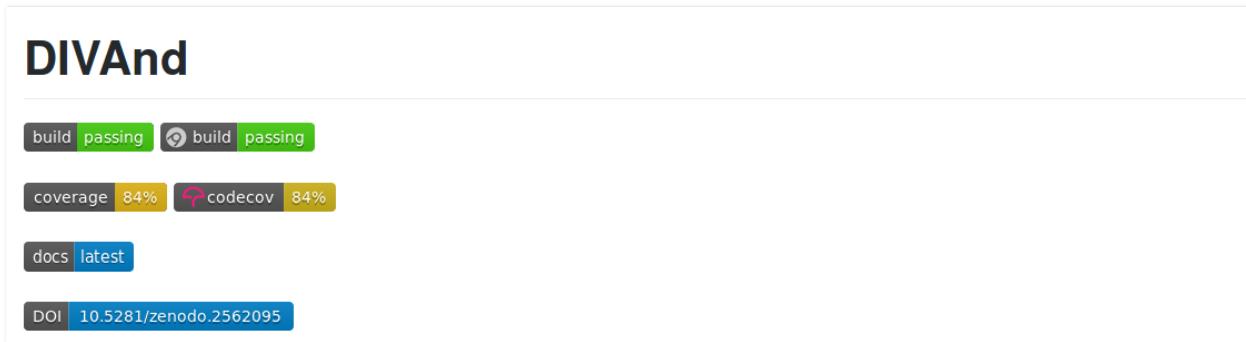
What (who?) is DIVA?

Data
Interpolating
Variational
Analysis



Software tool to interpolate in situ observations

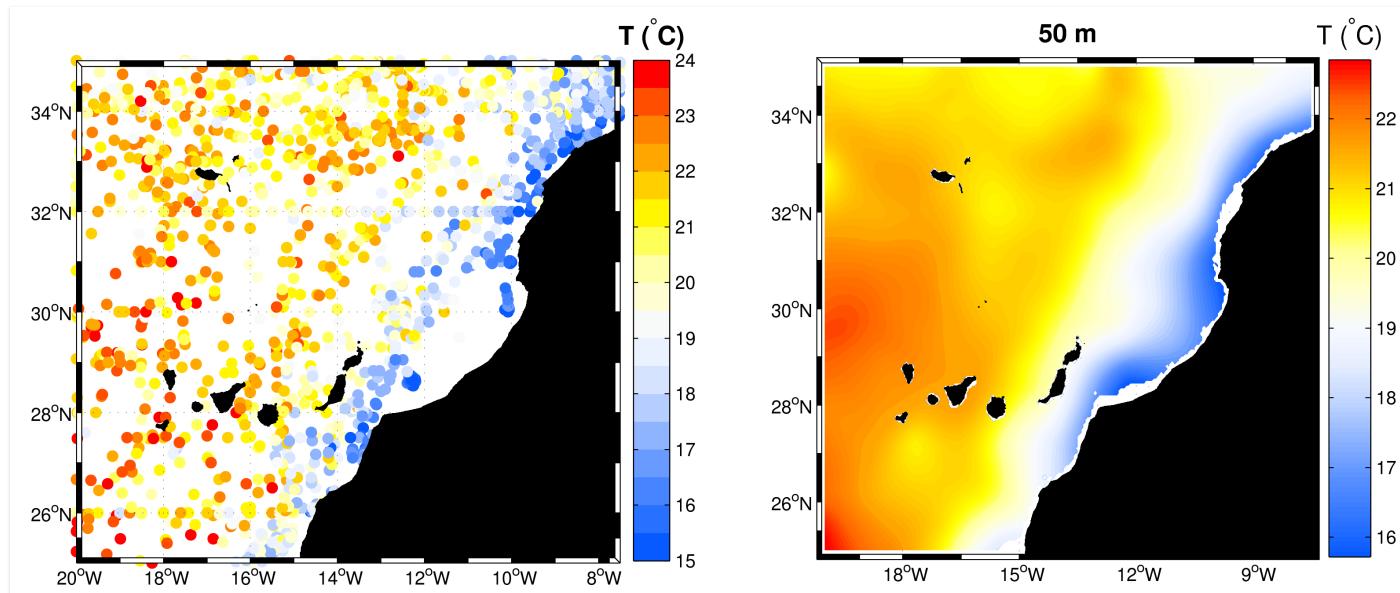
What is [not] DIVAnd?



= n dimensional version of DIVA

≠ not a new release of DIVA,
but a brand new code

What's the goal of DIVA{nd}?



Get gridded field from in situ data

What are the differences between them?

- Mathematical formulation

- ◁/▷ Programming language

- User interface

Who wrote the code?



Who wrote the code?



and a few others since 1991

Why julia,
why not  or  pythonTM ?



Source: <http://daftpunk.wikia.com>, No copyright infringement is intended

Better...

Multiple dispatch
Math-friendly syntax
Unicode support: π , η , $\int\!\!\!\epsilon\alpha$

```
julia> ℼ = 1./3.  
julia> cos(ℼ*π)  
0.5000000000000001
```

Faster

Just-in-time (JIT) compiled Parallelism

```
function fib(n::Int)
f=Vector{Int}(undef, n+1)
f[1]=f[2]=1;
for i=3:n+1
f[i]=f[i-1]+f[i-2]
end
return f
end
ff = @time fib(400000000);
1.158971 seconds (18.52 k allocations: 2.981 GiB, 0.84% gc time)
```

Stronger

Metaprogramming:

Julia programs can read, analyse, generate other Julia programs

"Easy" interfacing: R, Python, ...

```
@pyimport numpy.random as nr  
nr.rand(3, 4)
```

Harder

Learning a new and evolving language
Transition from 0.6 to 1.0

Here is the latest from Julia Computing



Julia 1.0 Released

10 Aug 2018 | Andrew Claster

London, UK - Julia 1.0 was [released](#) today during [JuliaCon 2018](#).

Today's Julia 1.0 release is the most important Julia milestone since Julia was introduced in February 2012.

Julia 1.0 is the first complete, reliable, stable and forward-compatible Julia release. More information about Julia 1.0 is available [here](#).

RECENT POSTS

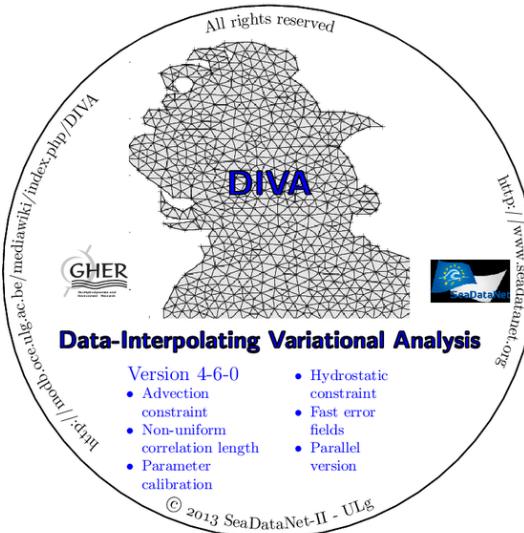
[Call for Proposals to Increase Diversity and Inclusion Within the Julia Community](#)

31 Oct 2018 | Jane E. Herriman

[The New JuliaPro](#)

16 Oct 2018 | Julia Computing

How can I get the code?



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

DOI [10.5281/zenodo.1407062](https://doi.org/10.5281/zenodo.1407062)



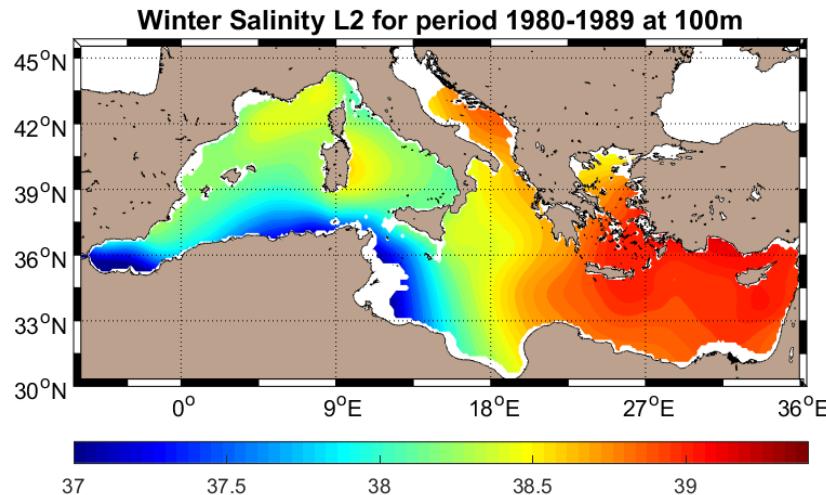
<https://github.com/gher-ulg/DIVAnd.jl>

DOI [10.5281/zenodo.2562095](https://doi.org/10.5281/zenodo.2562095)

Who's using it?

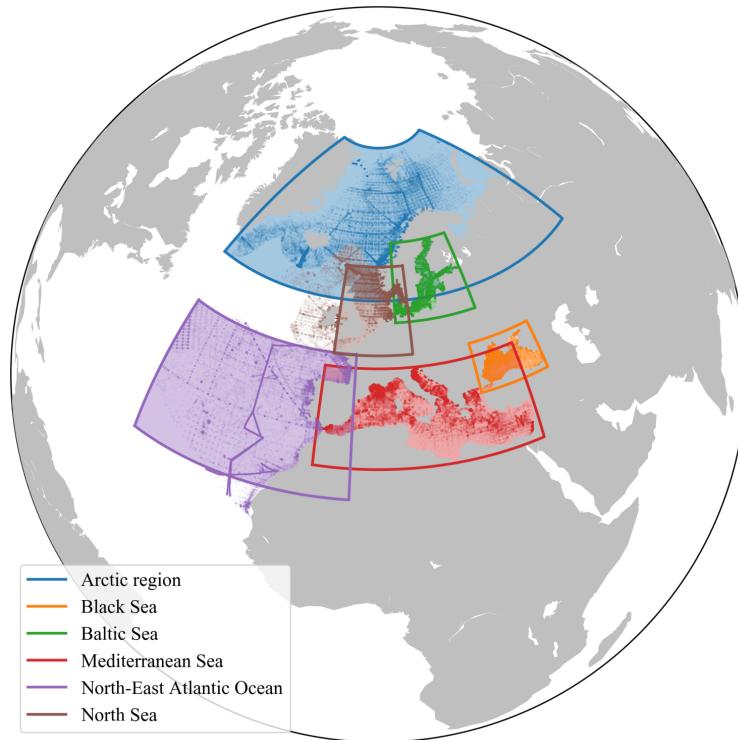
SeaDataCloud regional leaders, creating climatologies

<https://www.seadatanet.org/Products/Climatologies>



EMODnet Chemistry regional leaders

<http://www.emodnet-chemistry.eu/products>



EMODnet Biology (specific products)

<http://www.emodnet-biology.eu/data-products>

The screenshot shows the EMODnet Biology homepage. At the top, there is a header with the EMODnet logo, a 'BIOLOGY' section, a 'Dive into data on Europe's marine life' tagline, a search bar, and contact links for 'CONTACT US' and 'SUBMIT DATA'. Below the header is a dark blue navigation bar with links for Home, Data Catalog, Data Download, Map Viewer, Data Products (which is underlined), Project, Contribute, and Help-desk. A secondary search bar is located just below the navigation bar. The main content area features a grid of eight data product cards, each with a thumbnail image, a category name, and a count of cases. The categories and counts are: Benthos (19), Birds (10), Fish (6), EMODnet Biology use cases (8), Mammals (8), Microorganisms (5), Phytoplankton (24), and Reptiles (1). Each card also includes a play button icon.

BIOLOGY
Dive into data on Europe's marine life

Search ...
CONTACT US
SUBMIT DATA

Home Data Catalog Data Download Map Viewer Data Products Project Contribute Help-desk

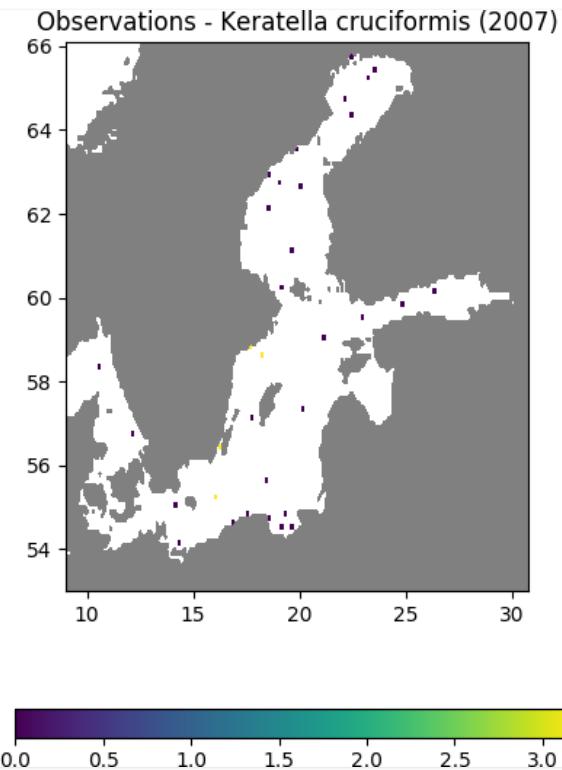
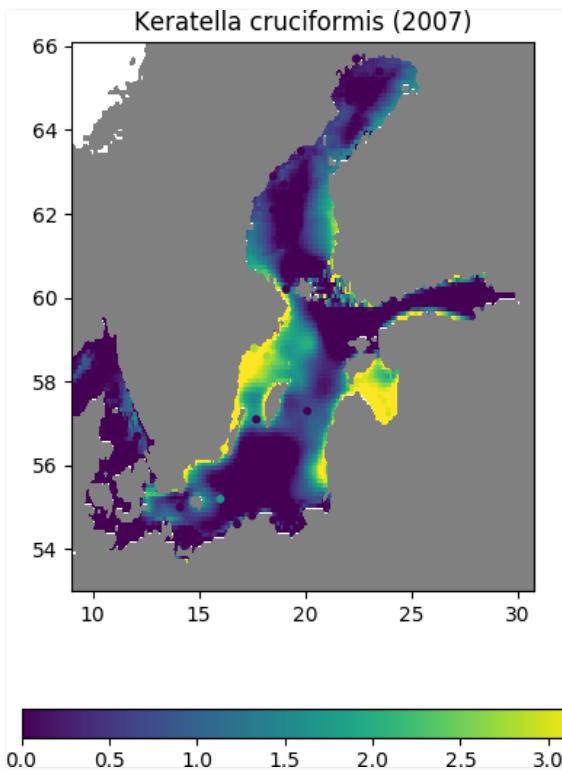
Data products

Benthos (19) Birds (10) Fish (6) EMODnet Biology use cases (8)

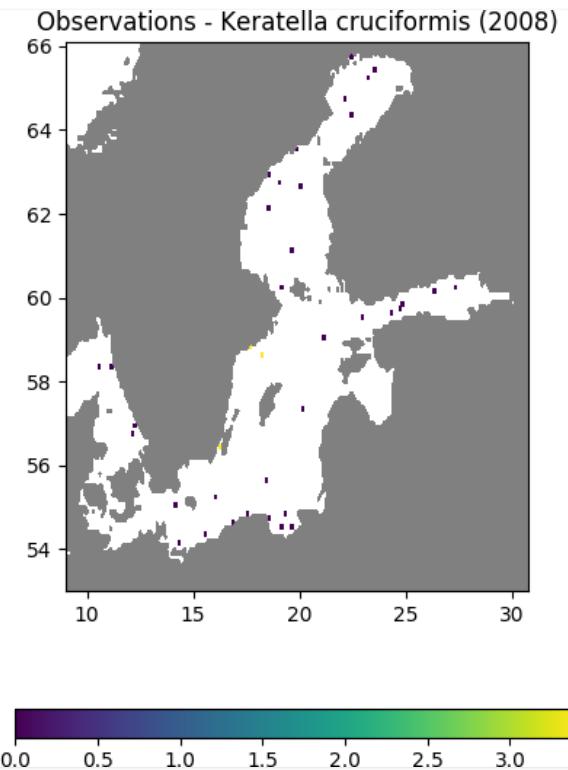
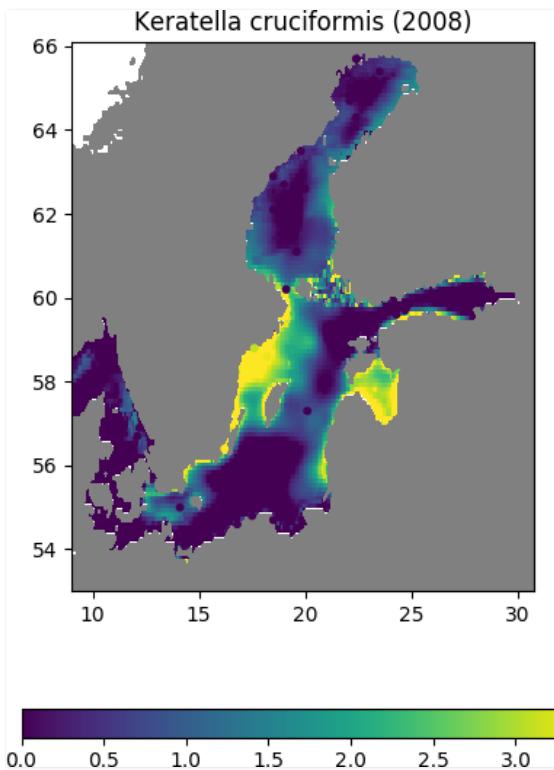
Mammals (8) Microorganisms (5) Phytoplankton (24) Reptiles (1)

Example: zooplankton count in the Baltic Sea

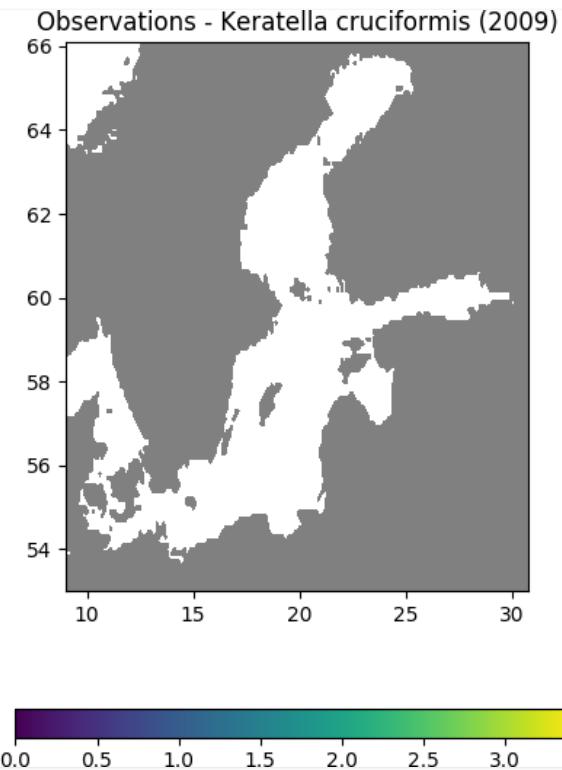
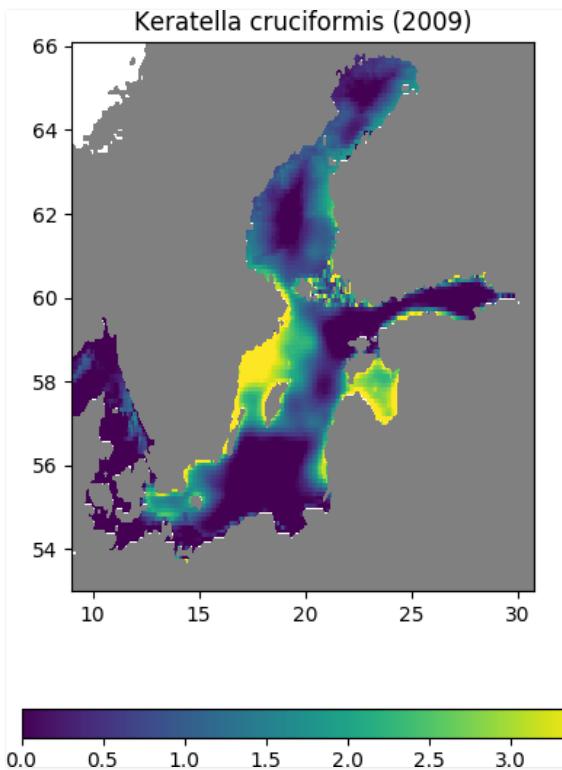
Example: zooplankton count in the Baltic Sea



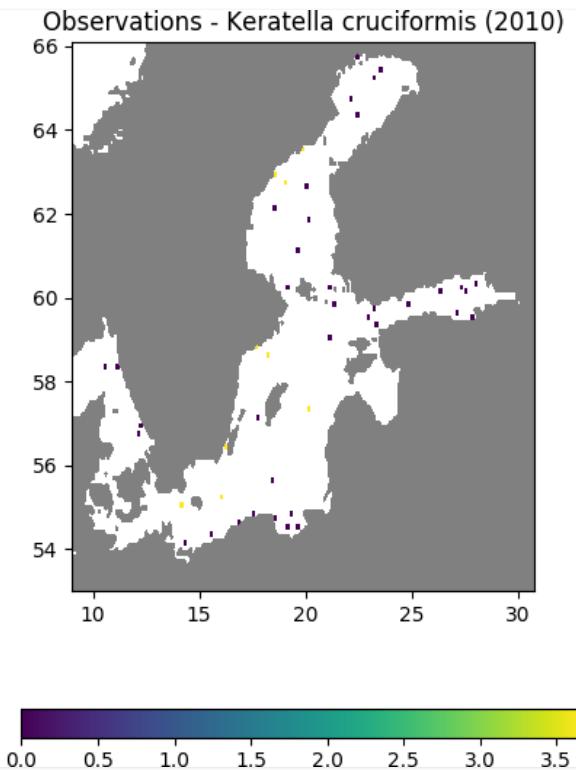
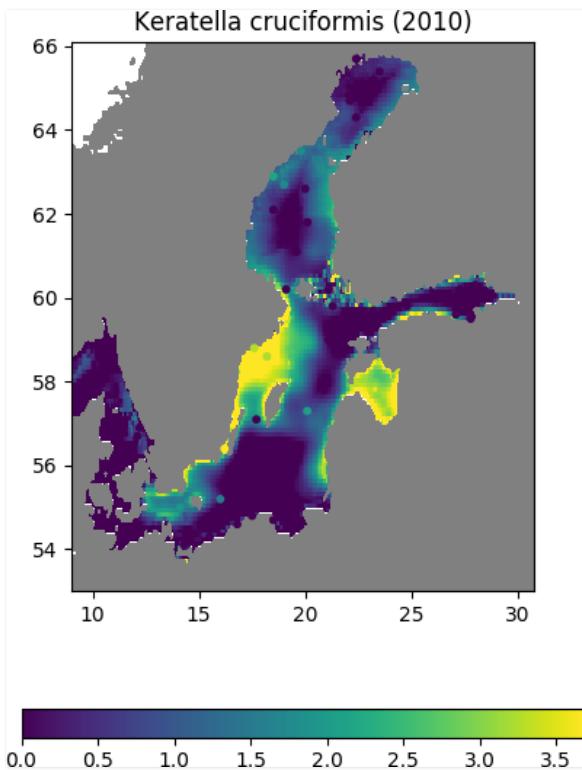
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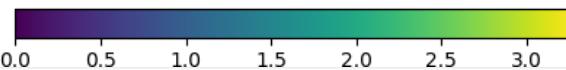
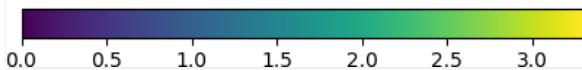
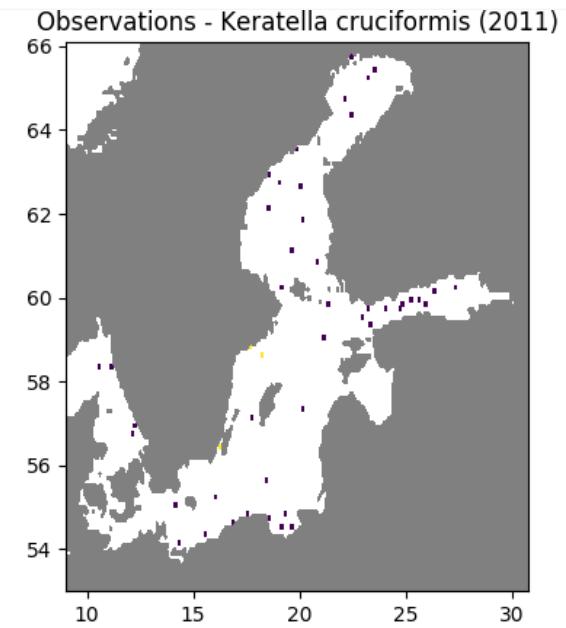
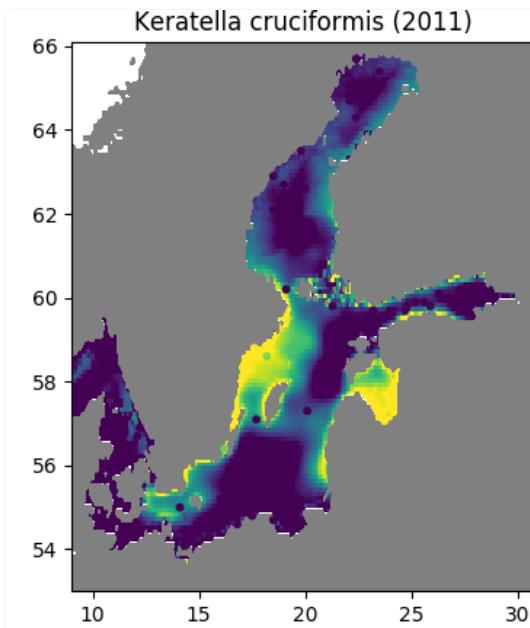
Example: zooplankton count in the Baltic Sea



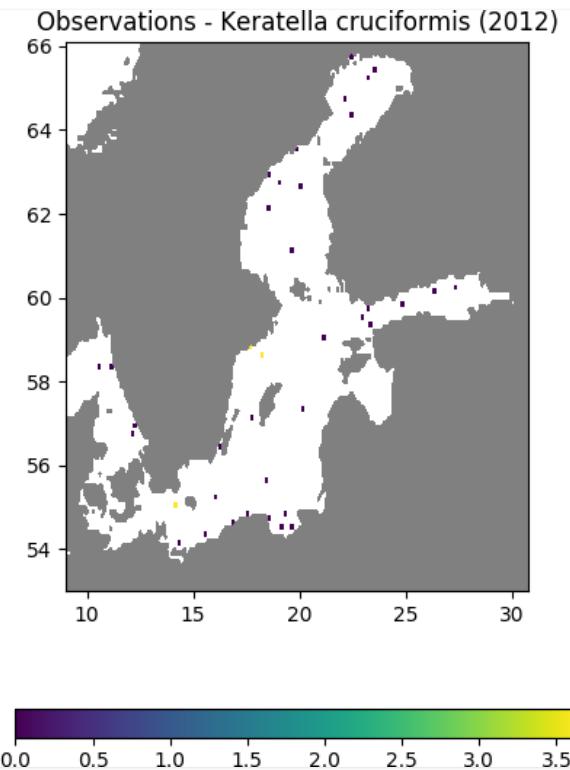
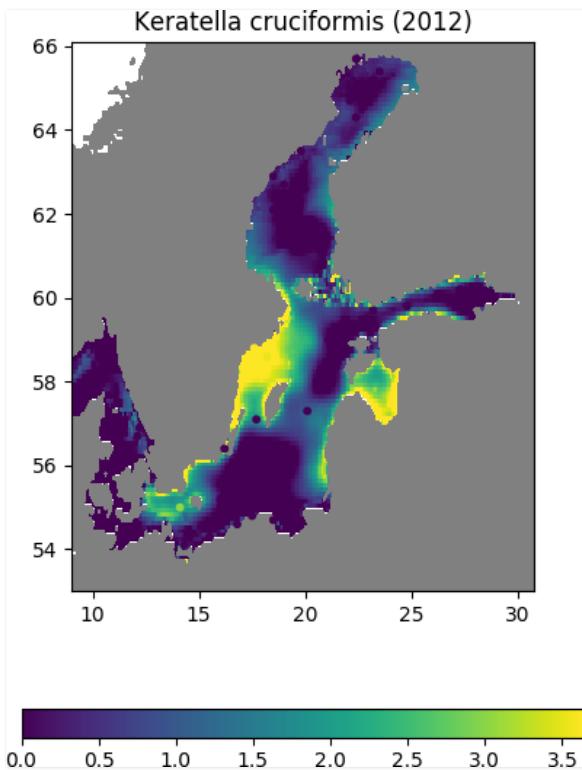
Example: zooplankton count in the Baltic Sea



Example: zooplankton count in the Baltic Sea



Example: zooplankton count in the Baltic Sea



BioOracle: <http://www.bio-oracle.org/index.php>



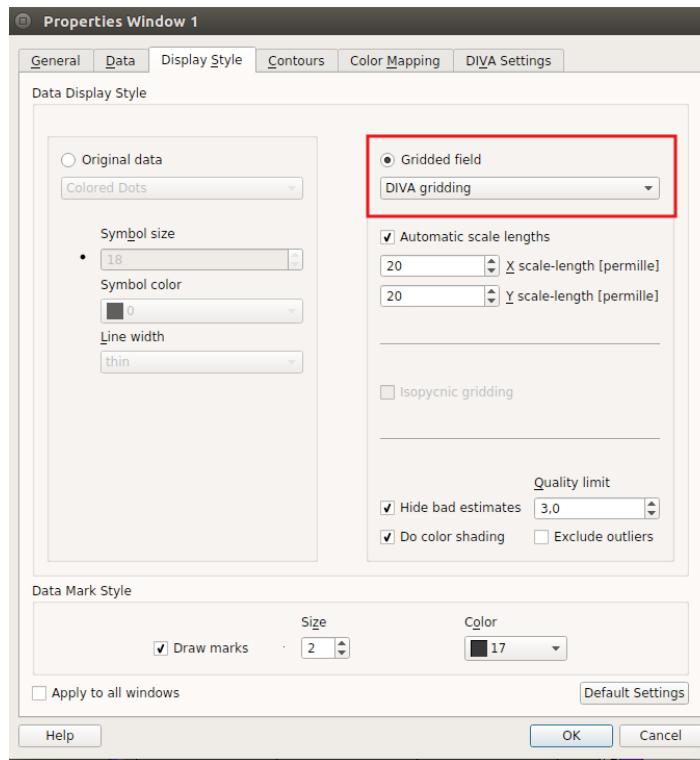
**Can I test it without installing
it?**

DIVA (2D) within Ocean Data View

<http://odv.awi.de/>

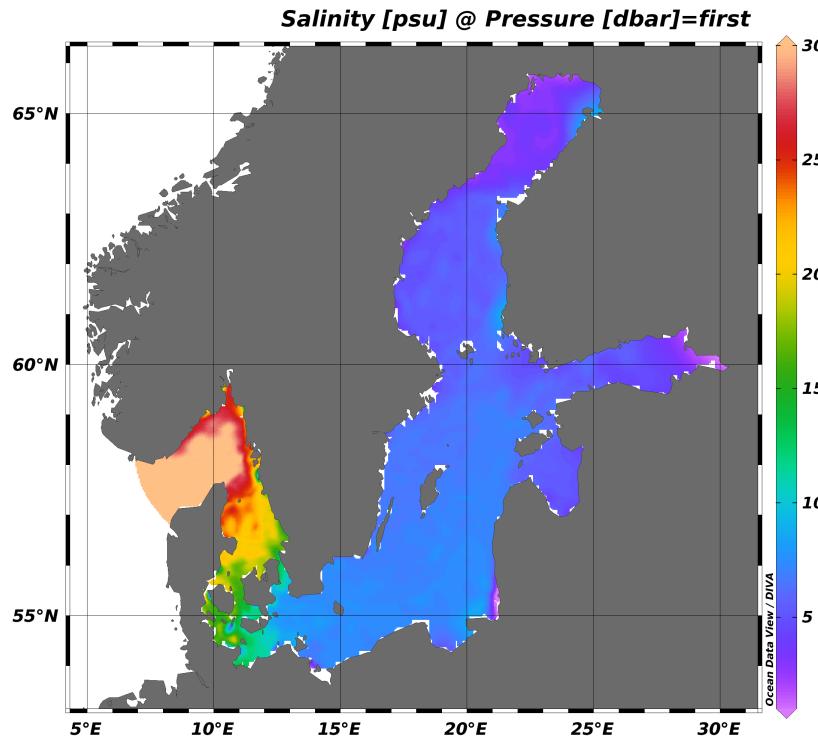
DIVA (2D) within Ocean Data View

<http://odv.awi.de/>



DIVA (2D) within Ocean Data View

<http://odv.awi.de/>



DIVA-on-Web (2D)

<http://ec.oceanbrowser.net/emodnet/diva.html>

Upload Grid Analysis

Upload observations

Text file ODV4

File: No file selected.

Column separator: space or tab

Decimal separator: dot (.)

Format

The file must be an ASCII text file with three columns. The columns represent longitude, latitude and value of the observation respectively. For example:

```
29.7667 45.15 16.146
29.7667 45.15 16.346
...
```

[Sample global temperature data from ARGO](#)

Statistics Download Link or embed Report a problem Help

-51.32813, 82.96875

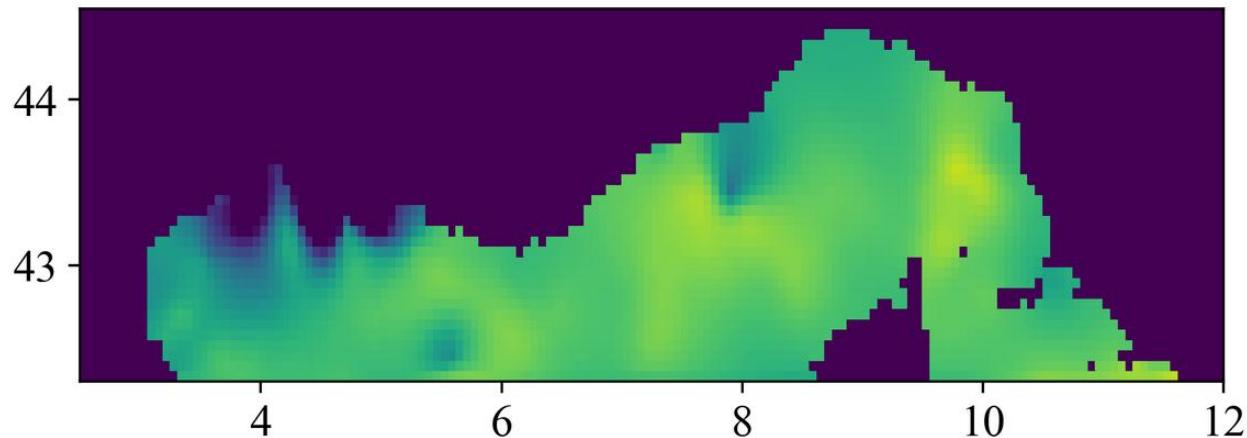
Jupyter notebooks inside the Virtual Research Environment

```
Analysis fi using mean data as background.  
Structure s is stored for later use in error calculation.
```

```
In [10]: fi,s = DIVAndrun(mask,(pm,pn),(xi,yi),(obslon,obslat),obsval.-mean(obsval),len,epsilon2);
```

```
Create a simple plot of the analysis
```

```
In [11]: pcolor(xi,yi,fi.+mean(obsval),vmin=37,vmax=38.5);  
colorbar(orientation="horizontal")  
gca()[:set_aspect](1/cos(mean([ylim()...]) * pi/180))
```



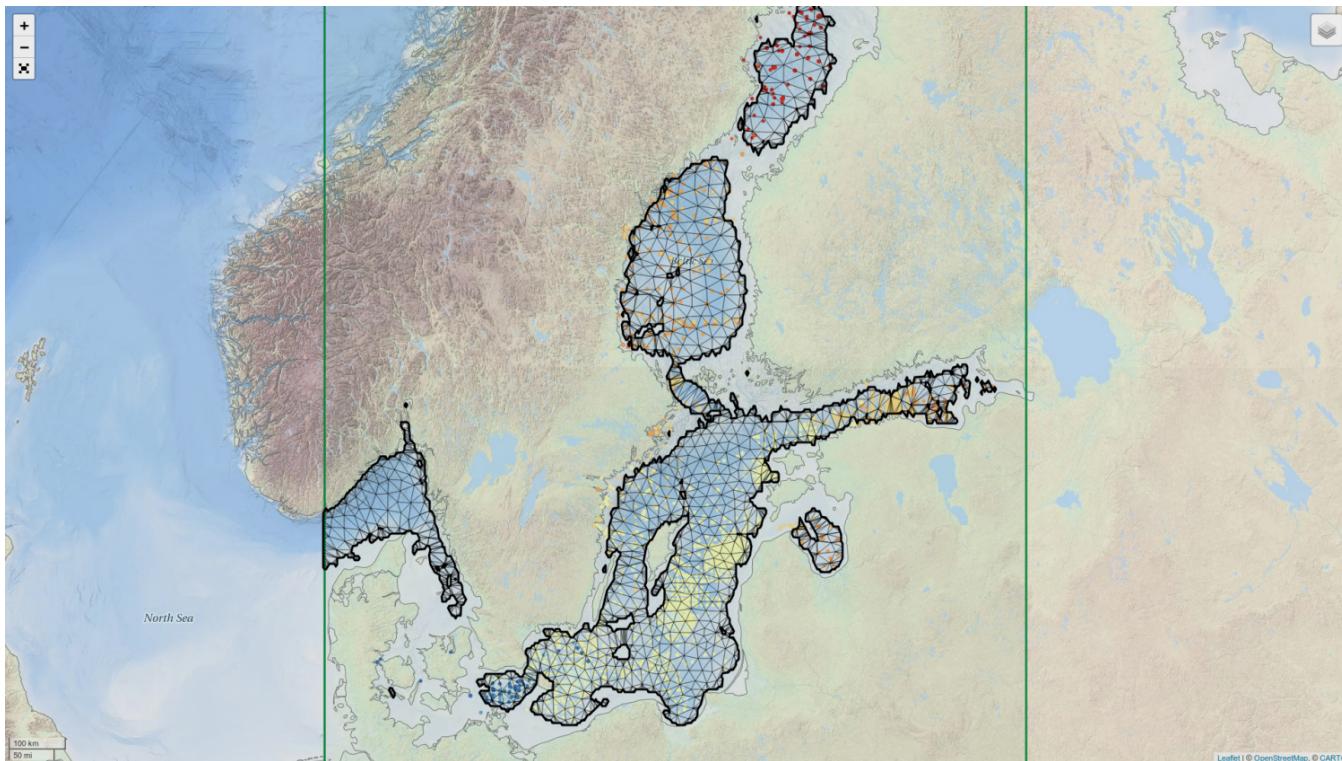
DIVAnd REST API (2D)

DIVAnd REST API

observations	sampleddata:WOD-Salinity			
varname	Salinity			
bbox	-3,42,12,44			
depth	0,20			
len	100000,100000			
epsilon2	1			
resolution	0.5,0.5			
years	1993,1993			
monthlist	1,2,3	4,5,6	7,8,9	10,11,12
bathymetry	sampleddata:gebco_30sec_16			
metadata_project	SeaDataCloud			

**Why (do we think) it is better
than any other method?**

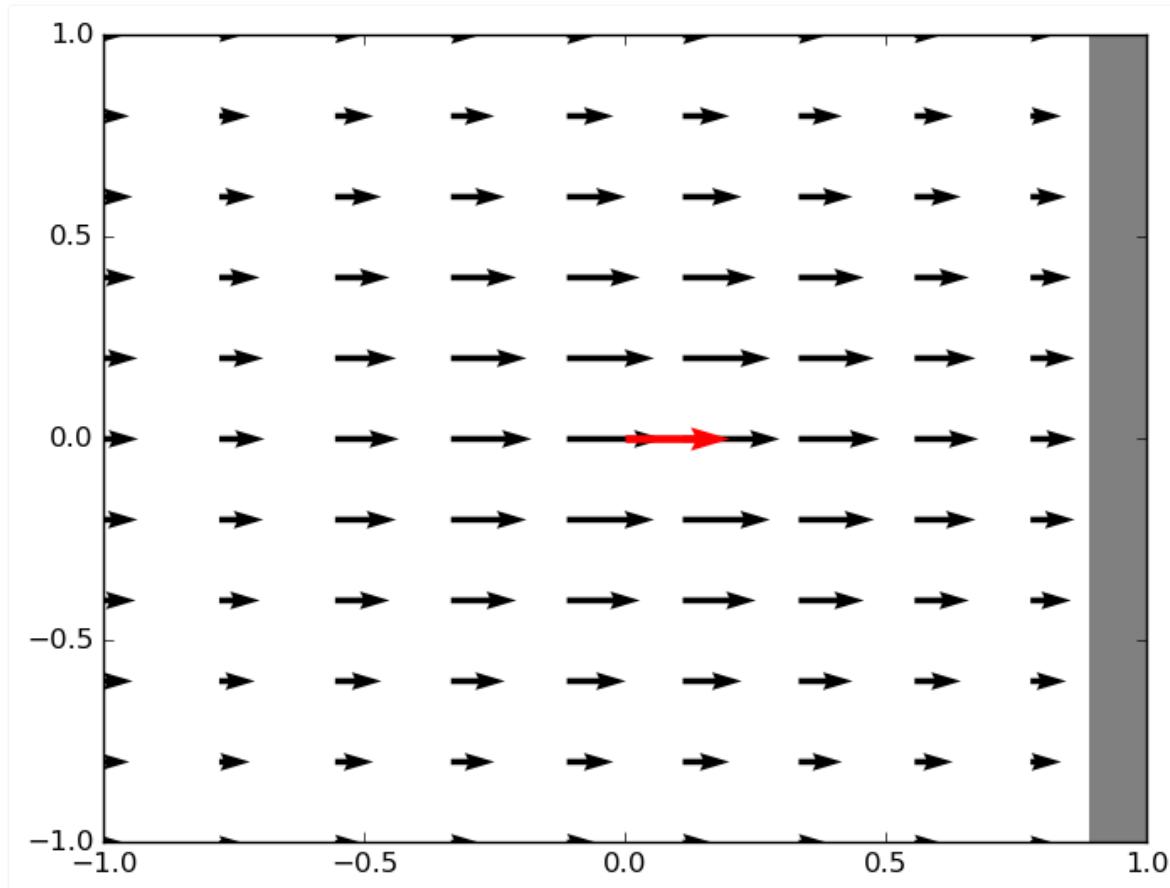
Fast, robust, specific to ocean
Separation of sub-domains
Associated error field



**Can I interpolate velocity
measurements?**

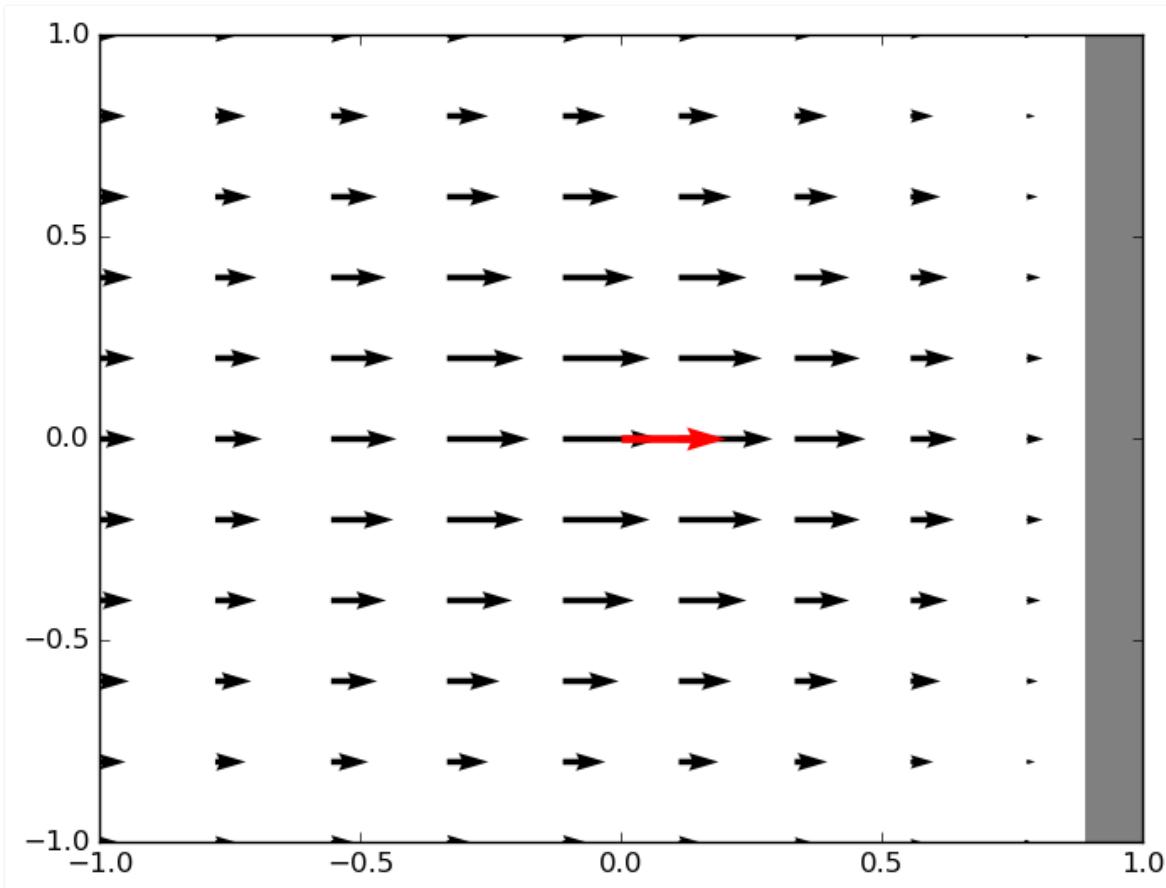
High-frequency radar interpolation

Synthetic velocity field, red arrow = measurement



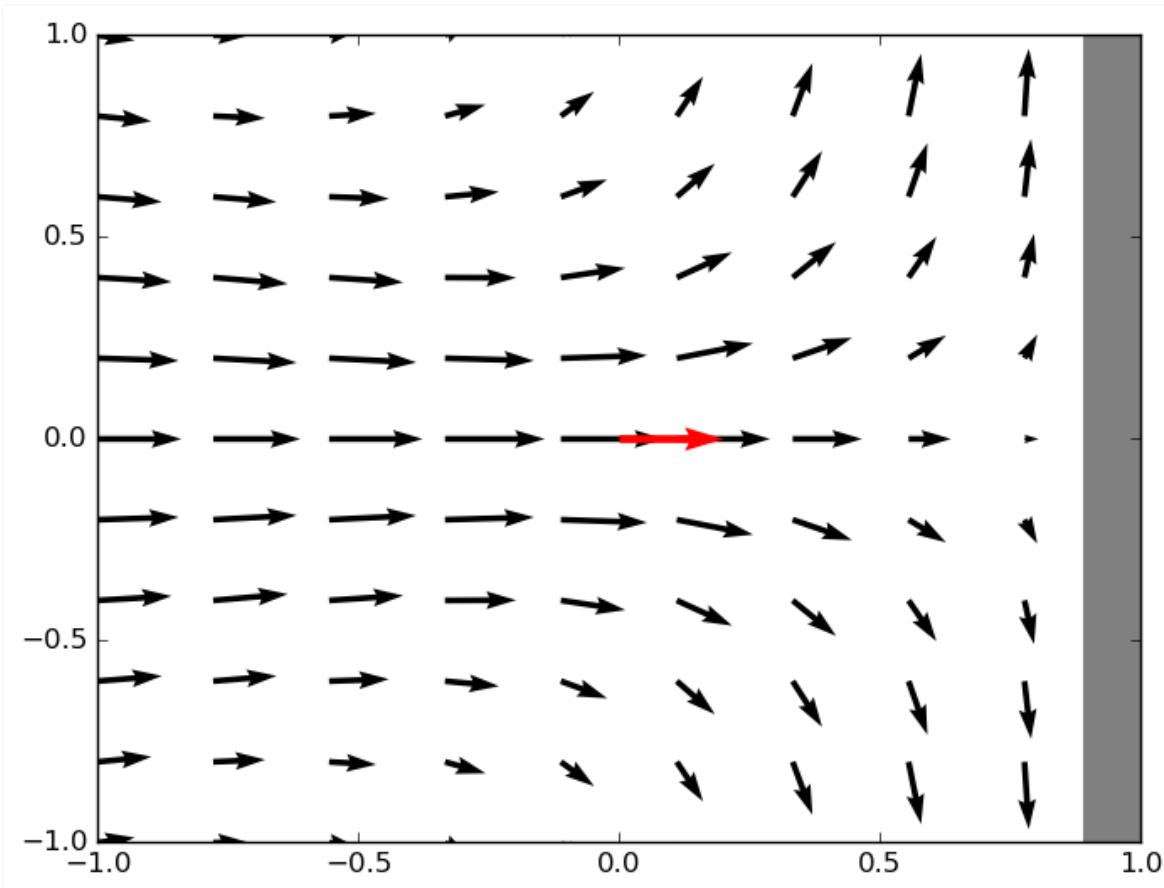
High-frequency radar interpolation

Adding the influence of the coast



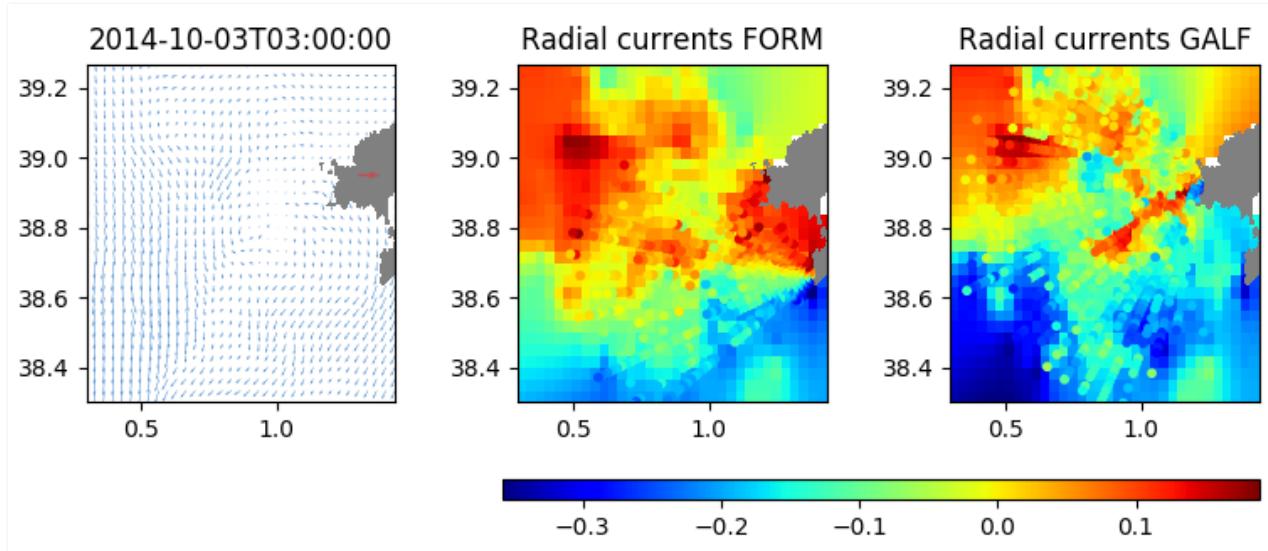
High-frequency radar interpolation

Low horizontal divergence of currents



High-frequency radar interpolation

Including Coriolis force and geostrophically balanced mean flow



Test areas: Ibiza Channel, Gulf of Trieste

Would you help me use it?

Why may I not be able to use it?



Why may I not be able to use it?



Hofstadter's Law:

It always takes longer than you expect,
even when you take into account Hofstadter's Law.

How to cite?

How to cite?

Barth, A., Beckers, J.-M., Troupin, C., Alvera-Azcárate, A., and Vandenbulcke, L.: DIVAnd-1.0: n-dimensional variational data analysis for ocean observations, Geosci. Model Dev., 7, 225-241, doi:10.5194/gmd-7-225-2014, 2014.

One DOI per code release

2.3.1 → [DOI 10.5281/zenodo.2562095](https://doi.org/10.5281/zenodo.2562095)

2.3.0 → [DOI 10.5281/zenodo.2548856](https://doi.org/10.5281/zenodo.2548856)

...

Who is Julia?

Who is Julia?

Julia Child (1912-2004)



Who is Julia?

Julia Child (1912-2004)



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Thanks for your attention