

EOF analysis of Sea Surface Temperature in the Canary Island – Madeira region

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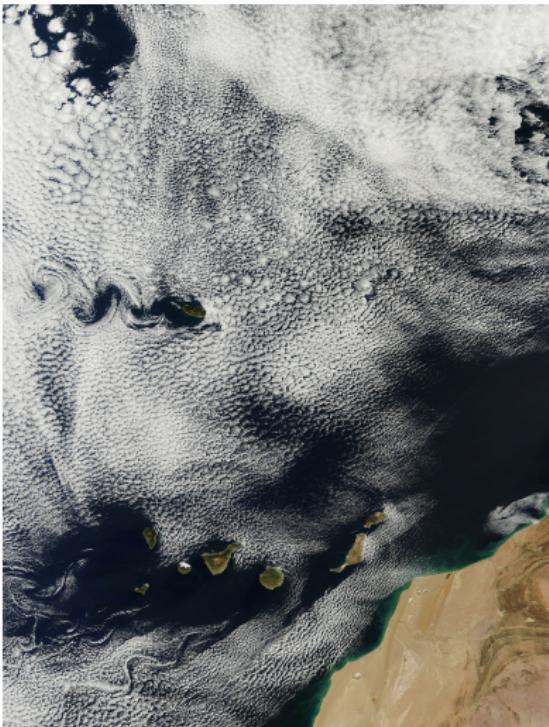
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April 29, 2011



Atmospheric vortices



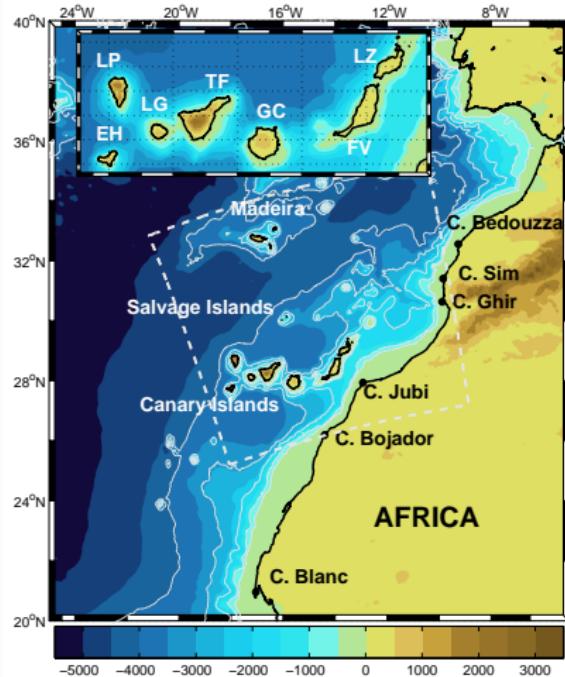
MODIS-Terra
February 22, 2011

Island wakes



MODIS-Aqua
June 3, 2010

Objectives



Goals:

- ✓ reconstruction of SST images in 2008, 2009 and 2010.
- ✓ determine main spatial/temporal structures

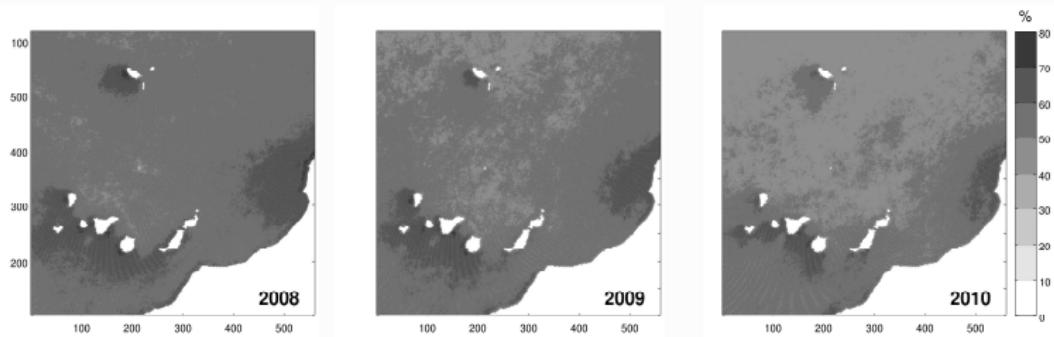
Why there?

- Island wakes
(e.g., [Barton et al., 2000](#)).
- Mesoscale eddies
(e.g., [Arístegui et al., 1994](#); [Sangrà et al., 2005](#))
- Upwelling filaments
(e.g., [Pelegrí et al., 2005](#)
+ my PhD thesis).



Data

- SST from Medspiration (<http://www.medspiration.org>)
- January 1, 2008 to December 31, 2010
- Night-time only
- Images with > 5% of valid pixels

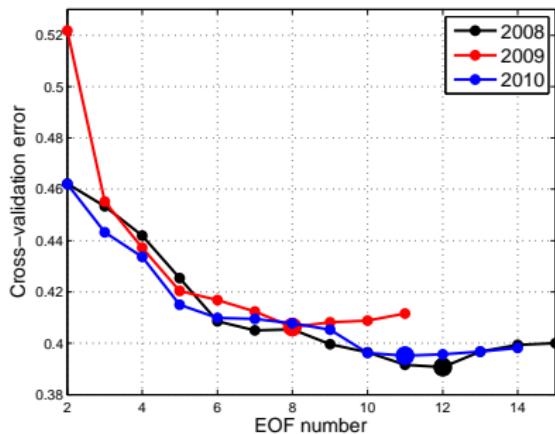


Method

Data INterpolating Empirical Orthogonal Functions

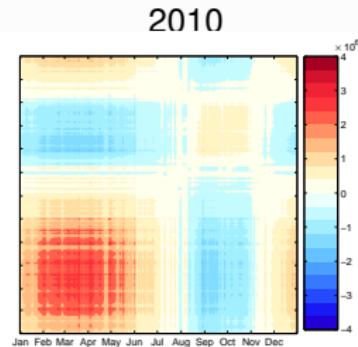
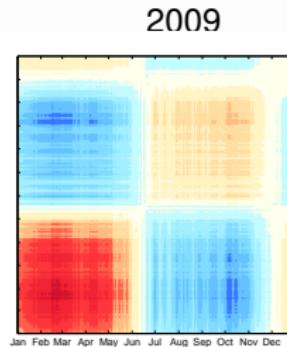
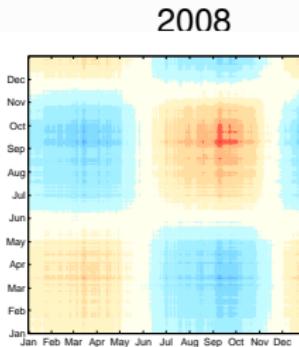
DINEOF, Beckers and Rixen, 2003, Alvera-Azcárate et al., 2005

- ✓ Based on the Singular Value Decomposition
- ✓ Iterative process
- ✓ Optimal number of modes → cross-validation

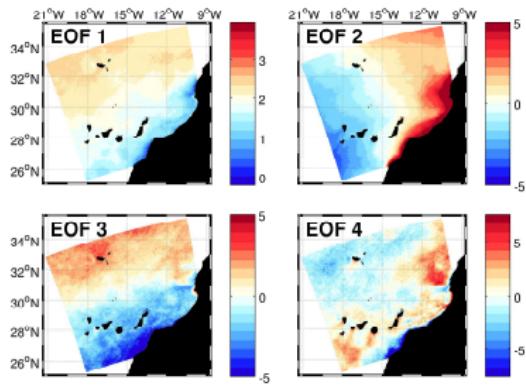


Temporal covariance matrix

- diagonal terms = variance of daily fields with respect to mean data
- off-diagonal terms = covariance of an individual image with the other ones.



EOF – 2008



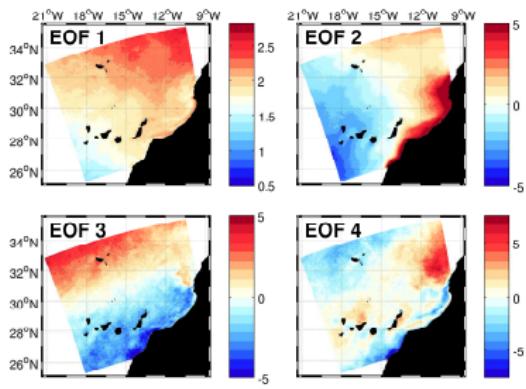
1st mode:
meridional gradient of temperature
seasonal cycle

2nd mode:
coastal vs. open-ocean waters
related to upwelling and filaments

3rd mode:
meridional gradient



Spatial EOF – 2009



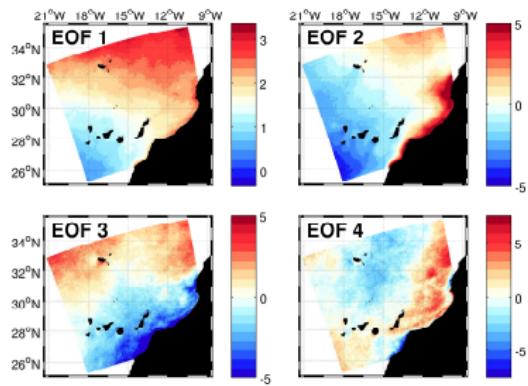
1st mode:
meridional gradient of temperature
seasonal cycle

2nd mode:
coastal vs. open-ocean waters
related to upwelling and filaments

3rd mode:
meridional gradient



Spatial EOF – 2010



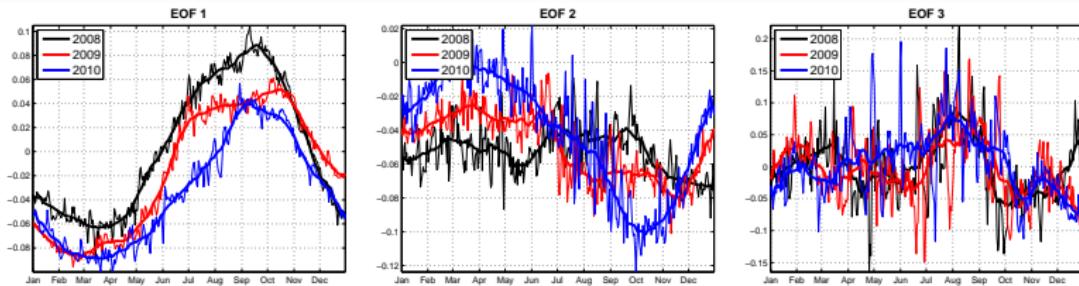
1st mode:
meridional gradient of temperature
seasonal cycle

2nd mode:
coastal vs. open-ocean waters
related to upwelling and filaments

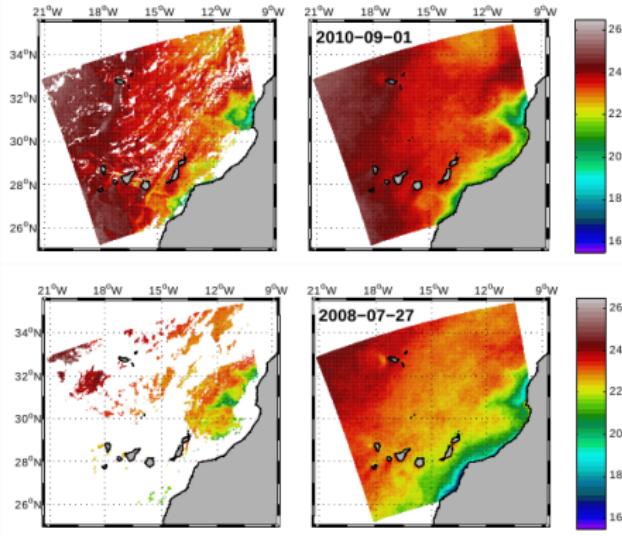
3rd mode:
meridional gradient



Temporal EOF – 2008, 2009, 2010

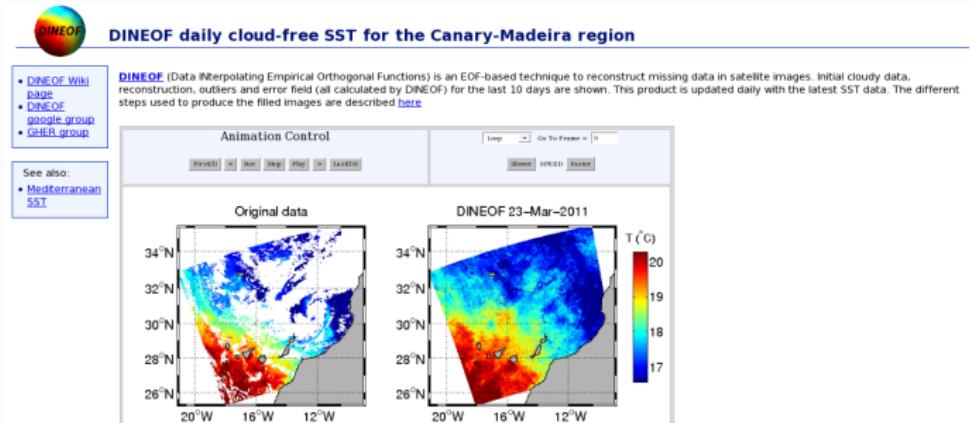


Examples



Near real-time reconstruction

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



Future work

- ✓ Combination of various sensors (MODIS, AVHRR, ...)
- ✓ Domain extension
- ✓ Use of in situ data



Conclusions

- Similar EOFs for 2008, 2009 and 2010
- Different behaviour in 2010 (time correlation)
- 2nd mode probably related to wind curl
- Dust not always detected

More details...

Poster: XY633
Wednesday, 06 Apr 2011

2010 anomalies:
poster: XY701
After this session

