DIVA & DIVAnd interpolation tools

All you need to know about them

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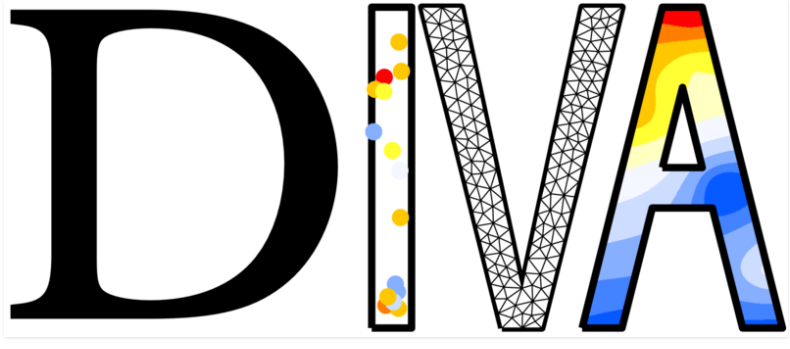
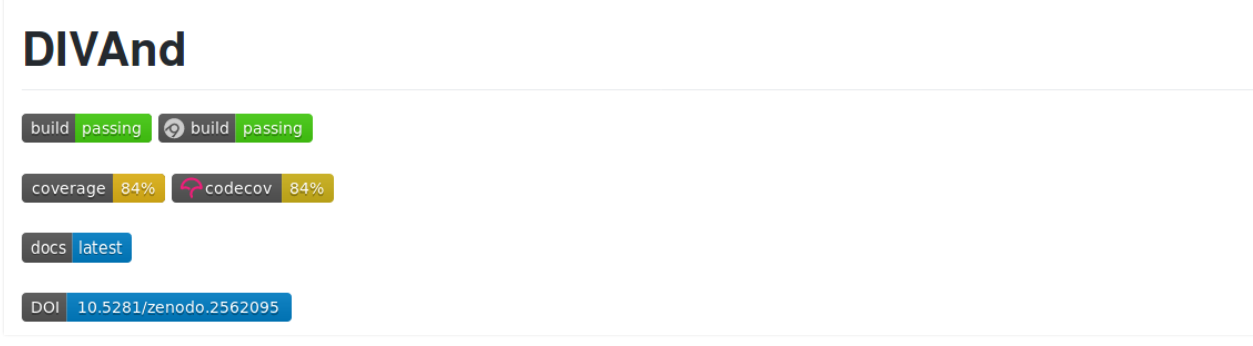
What (who?) is DIVA?

Data
Interpolating
Variational
Analysis



Software tool to interpolate in situ observations

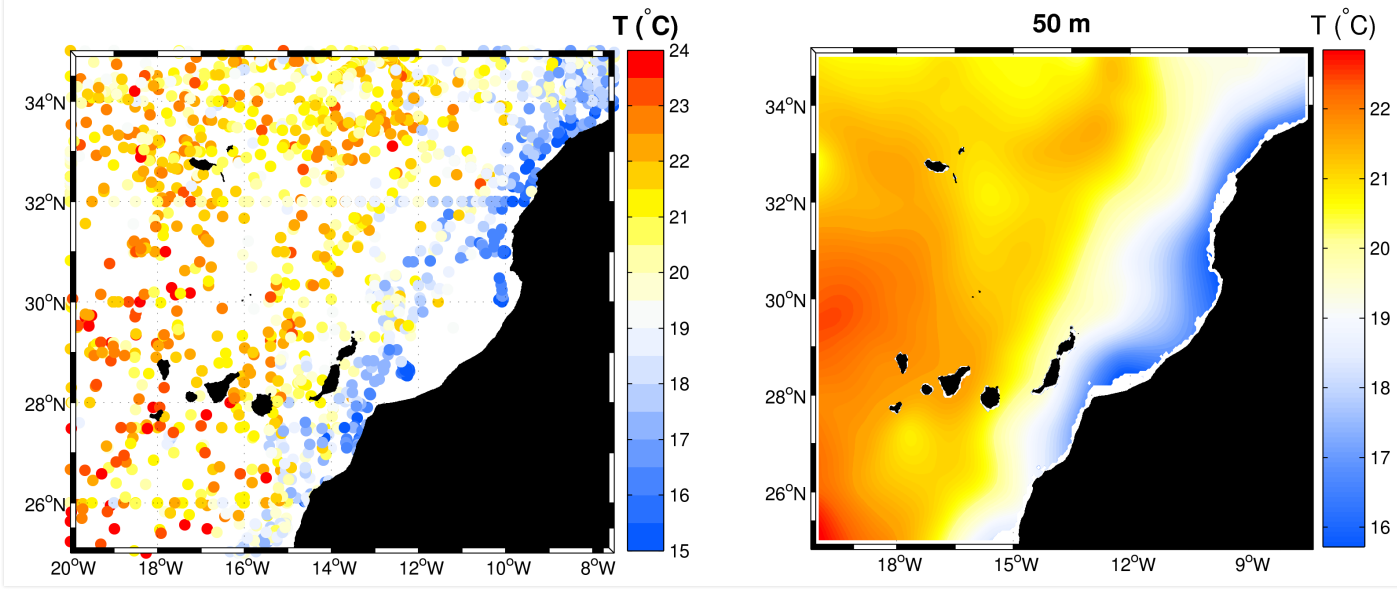
What is [not] DIVAnd?



= 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  ?

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

Better...

Multiple dispatch
Math-friendly syntax
Unicode support: π, η, ∫ϵα

```
julia> 🌊 = 1./3.
julia> cos(🌊*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

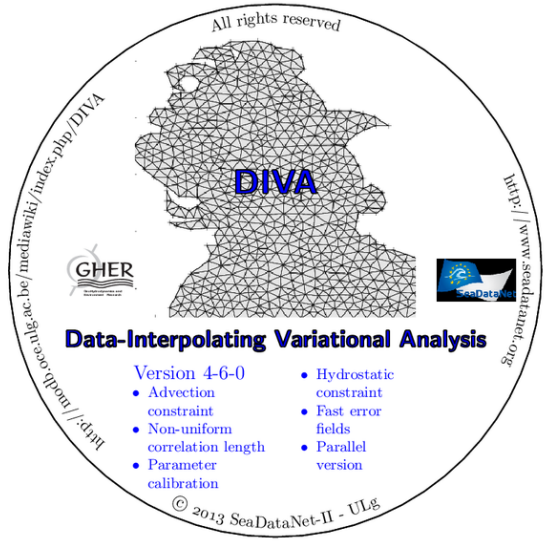
"Easy" interfacing: R, Python, ...

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

Harder

Learning a new and evolving language
Transition from 0.6 to 1.0

How can I get the code?



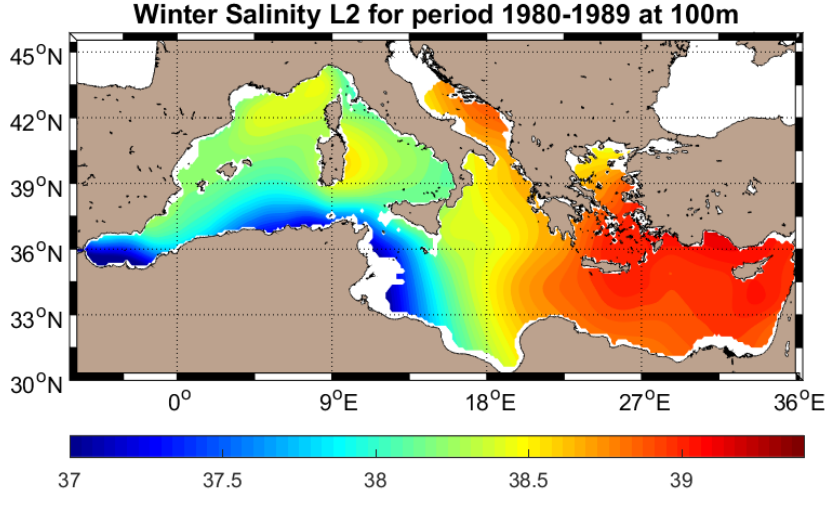
https://github.com/gher-ulg/DIVA DOI 10.5281/zenodo.1407062

https://github.com/gher-ulg/DIVAnd.jl DOI 10.5281/zenodo.2562095

Who's using it?

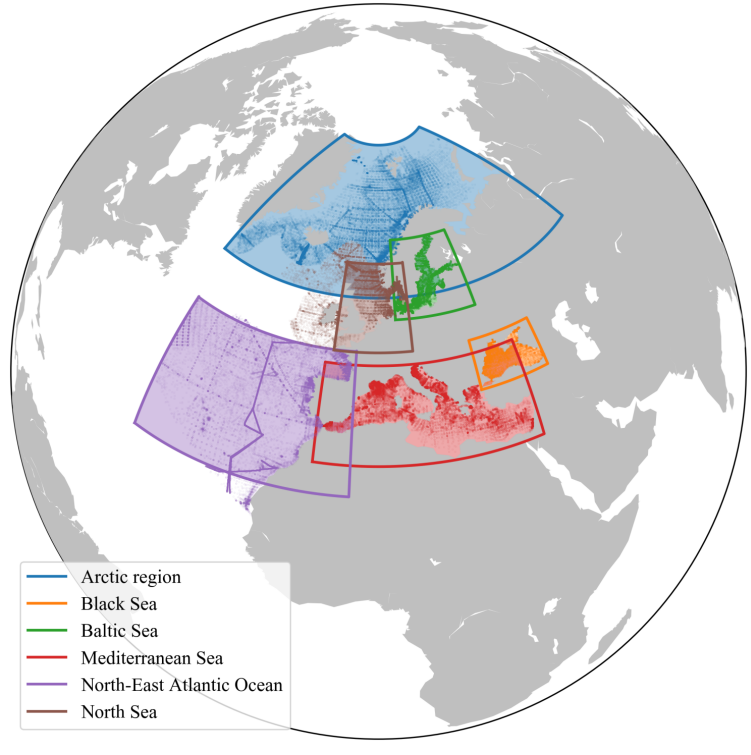
SeaDataCloud regional leaders, creating climatologies

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



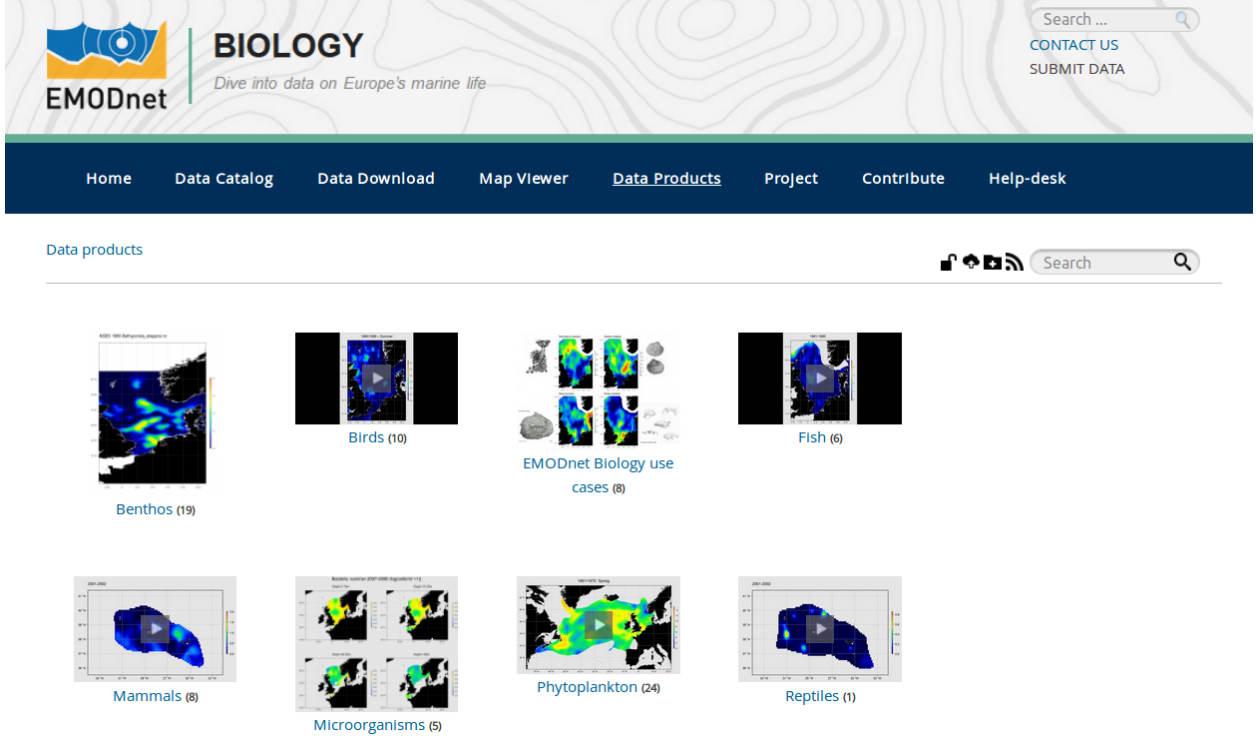
EMODnet Chemistry regional leaders

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



EMODnet Biology (specific products)

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



Example: zooplankton count in the Baltic Sea

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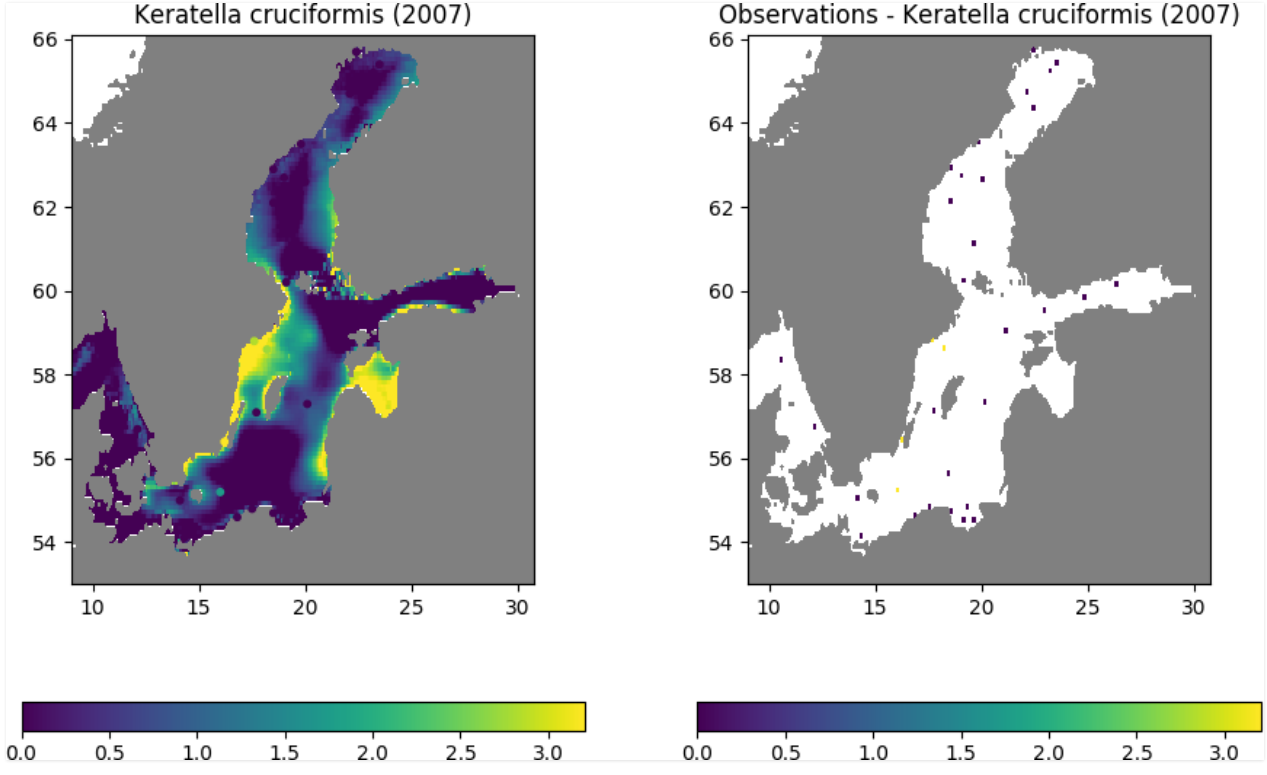

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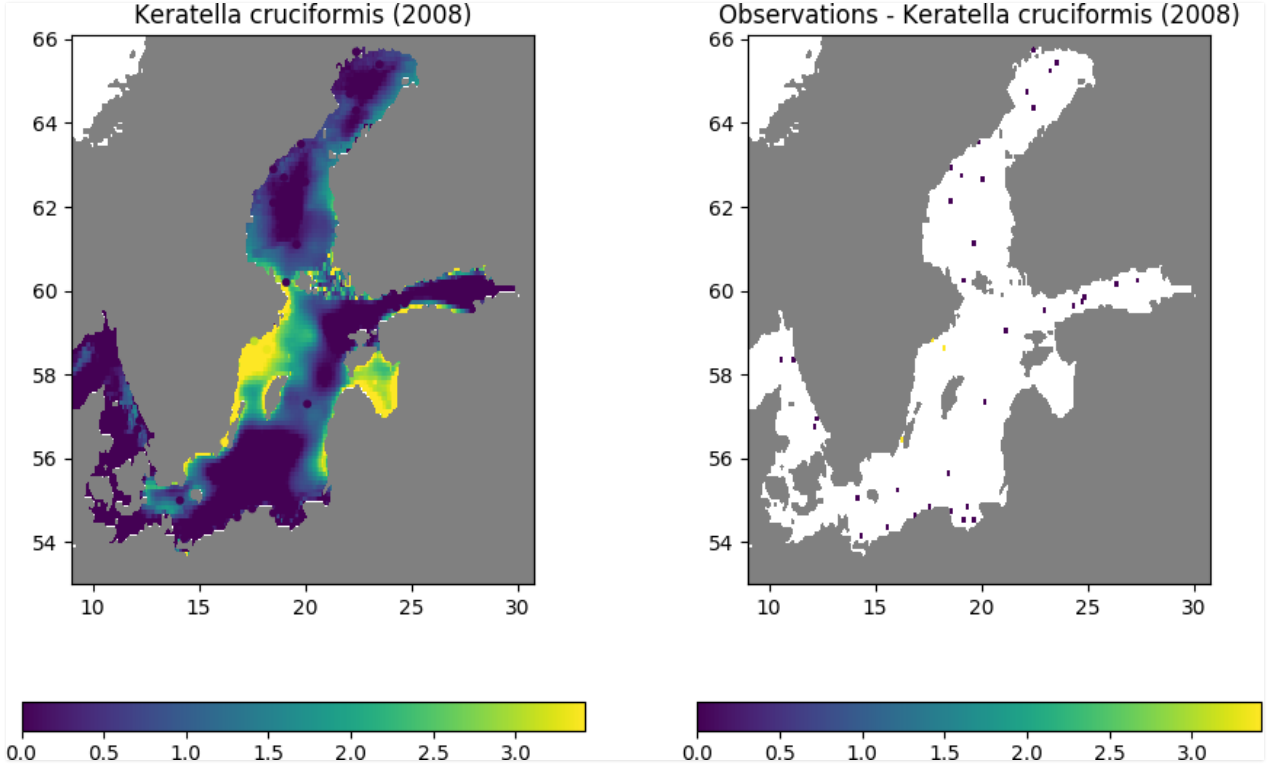

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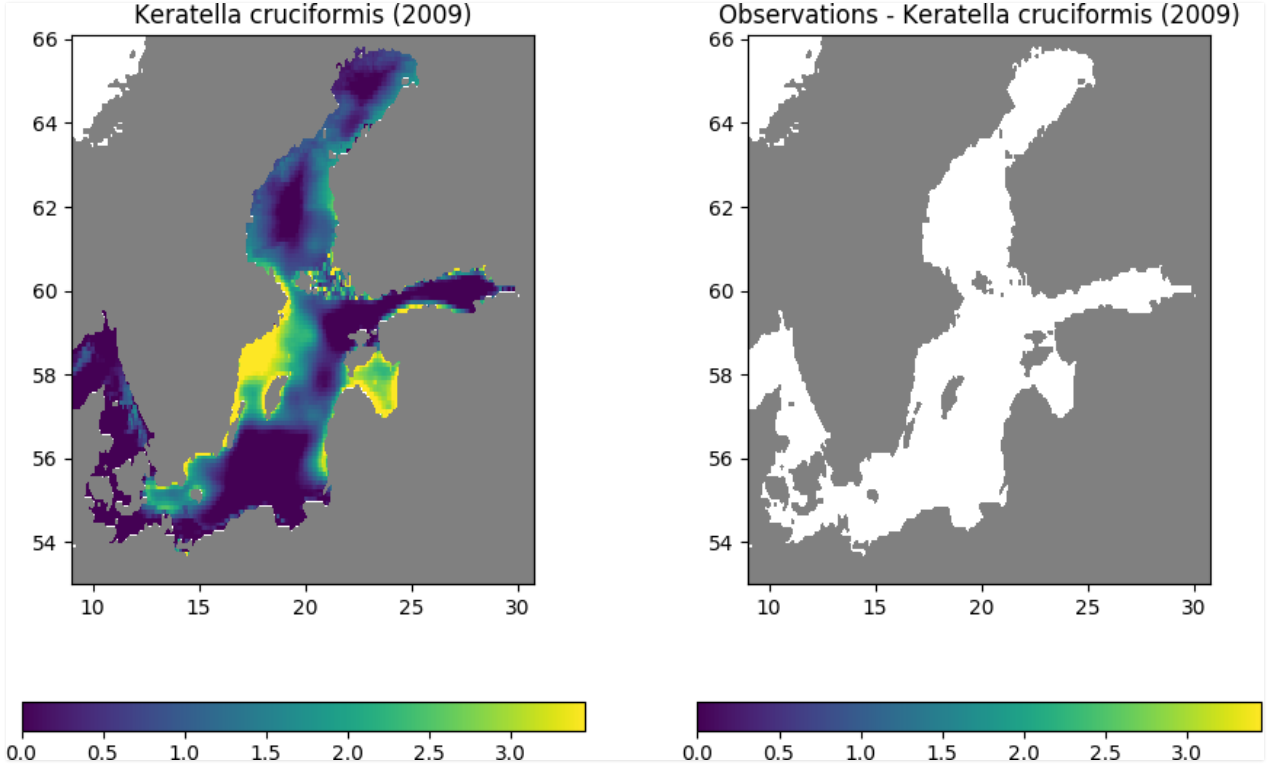

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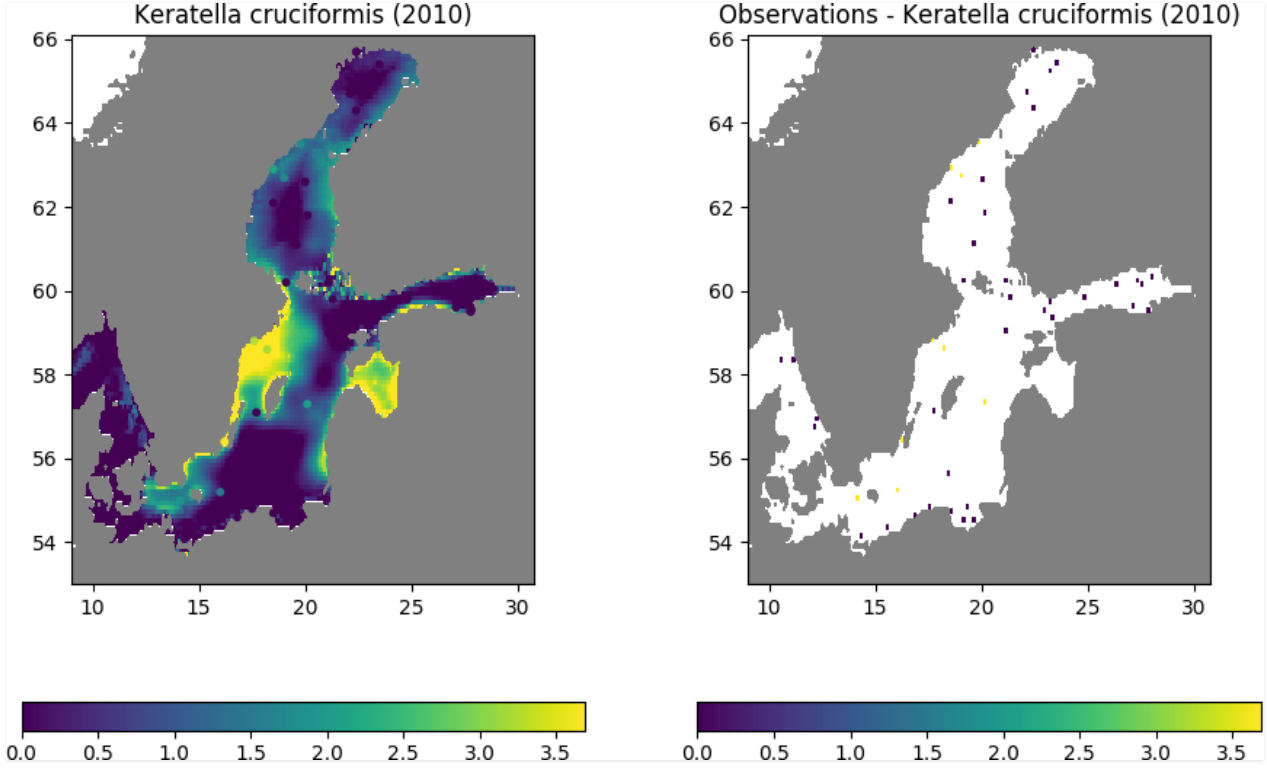

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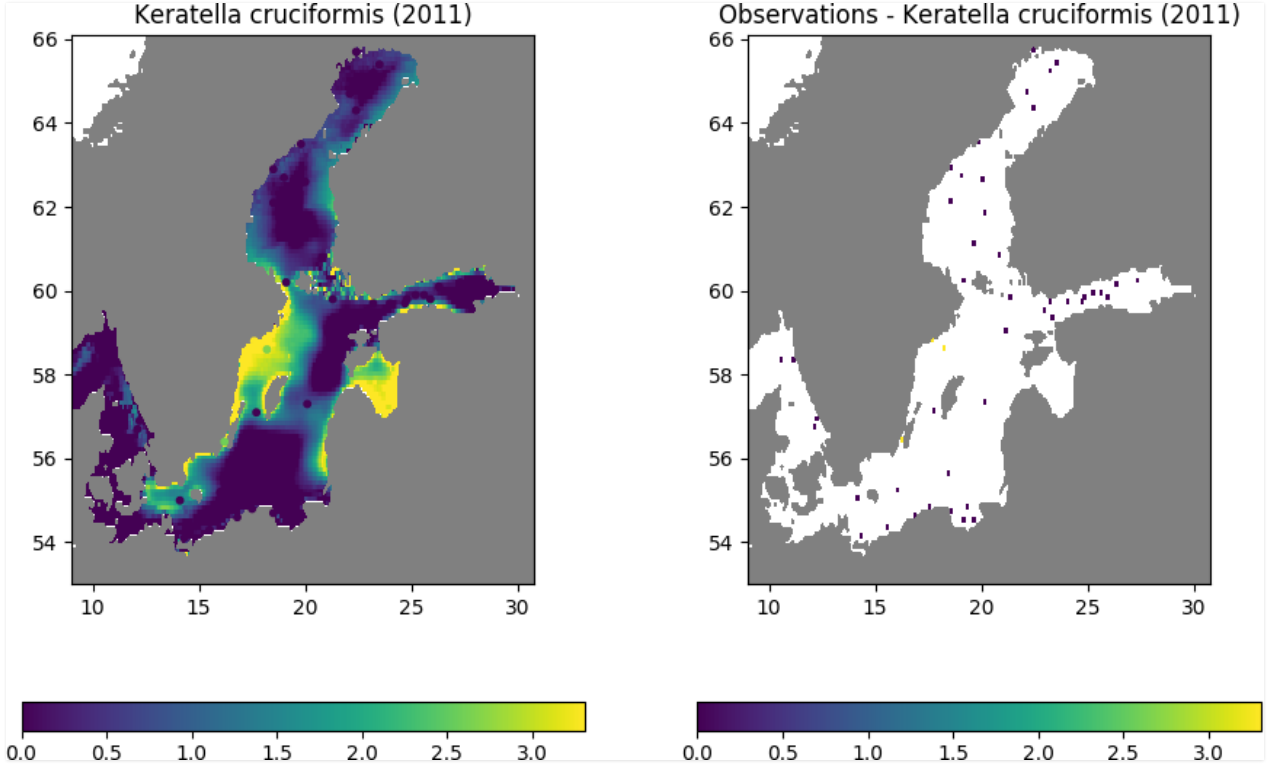

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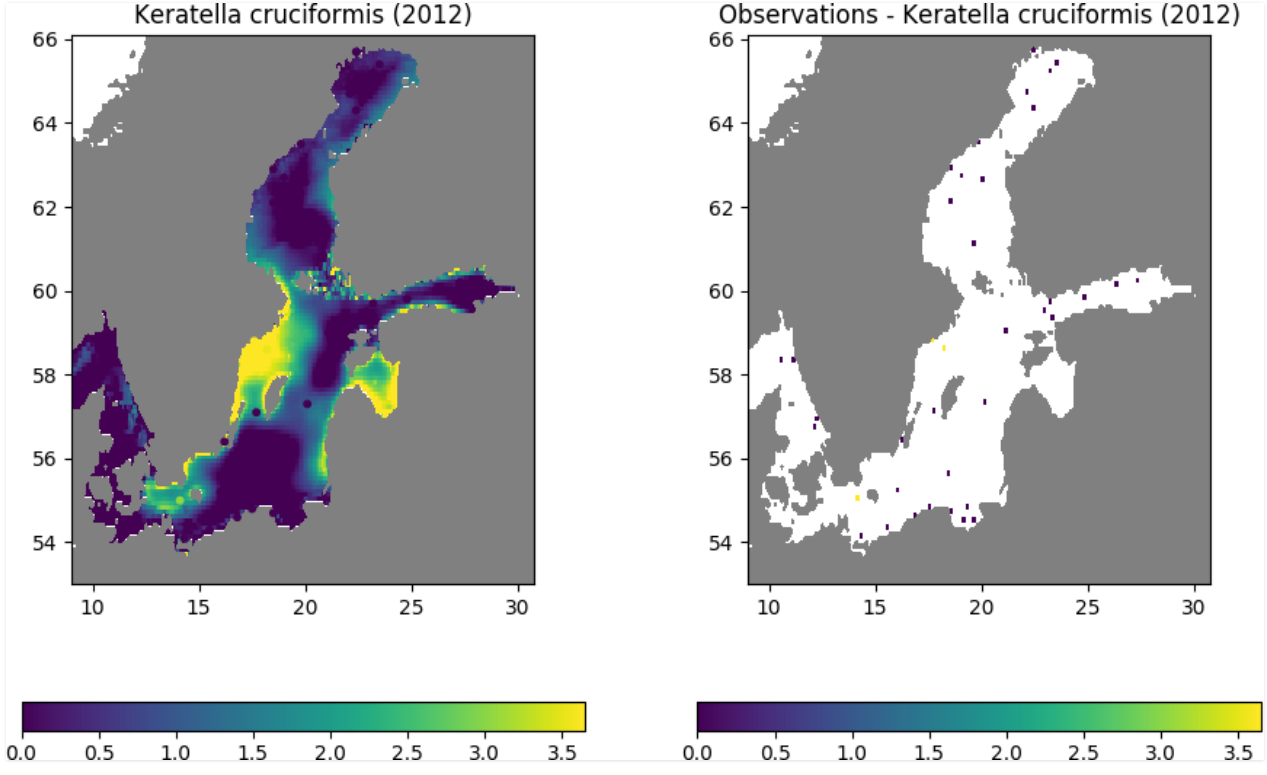

BioOracle: http://www.bio-oracle.org/index.php

Can I test it without installing it?

DIVA (2D) within Ocean Data View

http://odv.awi.de/

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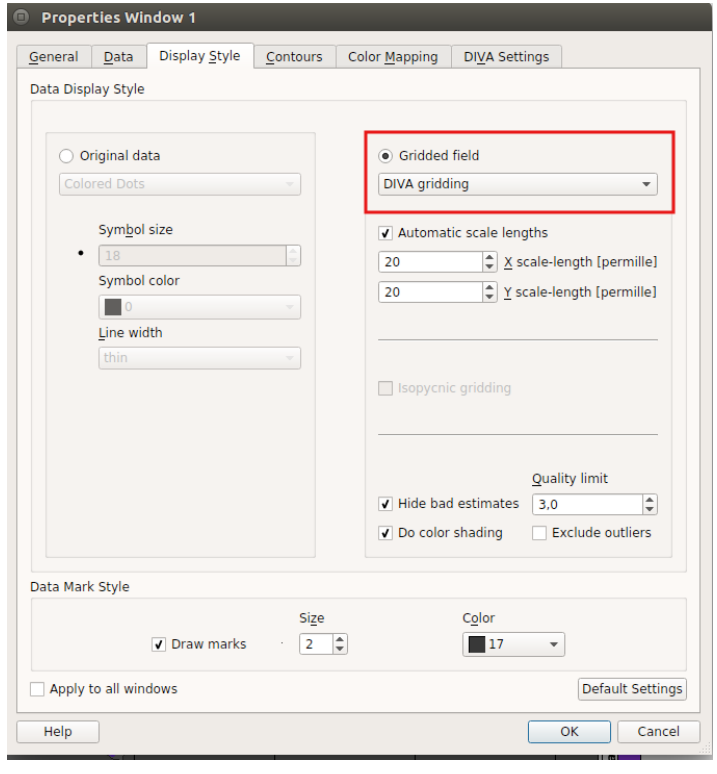
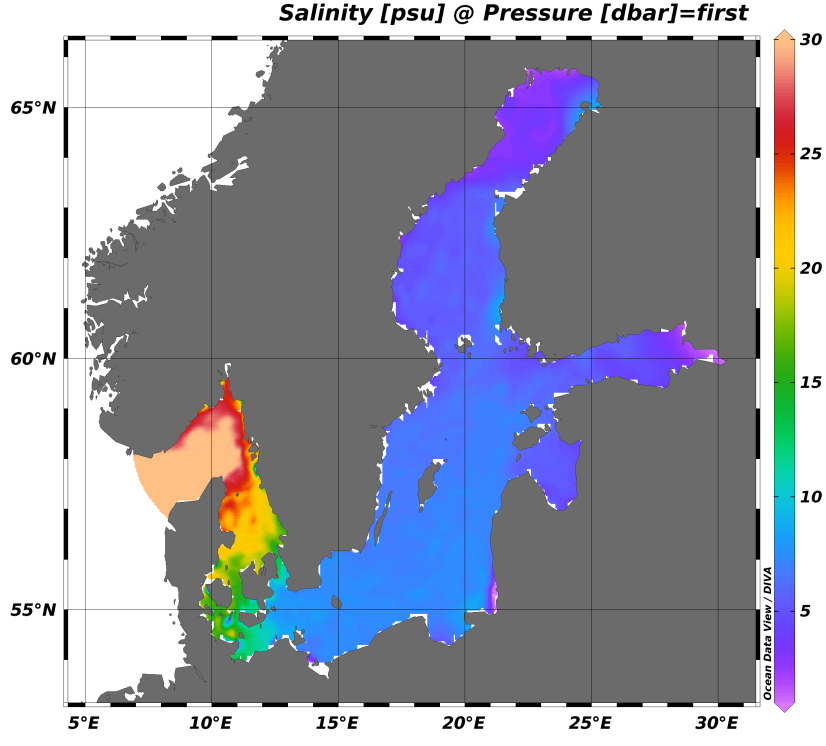


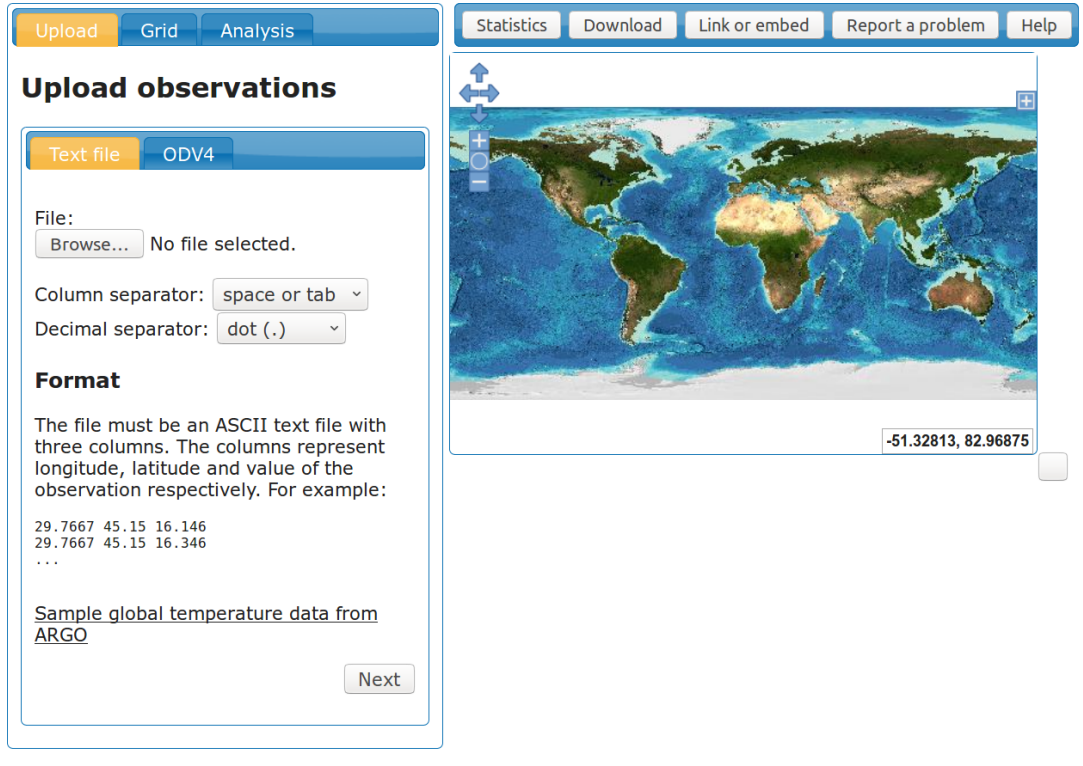
DIVA (2D) within Ocean Data View

http://odv.awi.de/



DIVA-on-Web (2D)

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



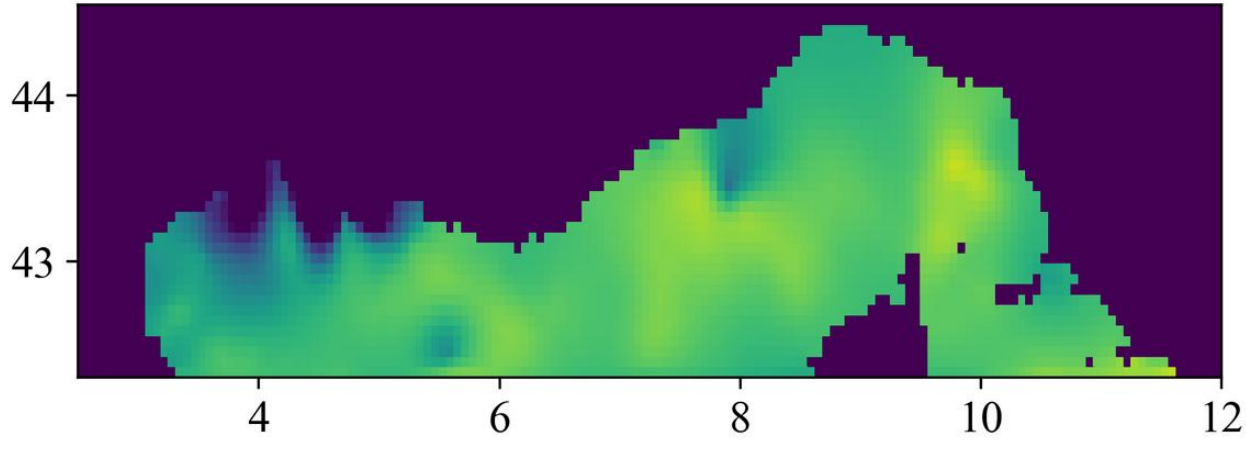
Jupyter notebooks inside the Virtual Research Environment

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))
```



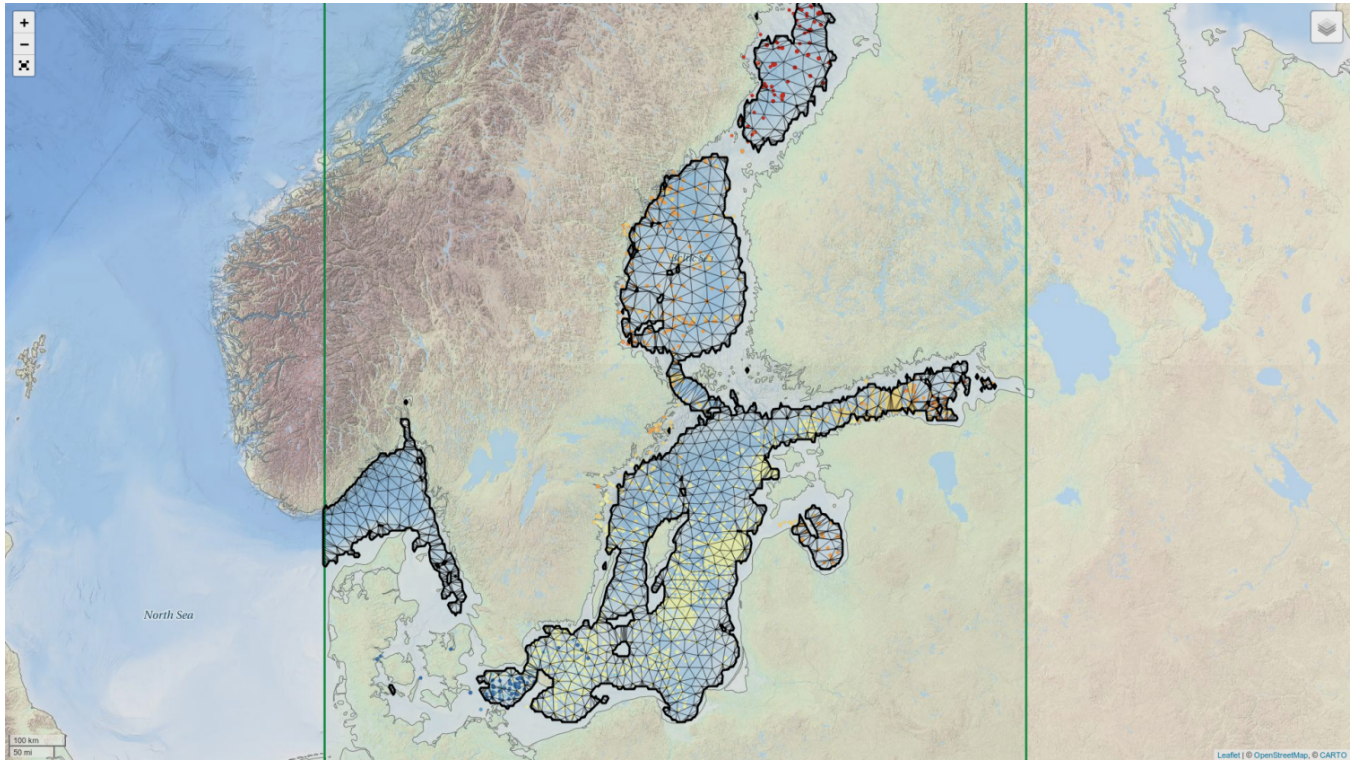
DIVAnd REST API (2D)

DIVAnd REST API

observations	sampledata: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	sampledata:gebco_30sec_16			
metadata_project	SeaDataCloud			

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

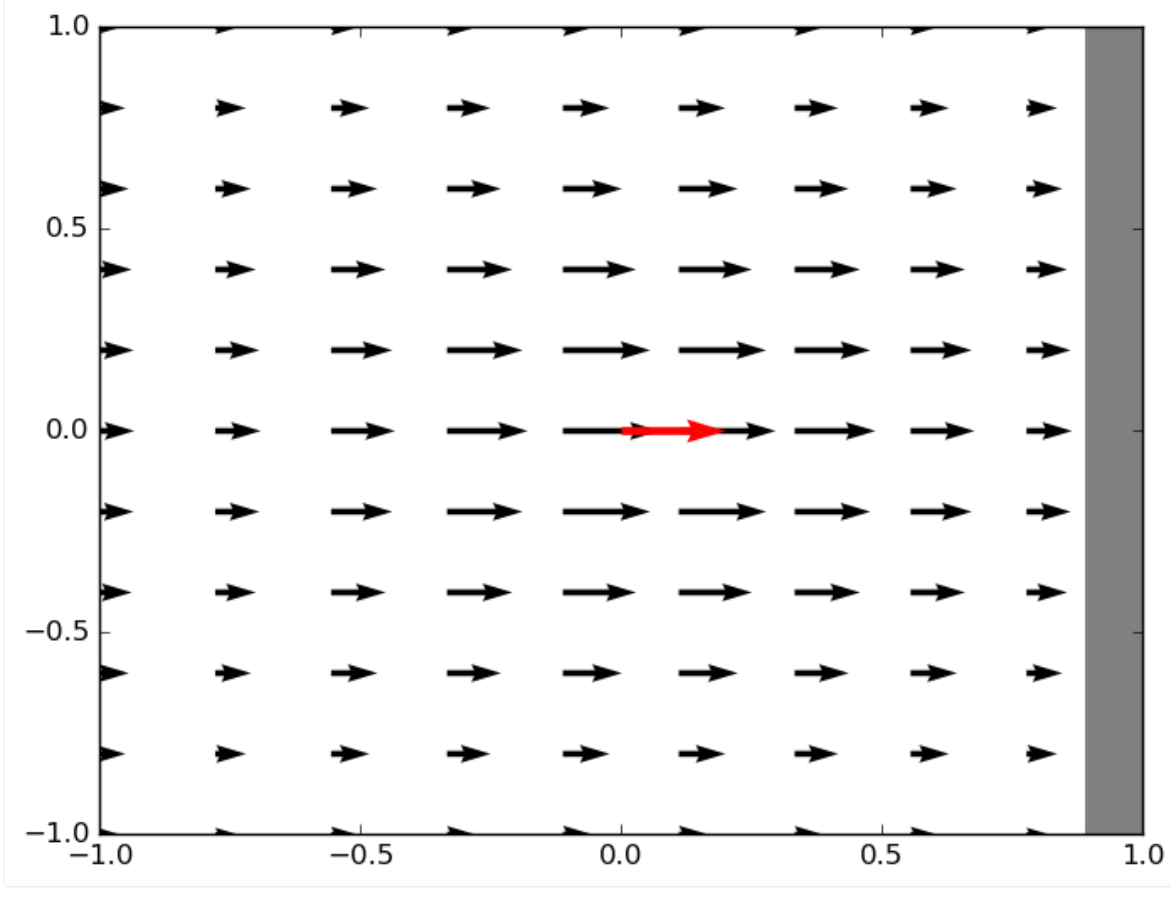
Fast, robust, specific to ocean
Separation of sub-domains
Associated error field



Can I interpolate velocity measurements?

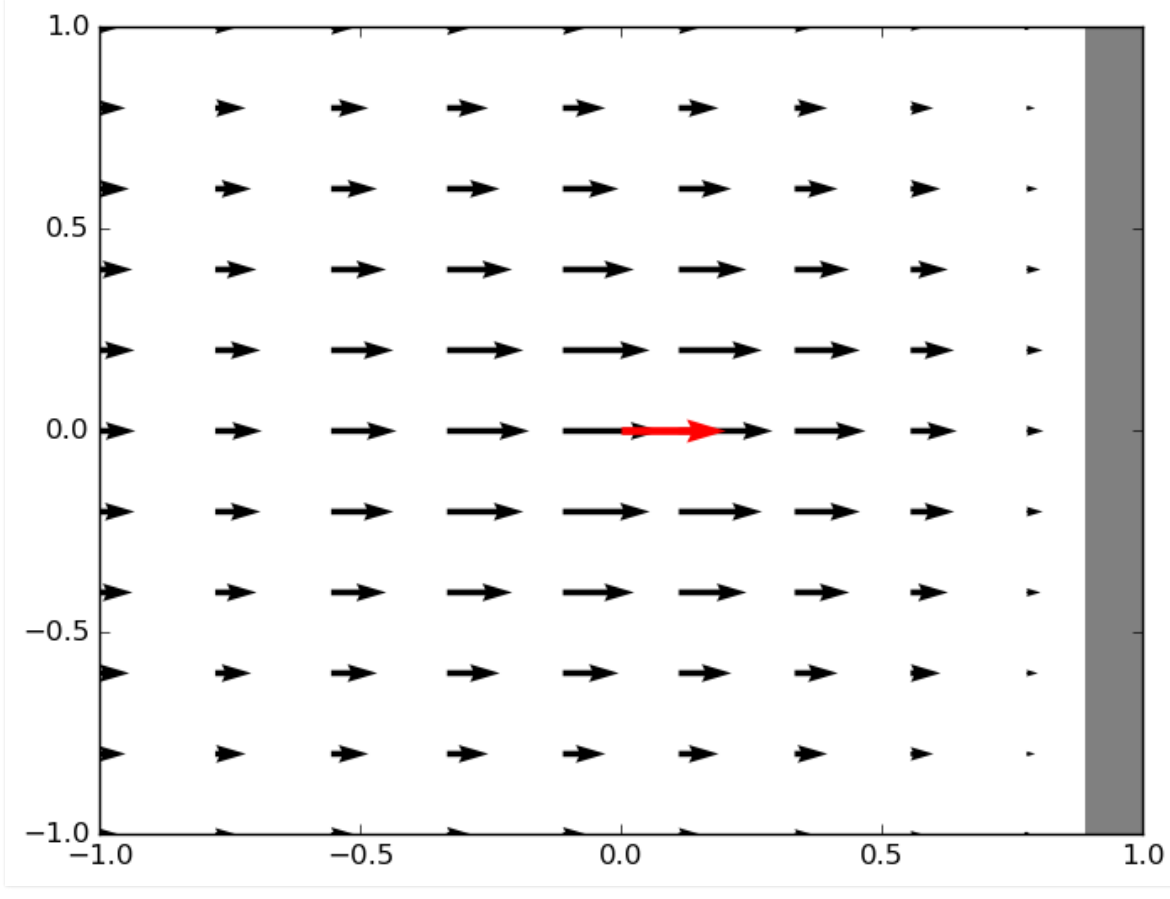
High-frequency radar interpolation

Synthetic velocity field, red arrow = measurement



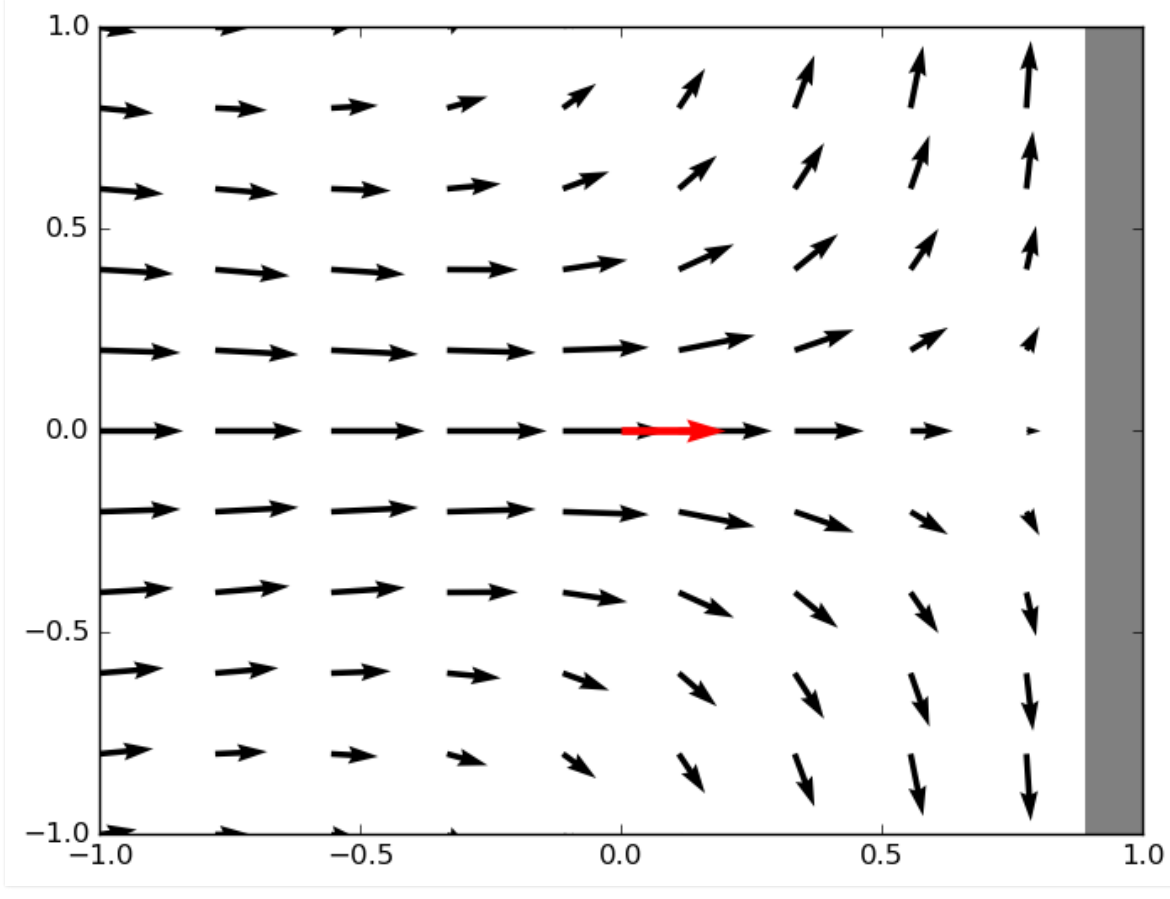
High-frequency radar interpolation

Adding the influence of the coast



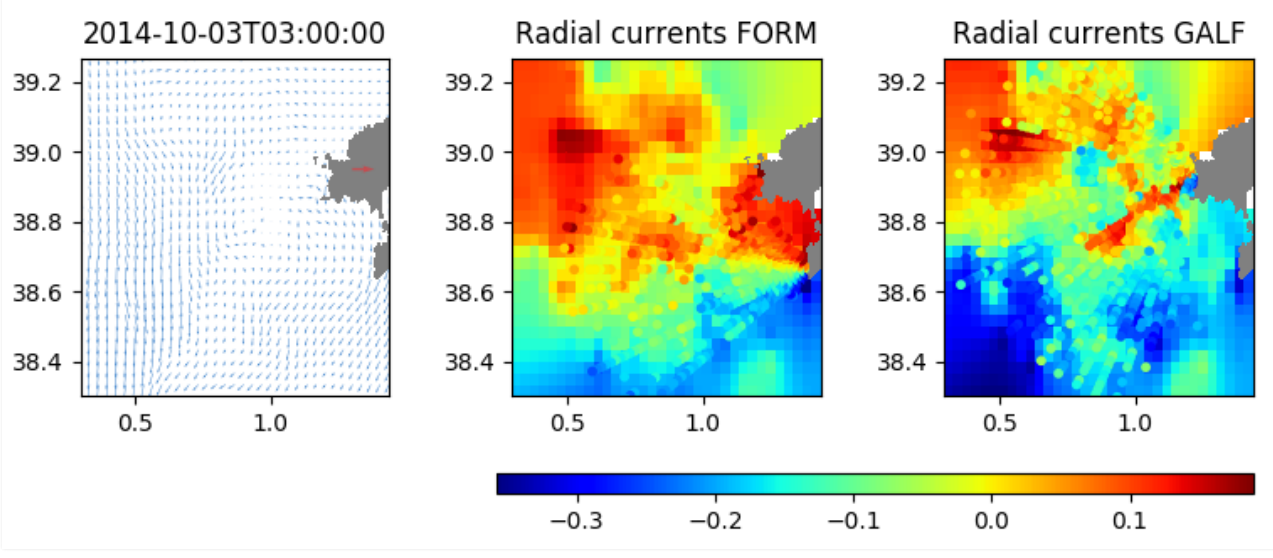
High-frequency radar interpolation

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?

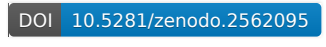
Hofstadter's Law:
It always takes longer than you expect,
even when you take into account Hofstadter's Law.

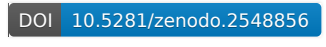
How to cite?

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 → 

2.3.0 → 

...

Who is Julia?

Who is Julia?

Julia Child (1912-2004)

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Julia Child (1912-2004)

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Thanks for your attention