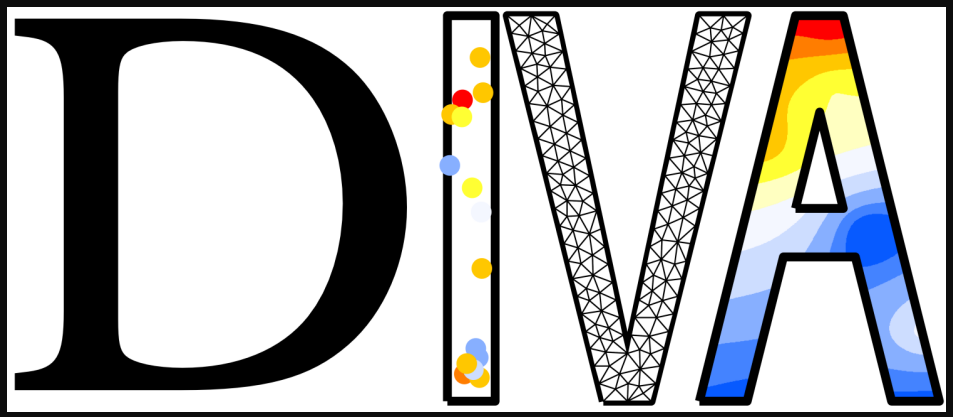
Recent methods for Data interpolation

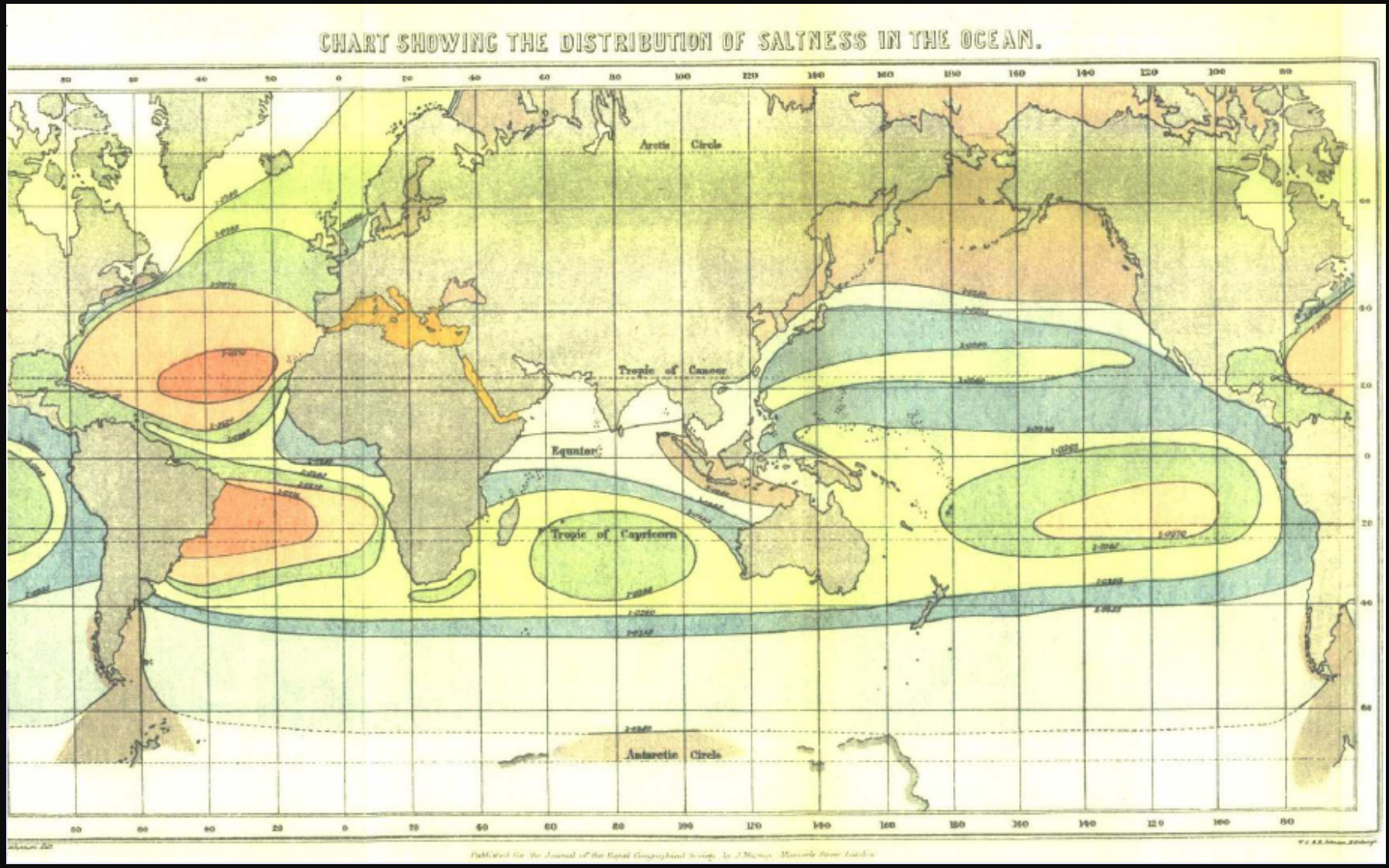
DINEOF and DIVA

Charles TROUPIN

January 31, 2013

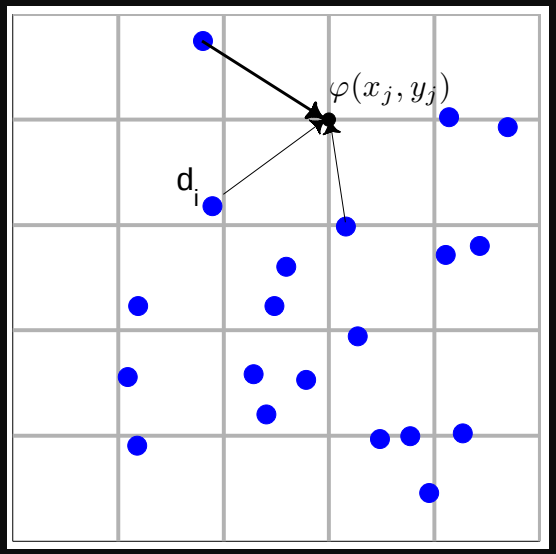

DIVA

The Diva tool: spatial interpolation of observations



DIVA = Data-Interpolating Variational Analysis

From sparse data points, construct gridded field = *analysis*



Formulation: minimize cost function that penalizes:

1. data–analysis misfit
2. smoothness of the field
3. physical constraint (advection, sources, . . .)

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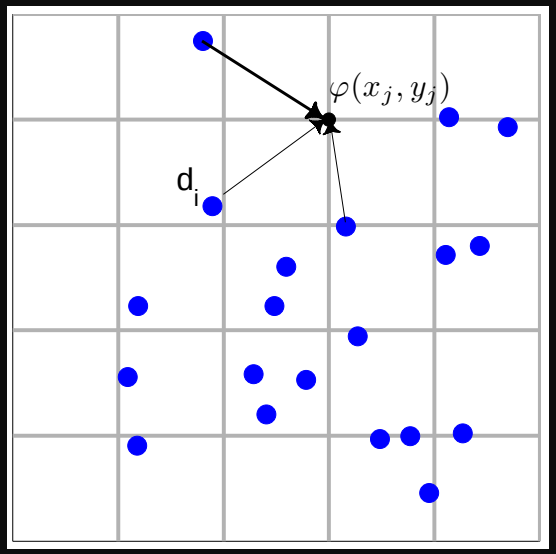

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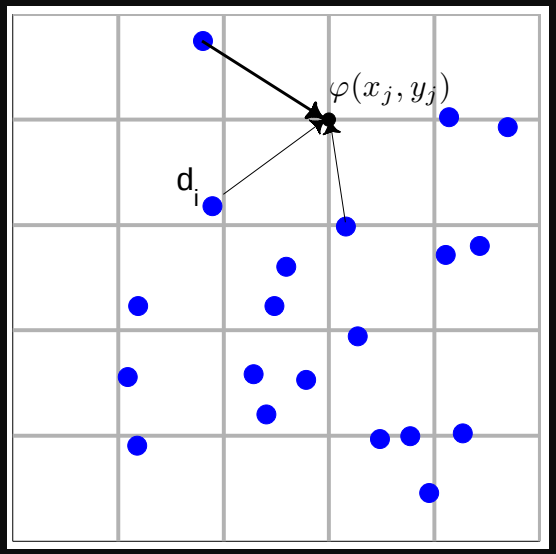

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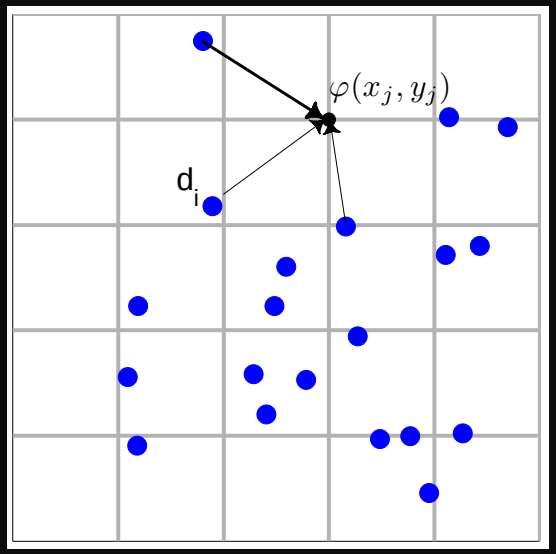

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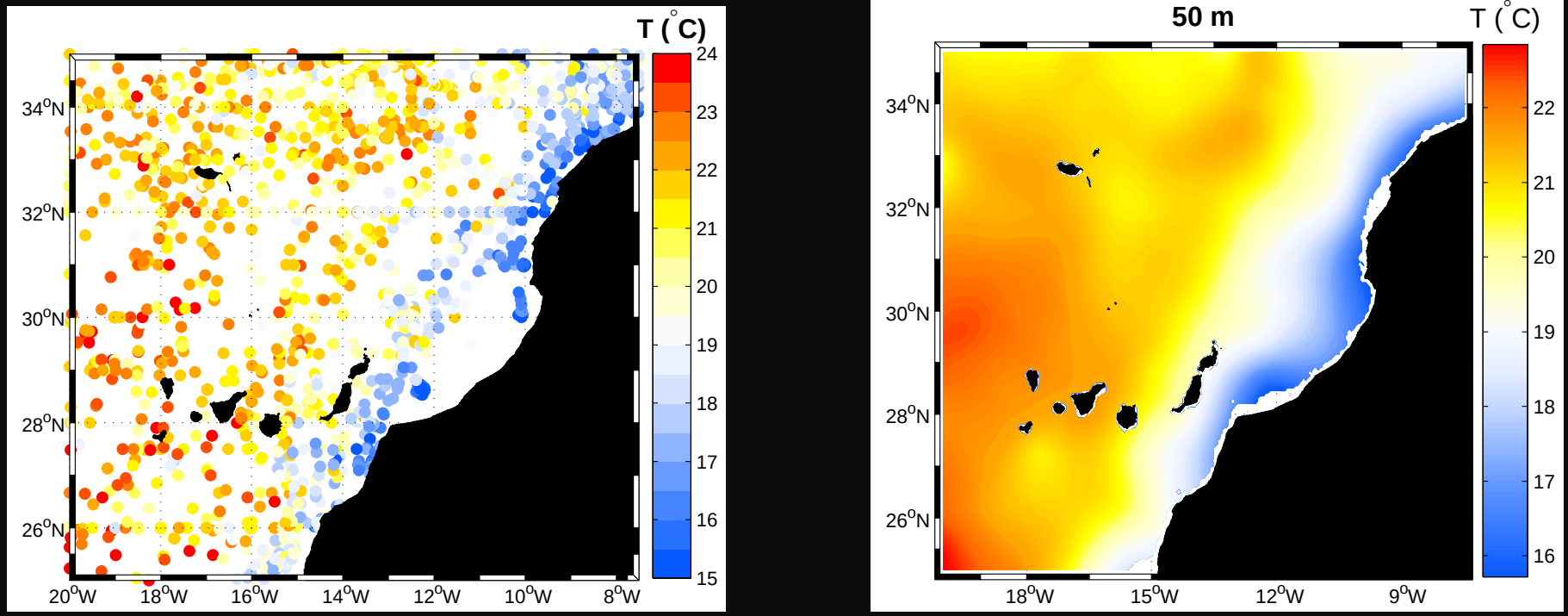
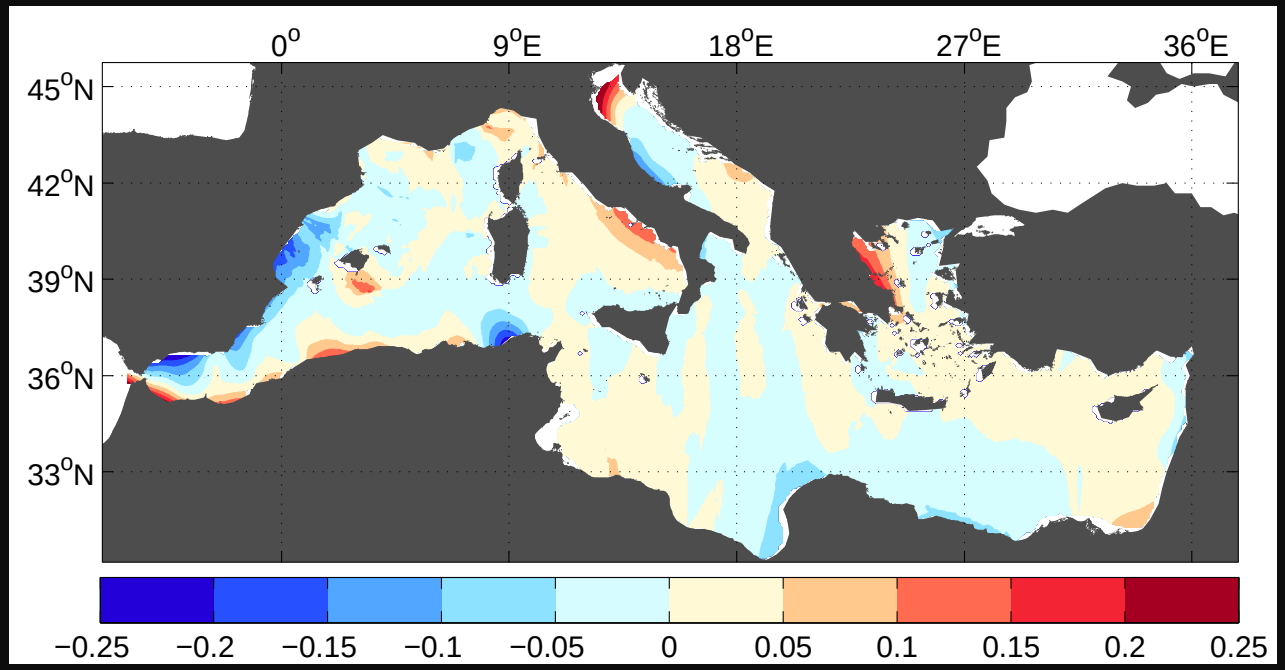
From in situ data to gridded fields



Measurements (left) and analysed field of temperature at 50 m in the Canary Island area.

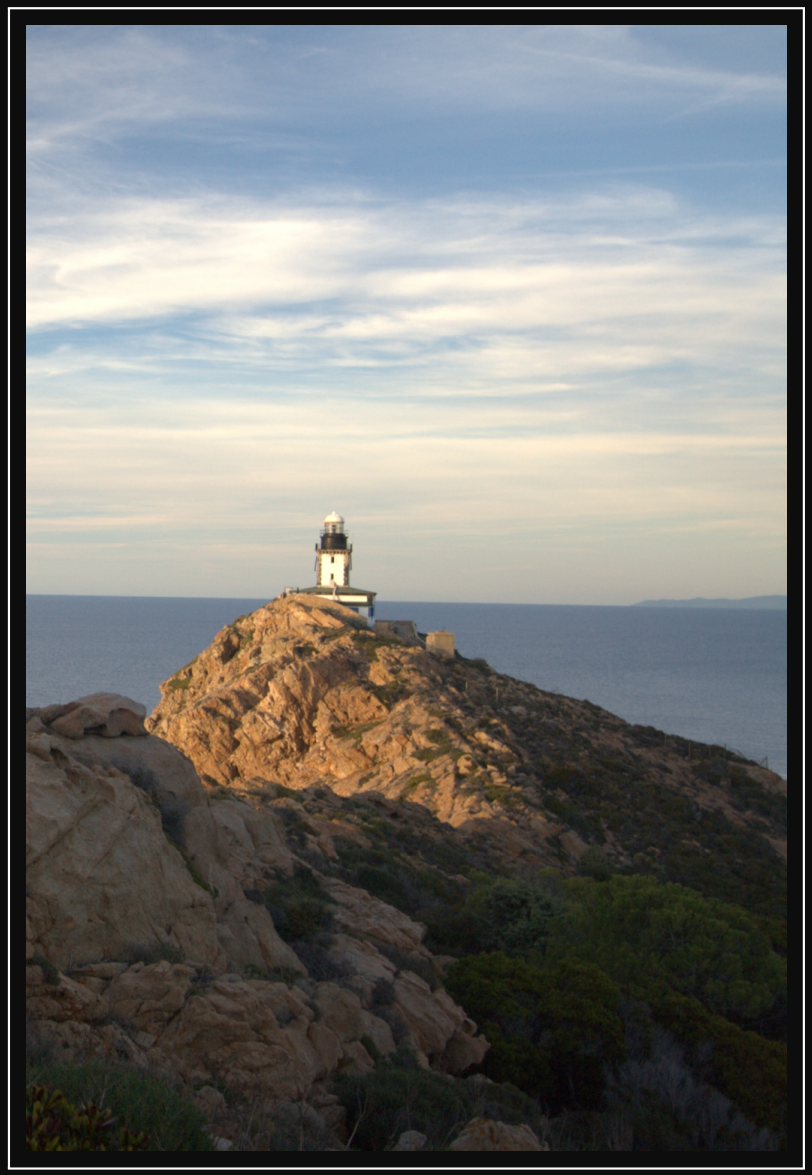
Why is better than other methods?

- Topographic constraints
- Optimized computation (finite-elements)
- Free software, user-driven developments



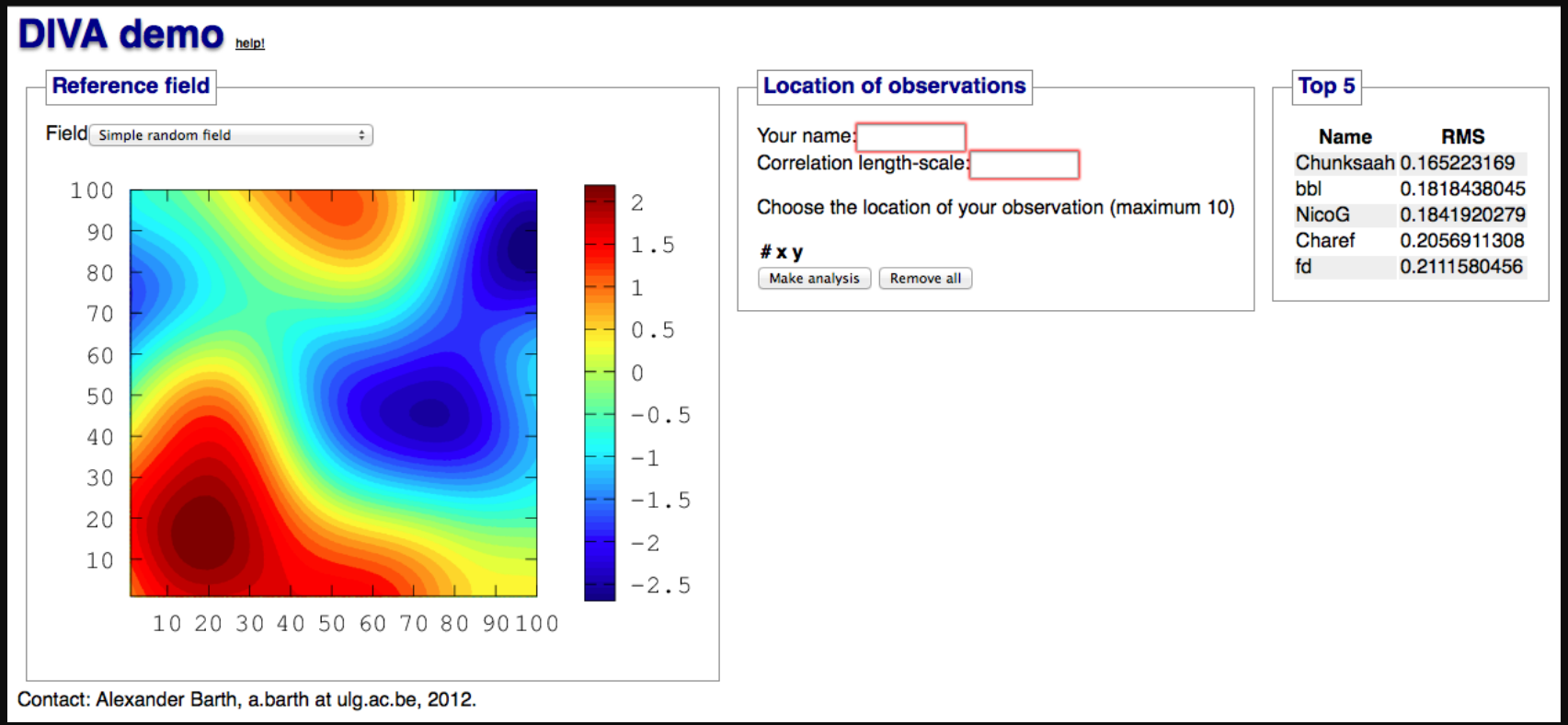
Difference between Optimal interpolation and DIVA for salinity in September at 30 m.

Diva user workshop



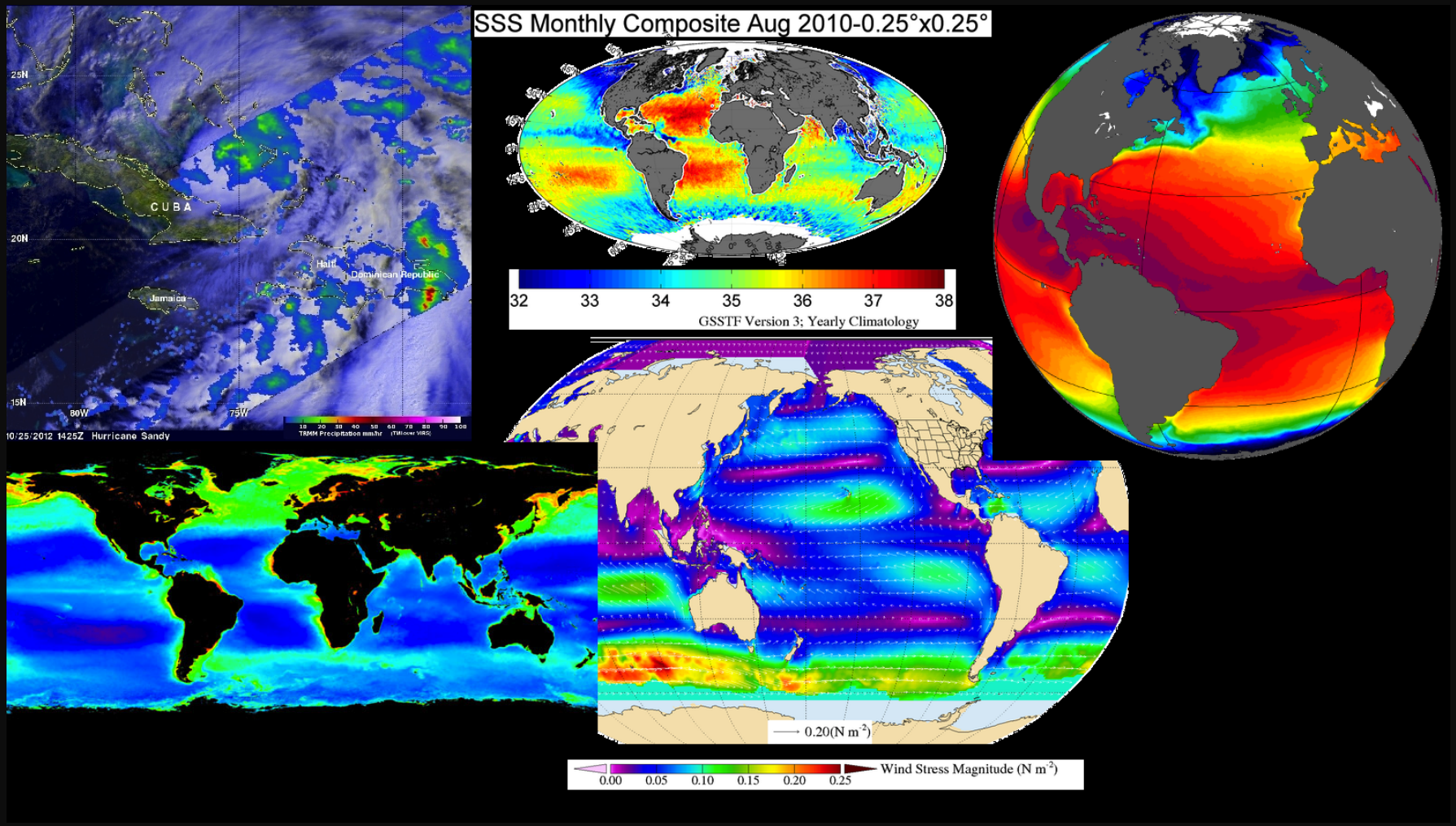
Where?	STARESO station (2007-2010), Roumaillac (2012)
When?	1/year, Autumn
Public:	beginners, intermediate and expert users
How?	Contact me

More information:
http://modb.oce.ulg.ac.be/mediawiki/index.php/DIVA
Test and play:
http://data-assimilation.net/Tools/divand_demo/html




DINEOF

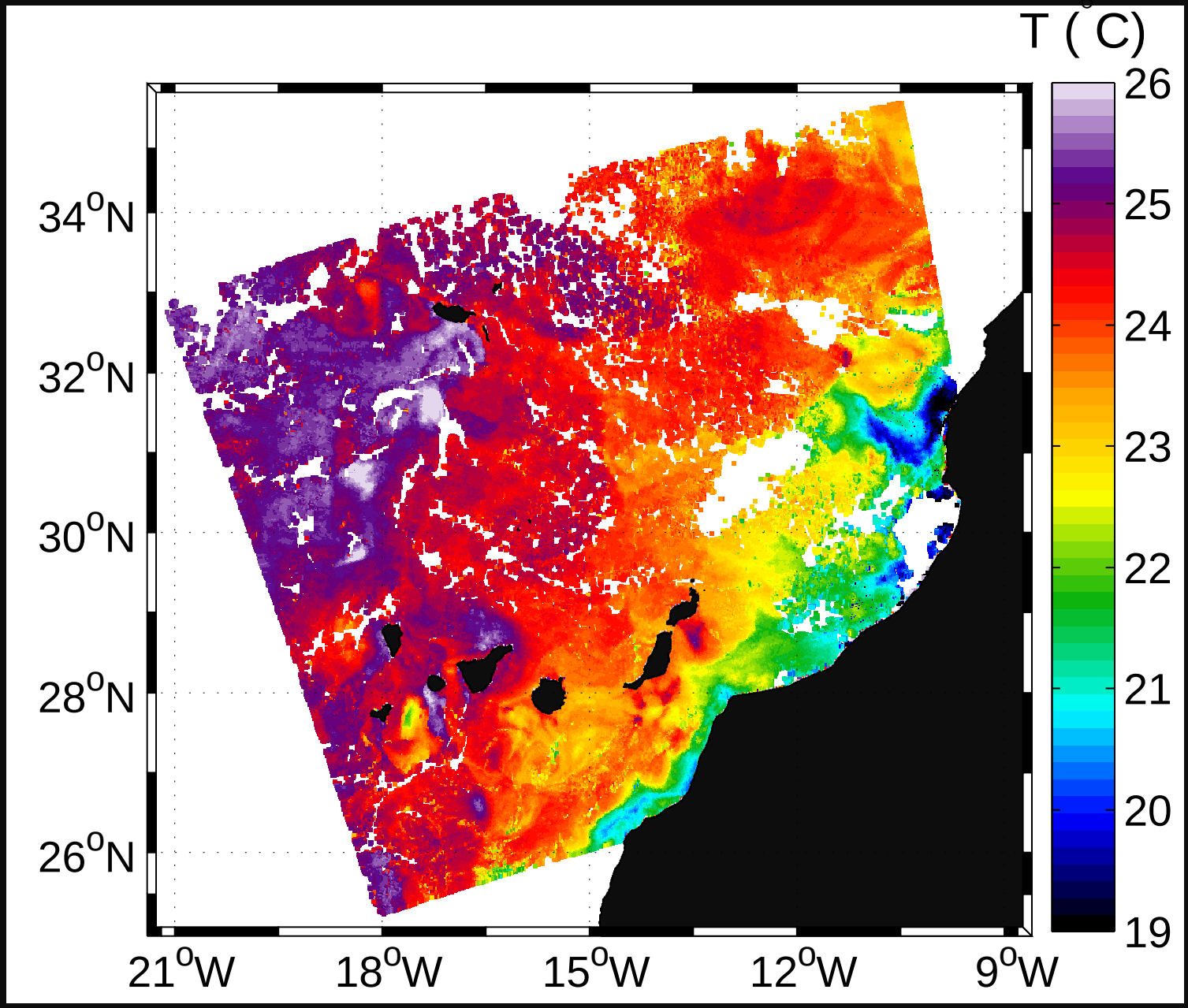
Satellites measure a lot of parameters, but . . .



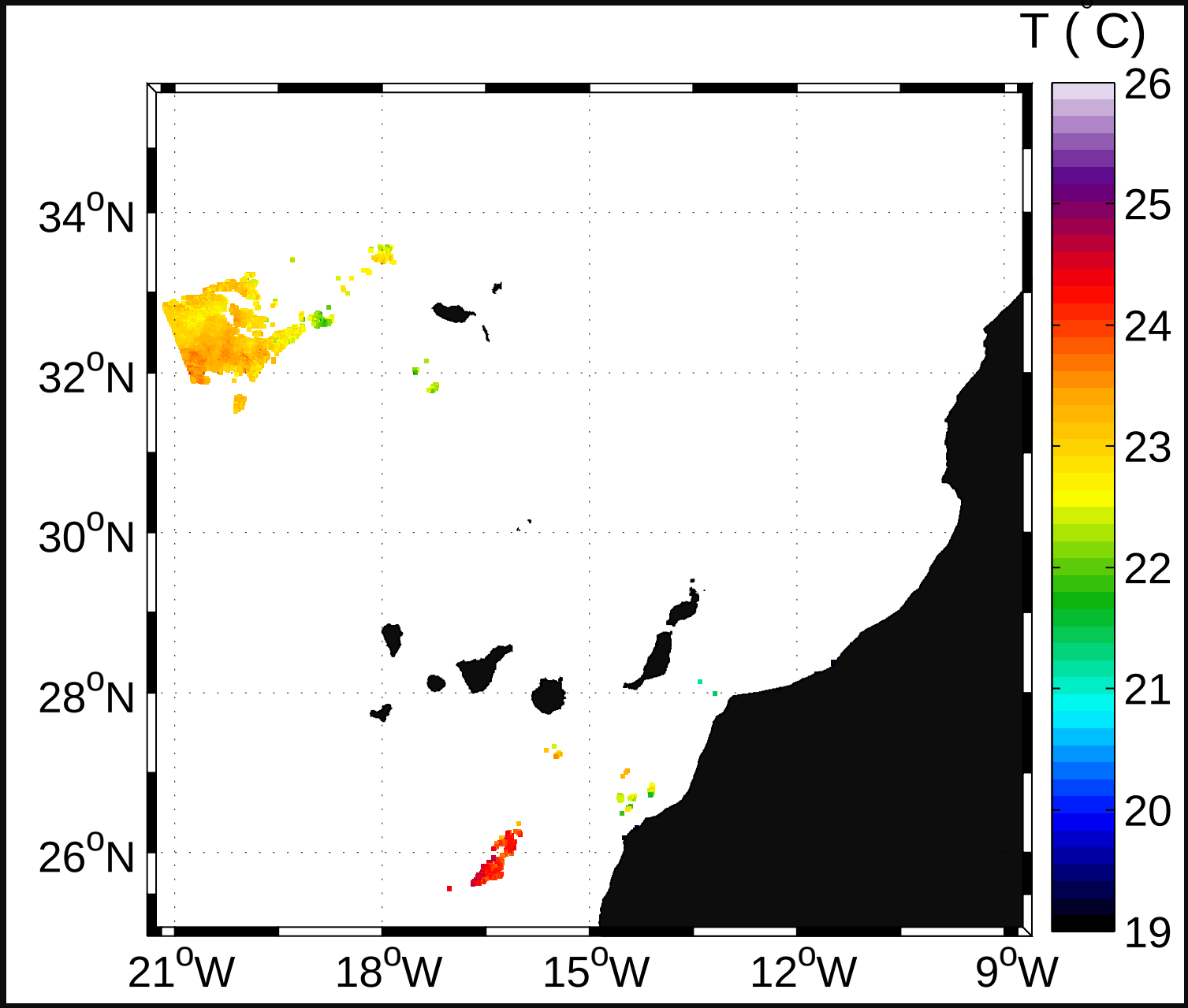
. . . they are limitations:

1. Spatial/temporal resolutions
2. Measurements limited to surface
3. Cannot view through clouds, dust, smoke, . . .

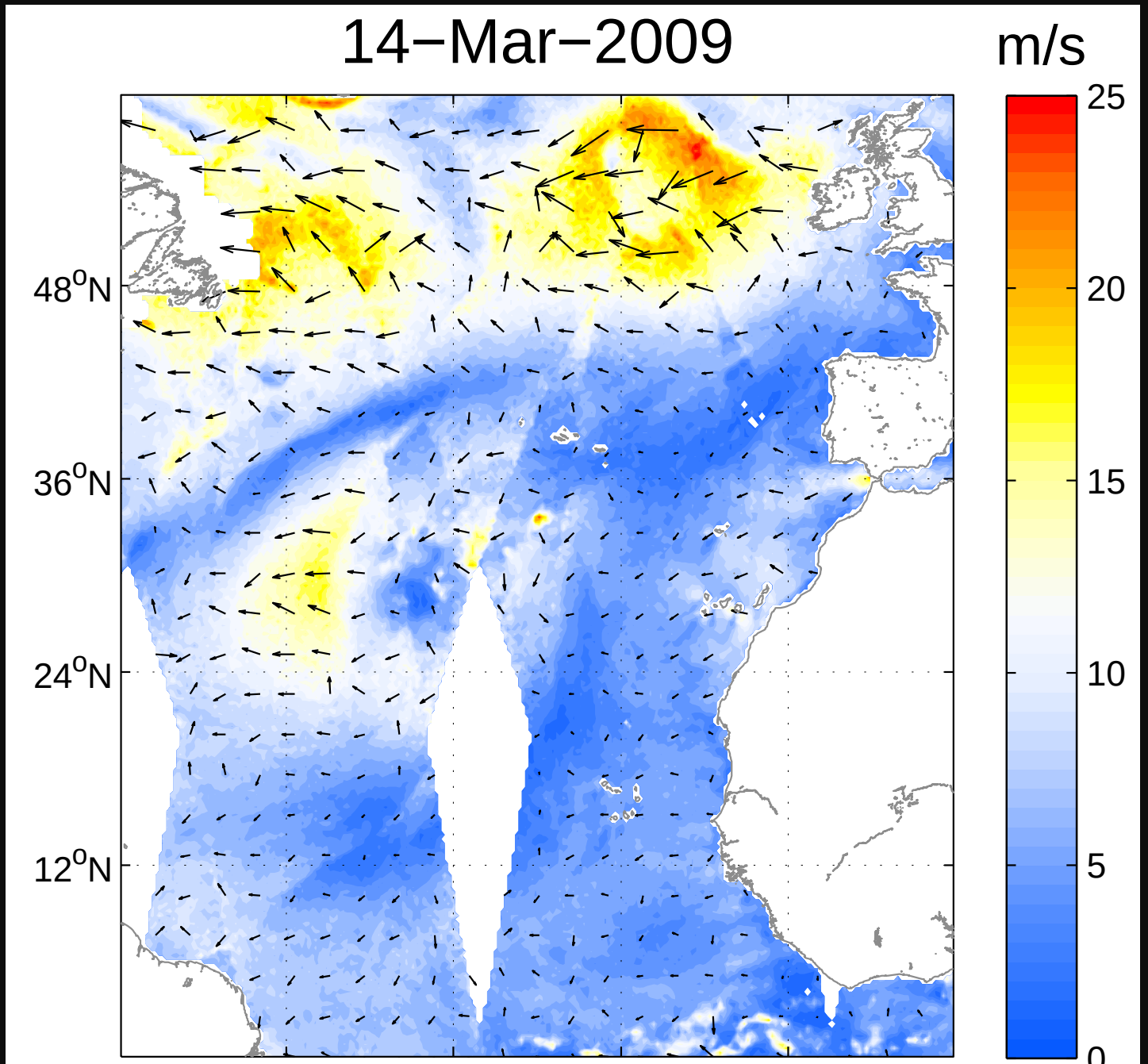
Examples



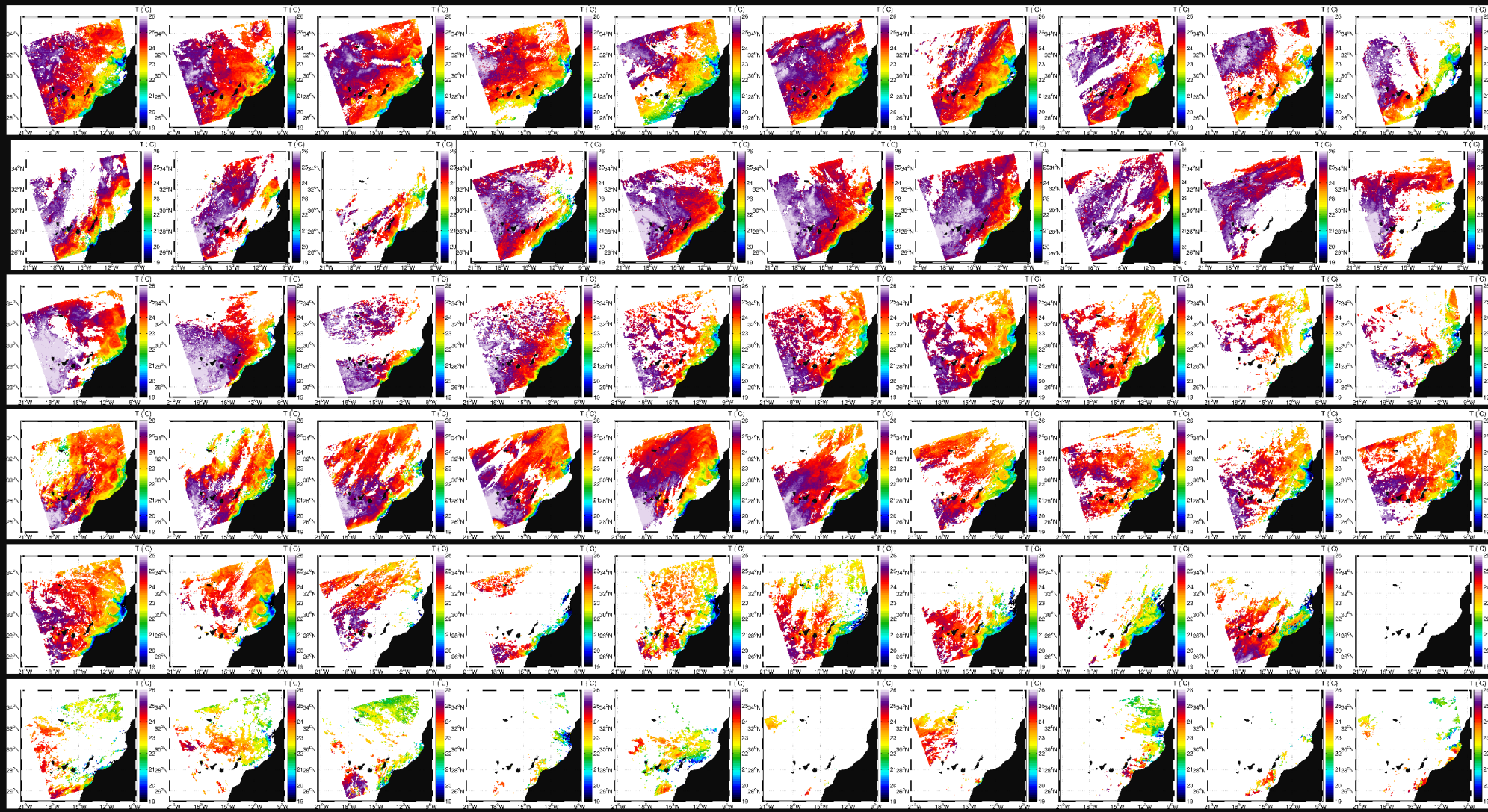
Examples



Examples



Solution: Use information from other images



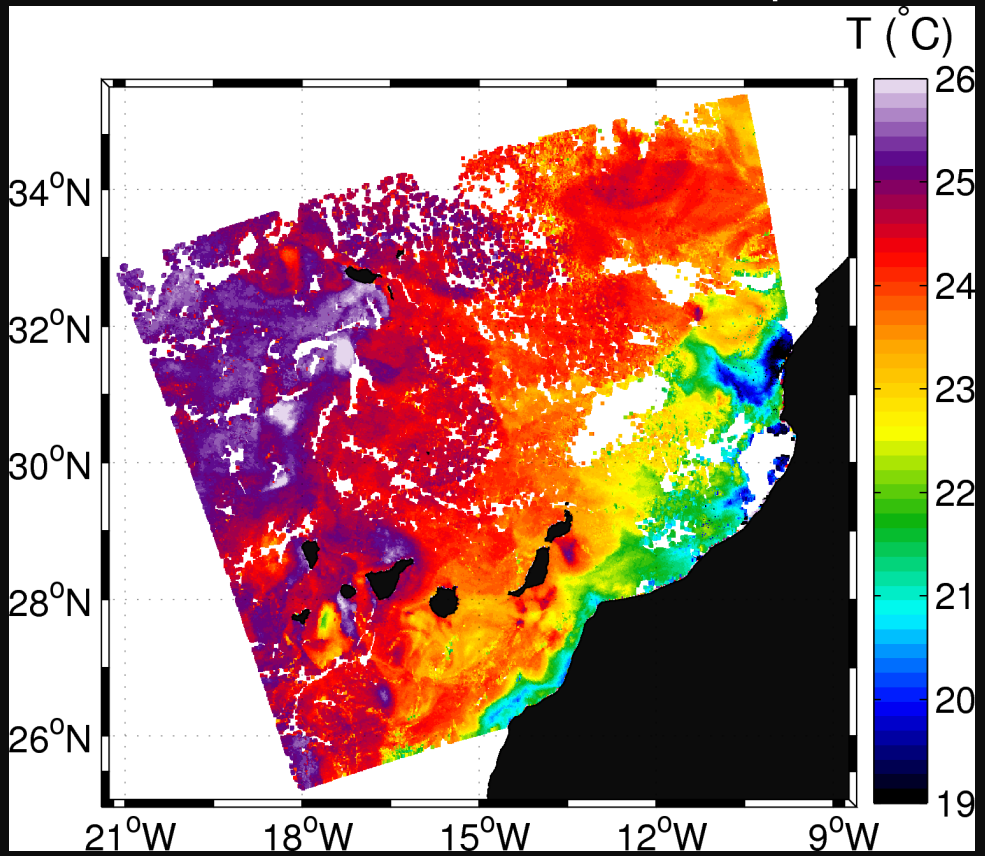
DINEOF = Data INterpolating Empirical Orthogonal Functions

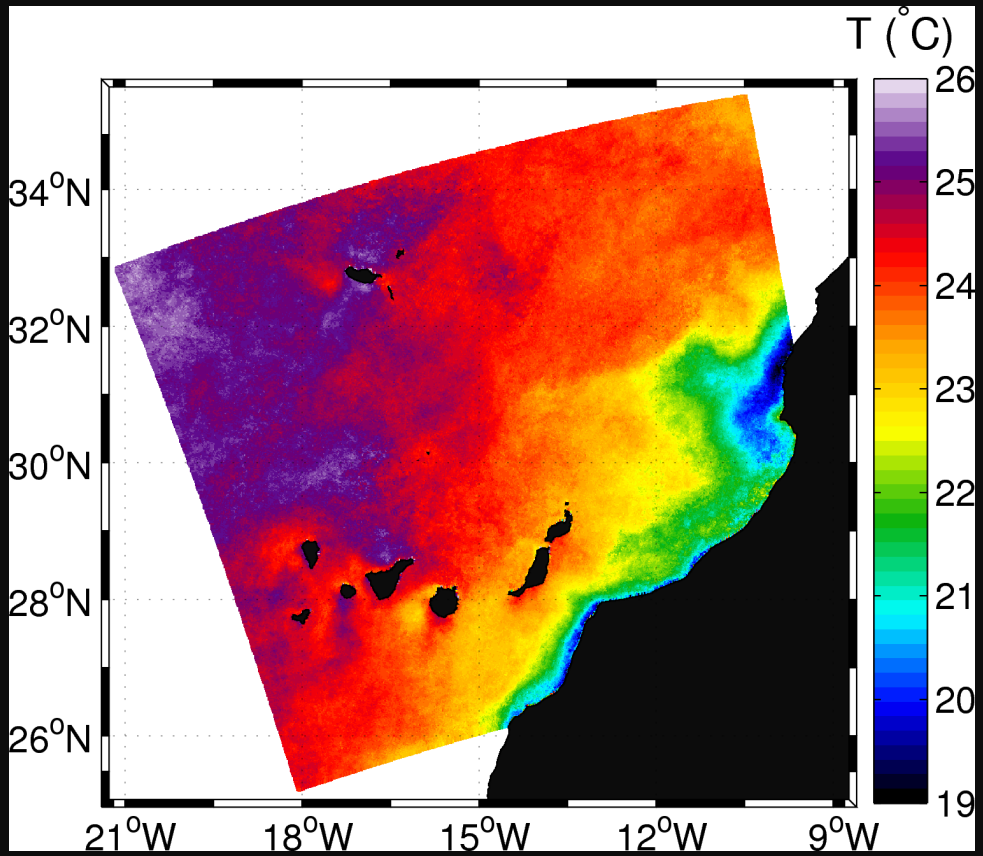
Iterative method

1. Start with $N = 1$ mode
   - Compute new values at missing pixels
   - Repeat until convergence
   - Estimate reconstruction error
2. Increase number of modes and repeat procedure
3. ...
4. Final reconstruction: number of modes that minimises error

Results

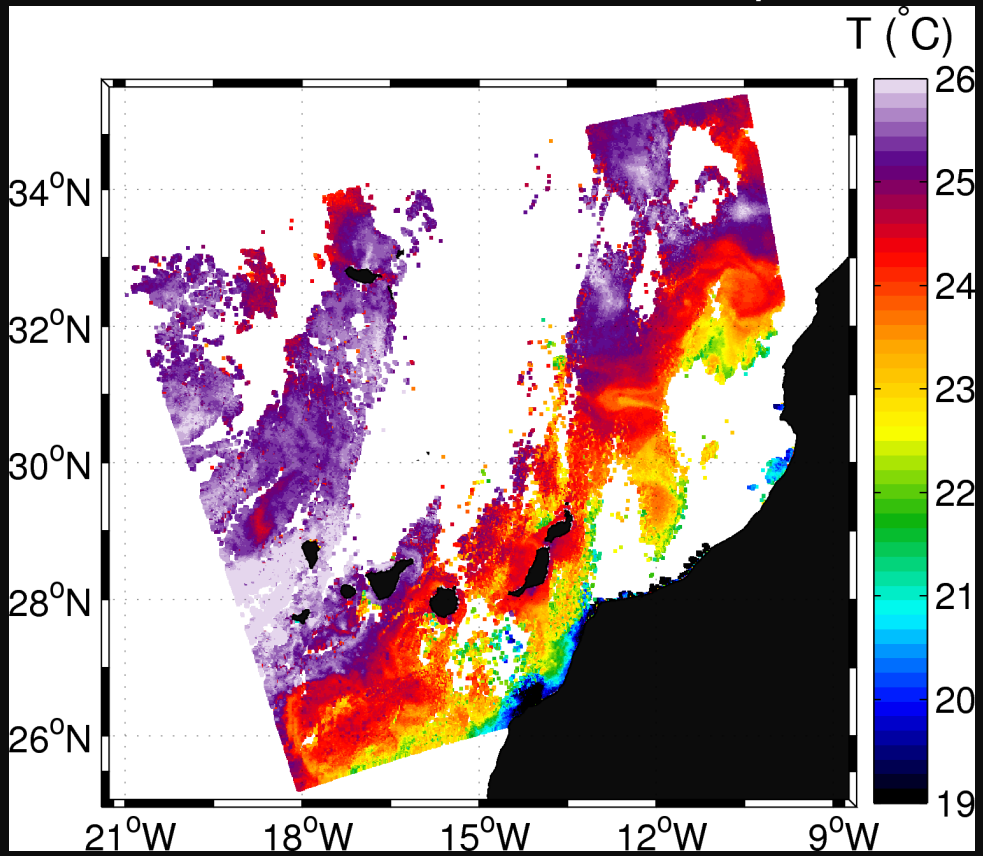
September 5, 2012

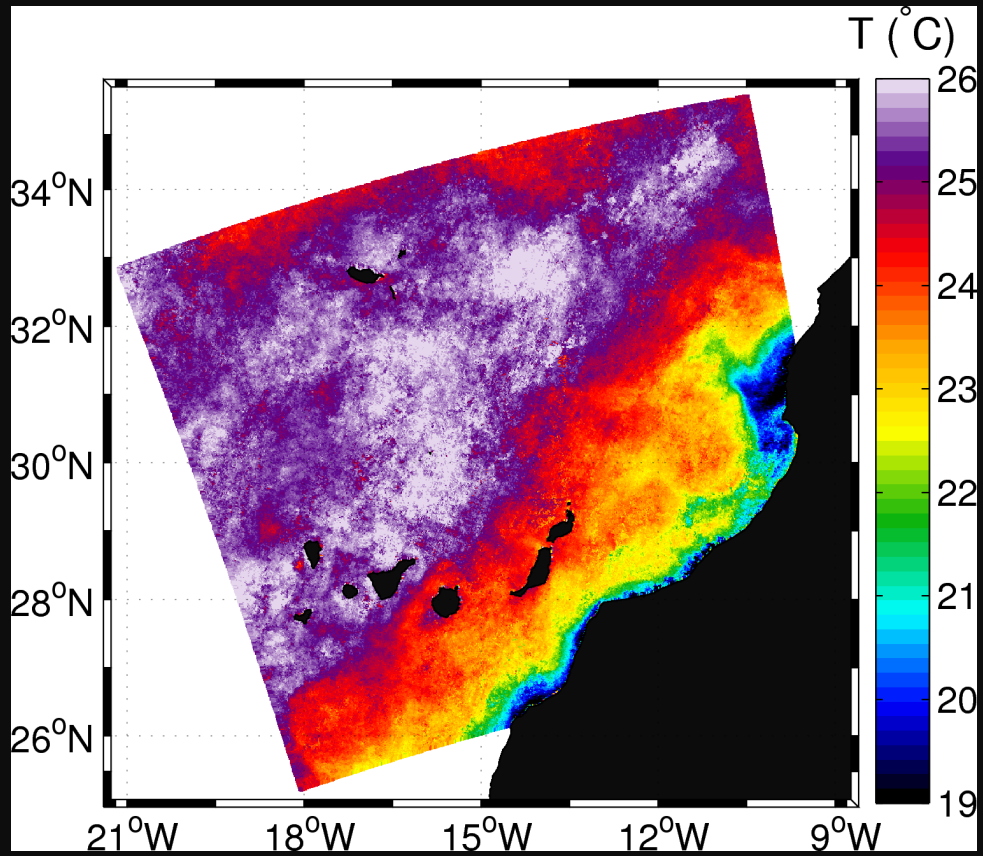




Results

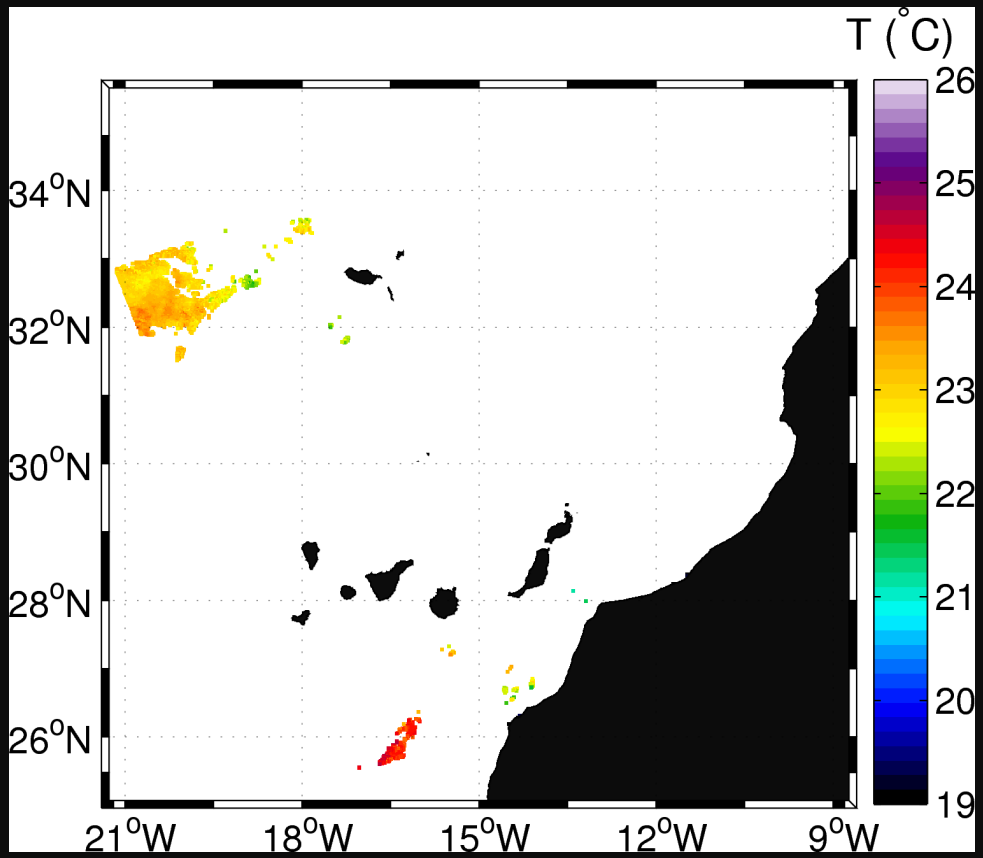
September 15, 2012

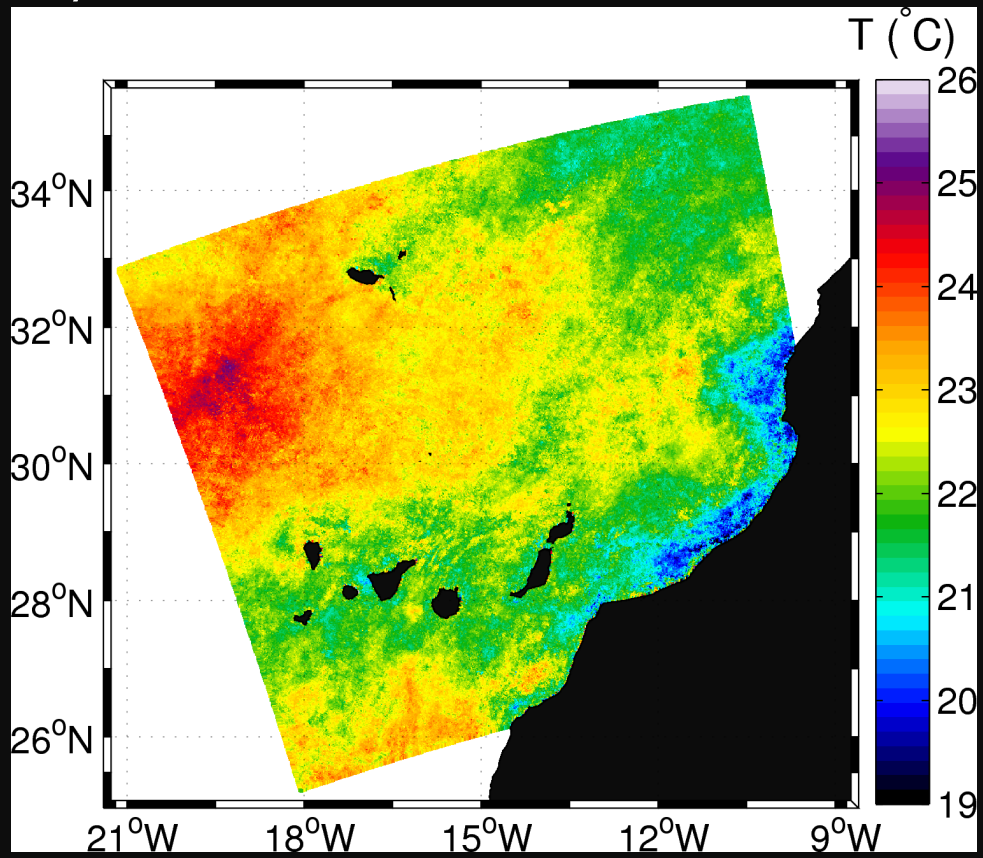




Results

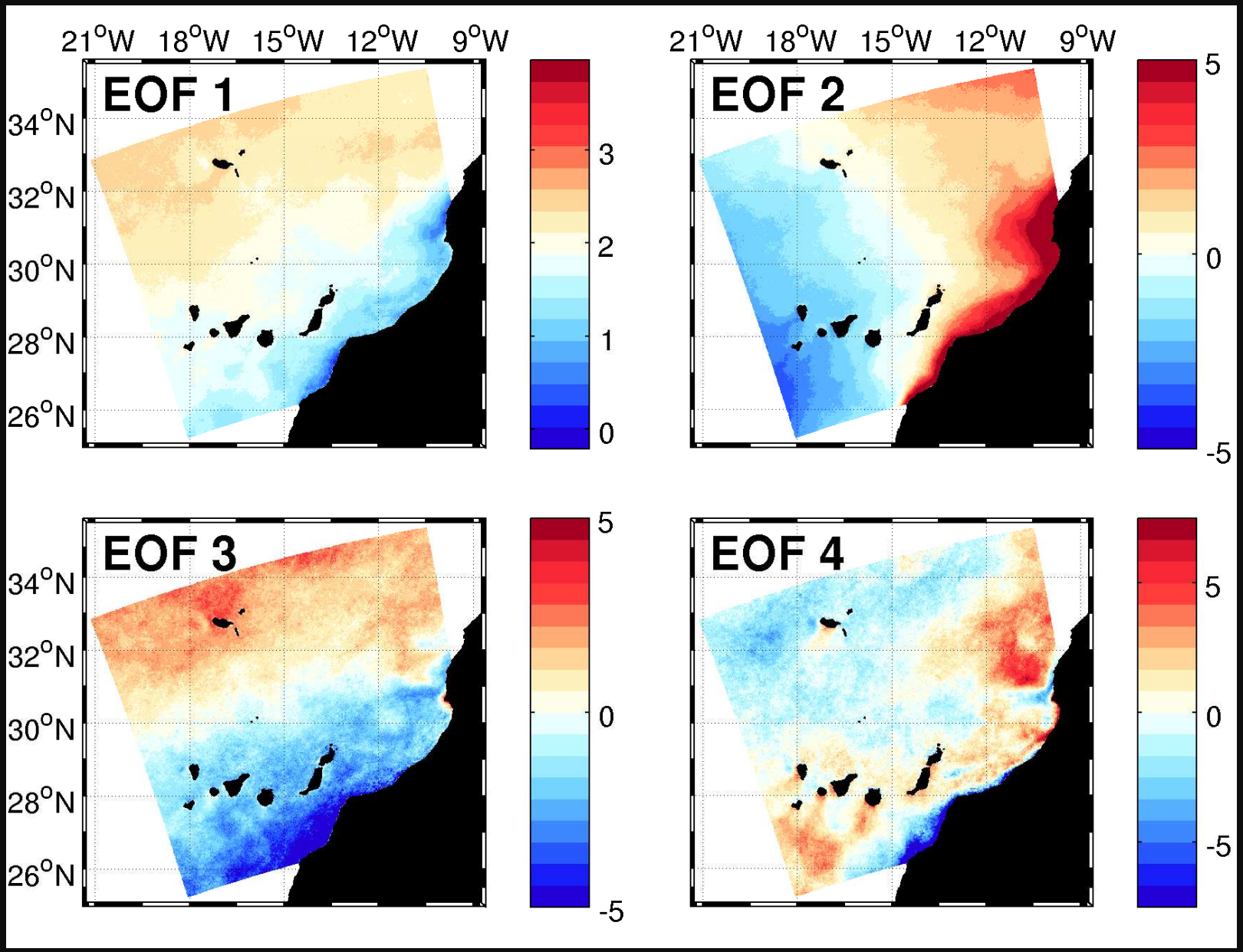
October 30, 2012





Spatial modes

2008



Automatic processing

http://gher-diva.phys.ulg.ac.be/DINEOF/dineof.html

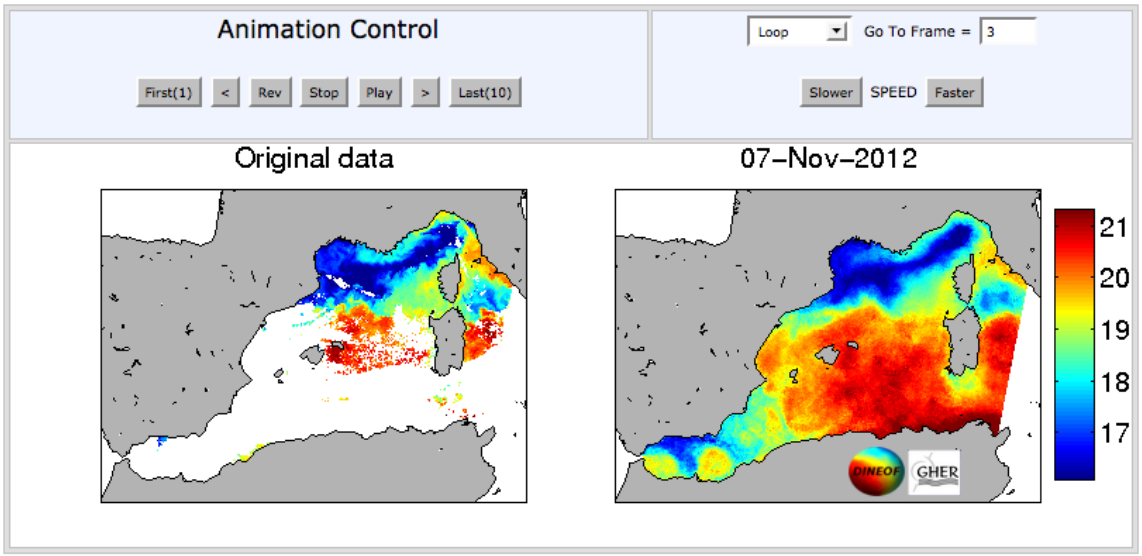
DINEOF daily cloud-free SST for the Western Mediterranean Sea

- Reconstructed SST field
- Initial and Reconstructed SST fields
- Outliers field
- All fields
- DINEOF Wiki page

See also:

- Canary-Madeira SST

DINEOF (Data INterpolating Empirical Orthogonal Functions) is an EOF-based technique to reconstruct missing data in satellite images. In this page the initial cloudy data set and the reconstruction for the last 10 days are shown. This product is updated daily with the latest SST data.

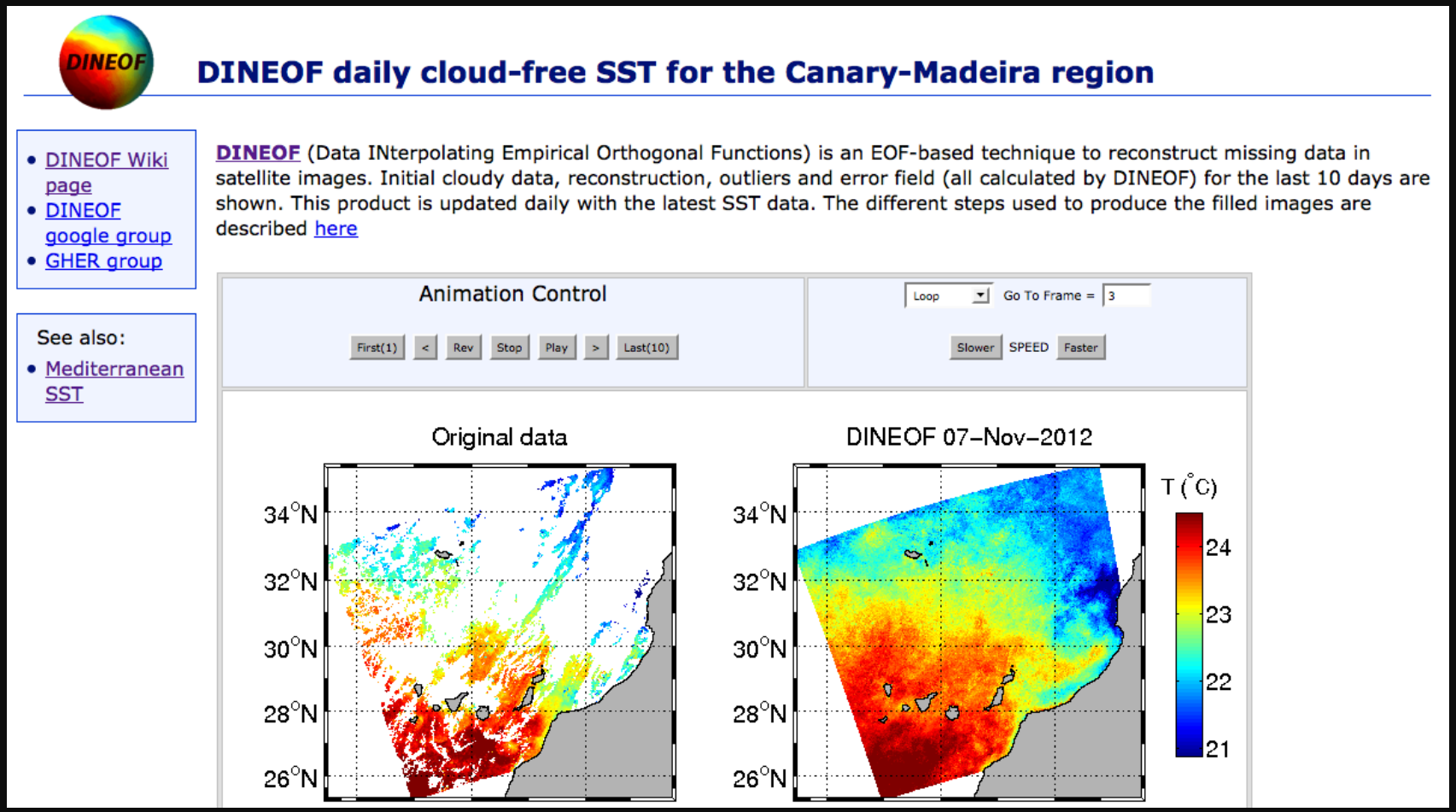


Note: Units are degrees Celsius

Here DINEOF is applied daily to NAR SST level 3 from the Ifremer Medspiration ftp site.

Automatic processing

http://gher-diva.phys.ulg.ac.be/DINEOF/dineof_allCAN.htm



What's more?

- Multivariate analysis
- Merging: polar-orbiting + geostationnary
- Forecasts

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DINEOF: remote-sensing measurements + model variables

↓ ↓

no explicit parameterization

forecasts

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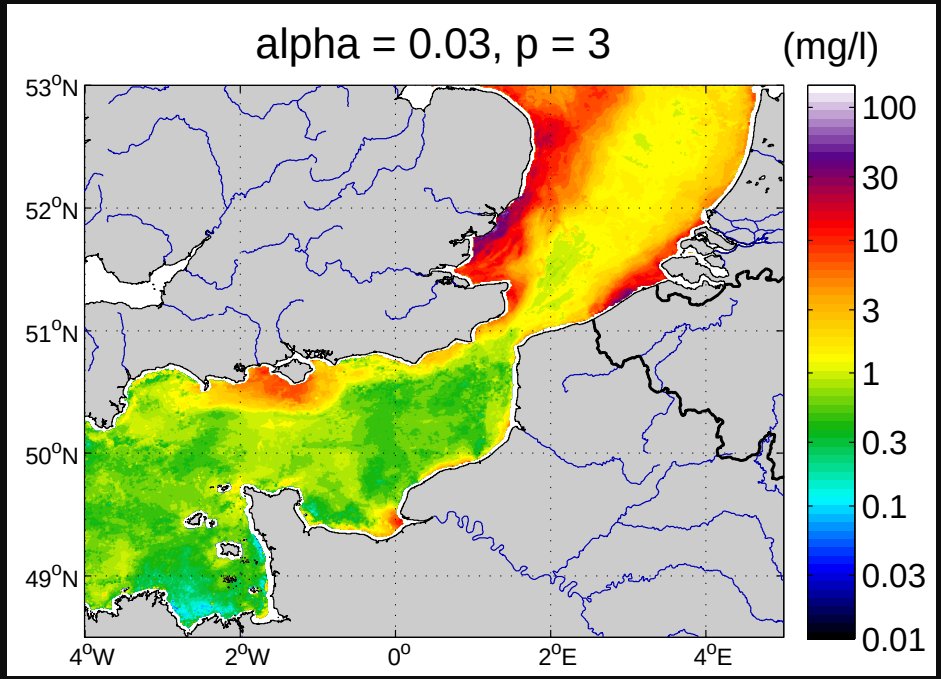
"Forecast" of Total Suspended Matter



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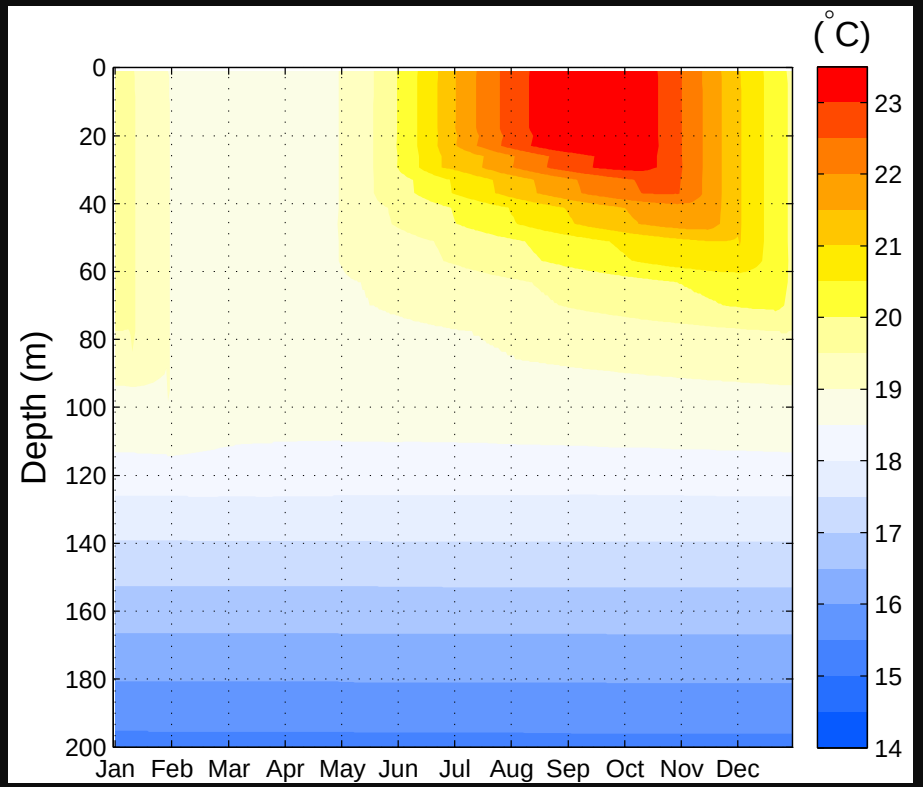

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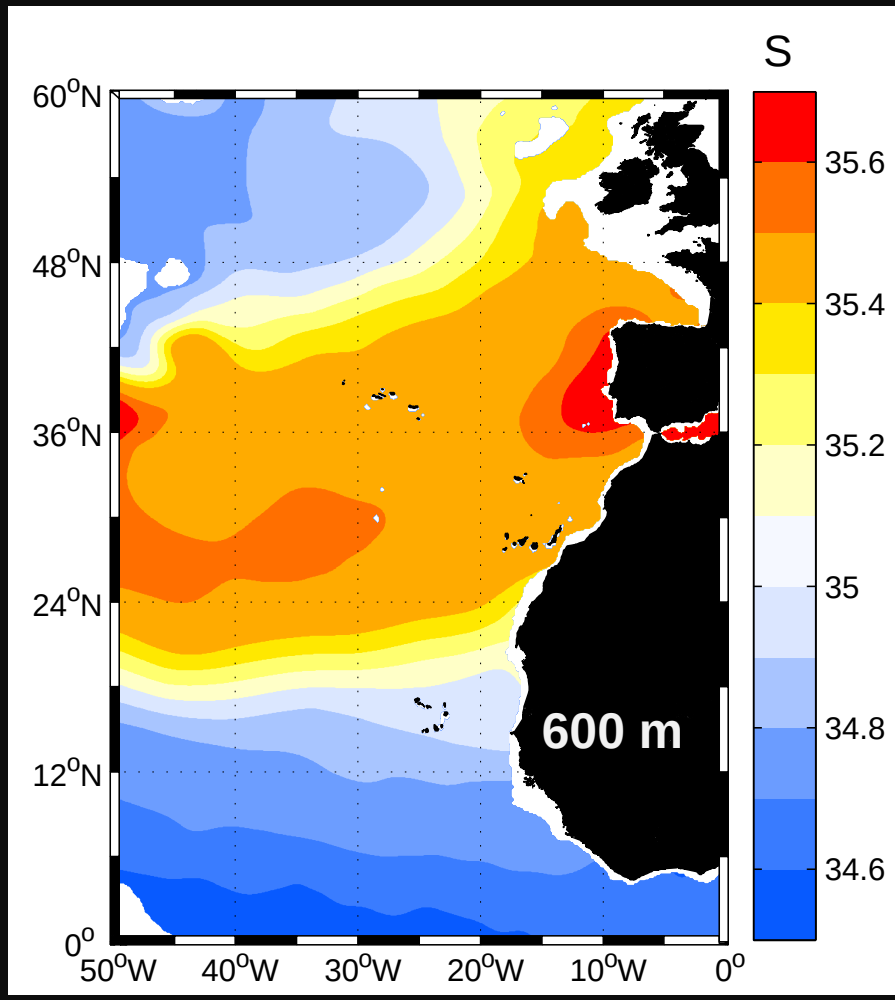

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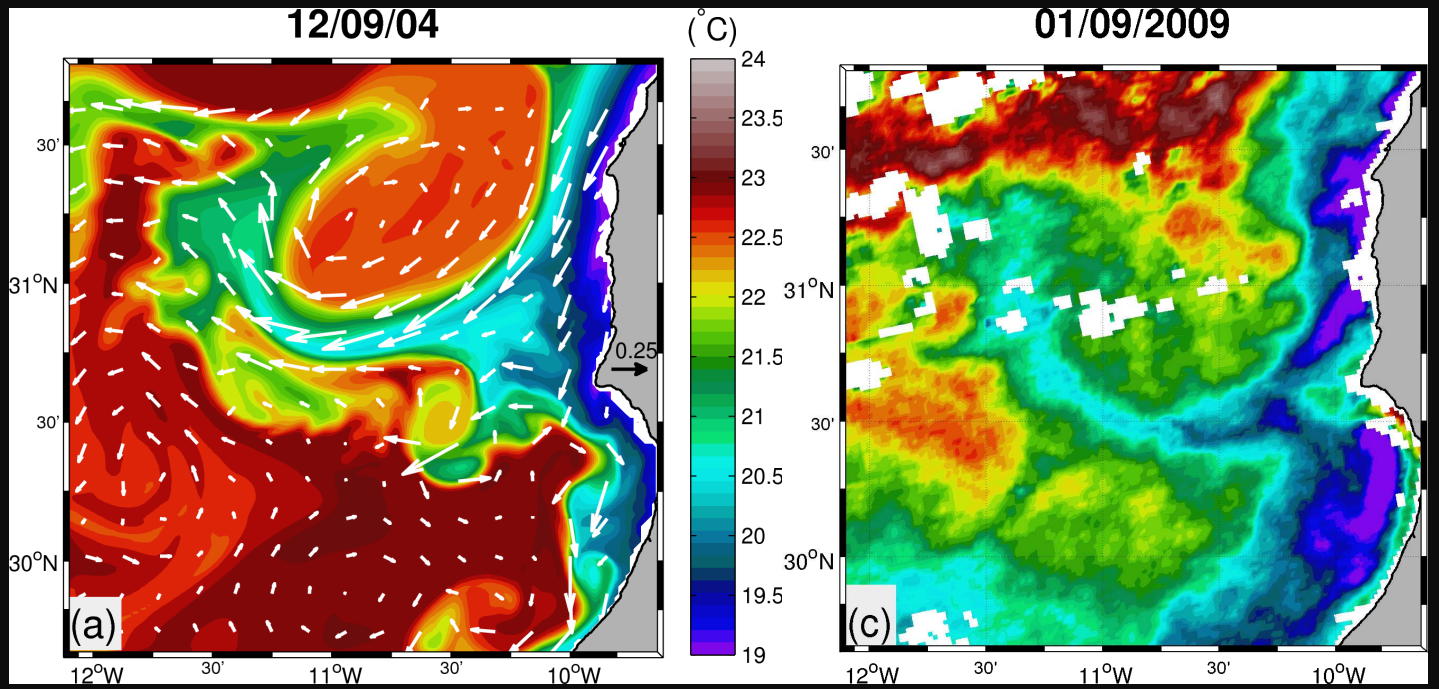

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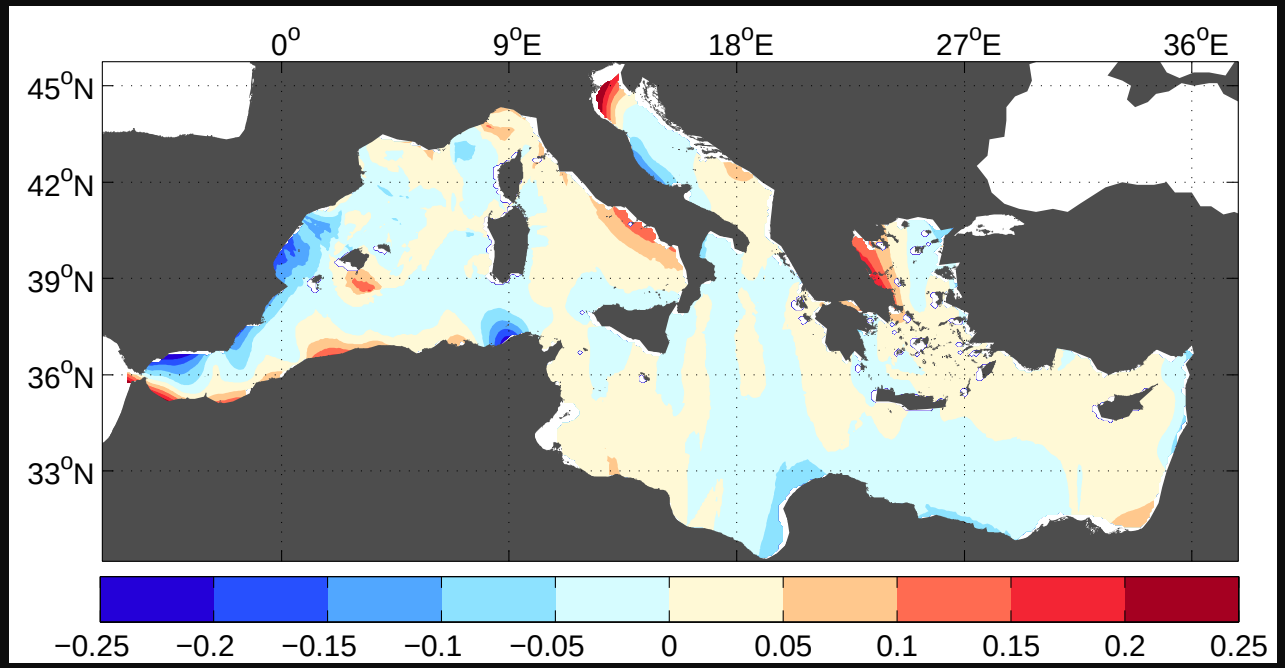

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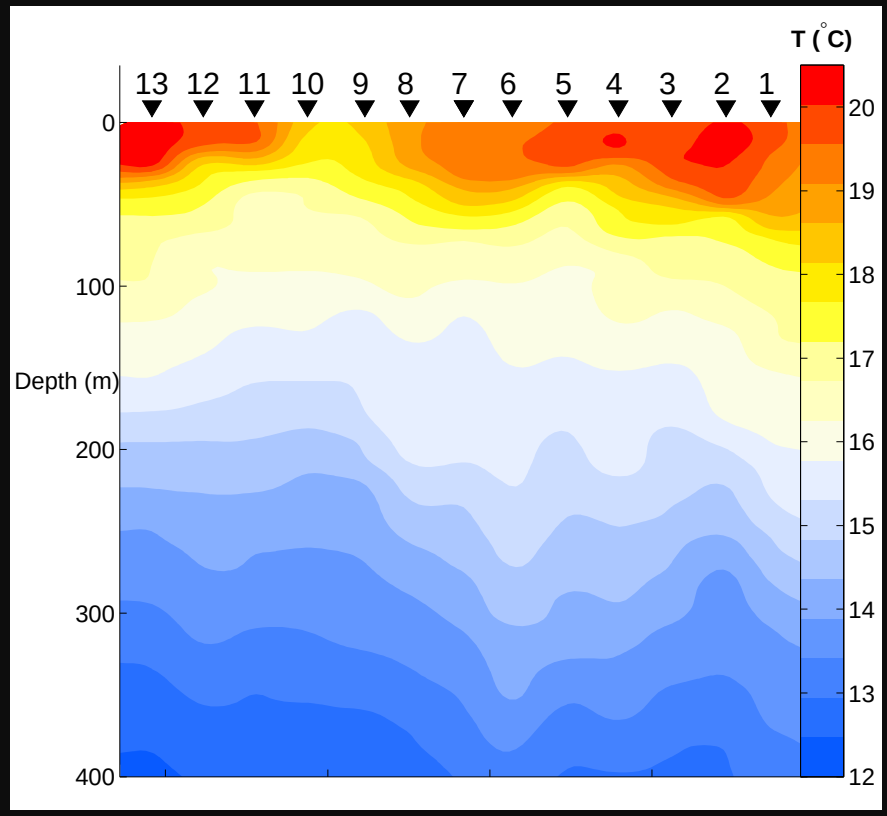
- *Temporal trends of the Black Sea Cold Intermediate Layer*



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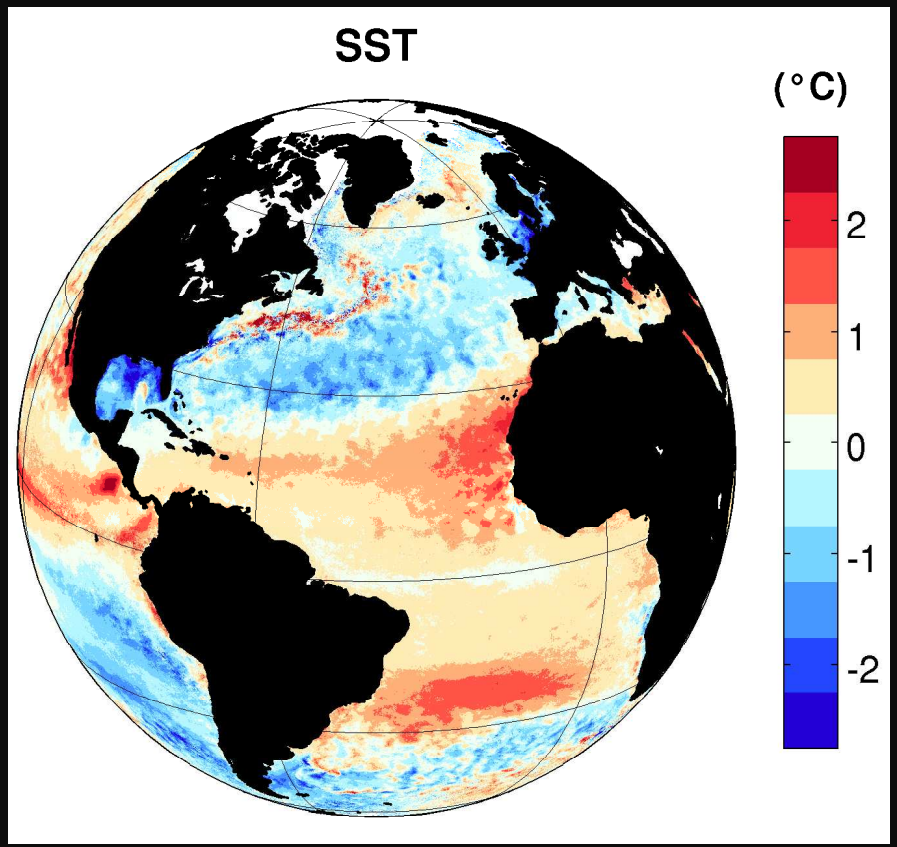

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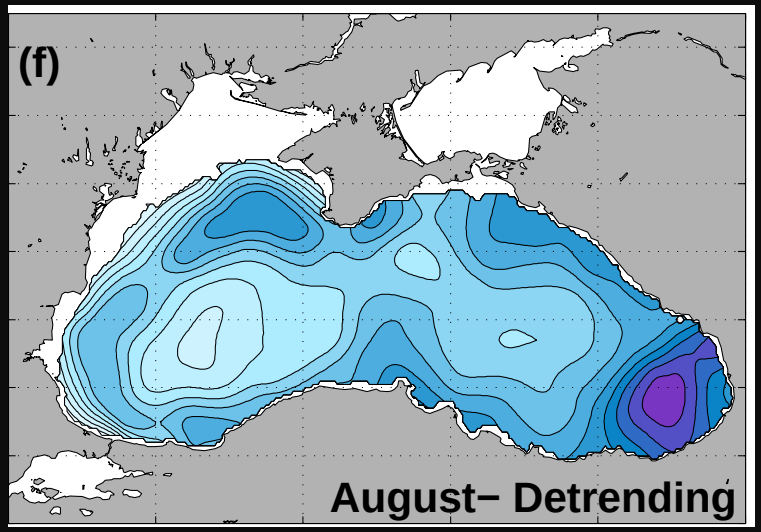

Thanks for your attention