

# Monitoring Marine Coastal Areas

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**Joint work with: G. Garcia-Sanchez, A.G. Ramos, J. Coca, V.J. Garcia-Garrido, S. Wiggins, E. Alvarez-Fanjul, B. Perez-Gomez , M. Garcia Sotillo, J. A. Jimenez-Madrid**





## COPERNICUS MARINE ENVIRONMENT MONITORING SERVICE

Providing PRODUCTS and SERVICES for all marine applications

➤ The Copernicus Marine Environment Monitoring Service offers through the Copernicus portal <http://marine.copernicus.eu/>

- Reliable ocean data
- Open access data

➤ The use of dynamical systems tools on accurate ocean velocity data sets, open new possibilities to address important ocean challenges.

Accurate Ocean Velocity Data

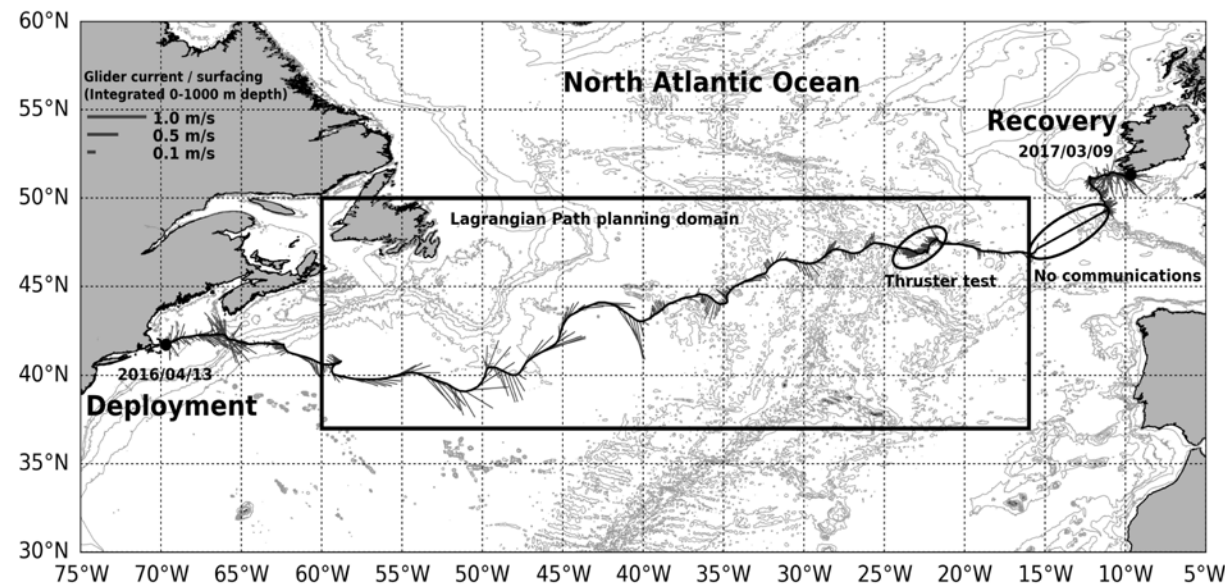


Dynamical System Tools

## Are available ocean data accurate?

A. G. Ramos, V. J. García-Garrido, A. M. Mancho, S. Wiggins, J. Coca, S. Glenn, O. Schofield, J. Kohut, D. Aragon, J. Kerfoot, T. Haskins, T. Miles, C. Haldeman, N. Strandskov, B. Allsup, C. Jones, and J. Shapiro. Lagrangian coherent structure assisted path planning for transoceanic autonomous underwater vehicle missions. Scientific Reports. 8, 4575 (2018).

- **Silbo Mission: a trans-Atlantic crossing from Massachusetts to Ireland between the 13th April 2016- March 9th 2017**



- **Dynamical features detected from the Copernicus Global Model are a robust feature visible by Silbo.**

## Are available ocean data accurate?

V. J. García-Garrido, A. Ramos, A. M Mancho, J. Coca, S. Wiggins. A dynamical systems perspective for a real-time response to a marine oil spill. *Marine Pollution Bulletin* 112, 201-210 (2016).

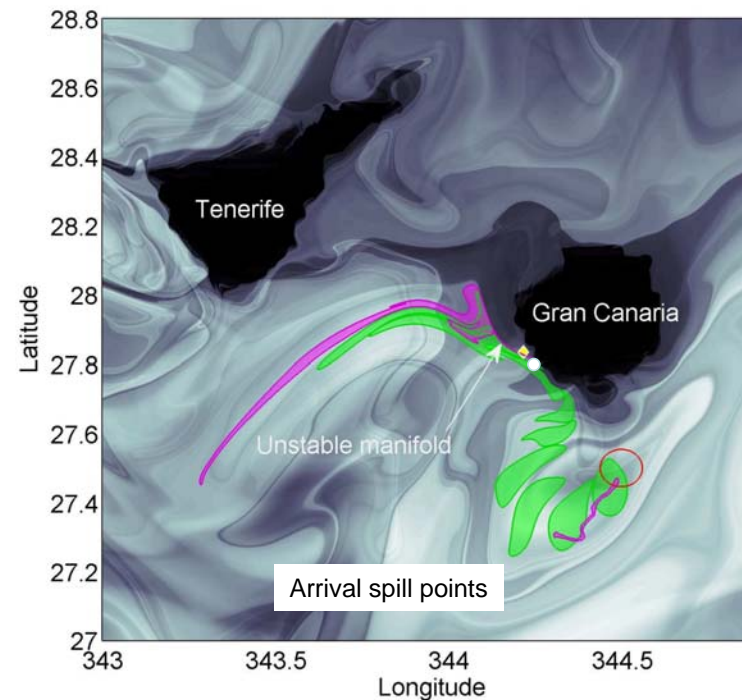
### Oleg Naydenov

- Oleg Naydenov caught fire on Saturday 11th April 2015 in Las Palmas Port
- Spanish authorities towed the ship out of the port
- The fishing ship eventually sank on the night of the 14th April in waters 2700m deep
- On the 16th of April, several oil slicks were spotted on the sea surface
- Important questions that raised then were: would the spill arrive to the coast? Was the sinking point dangerous in this regard?

## Are available ocean data accurate?

Oleg Naydenov

23rd April 2015



We were able to compute with these tools **the date of the arrival of the fuel to the coast**, on the 23rd of April, and also **the point of arrival**, marked in white, which was very close to what was observed from the in situ observations, marked in yellow.

## **Are available ocean data accurate?**

- **The potential of these tools is remarkable. In contrast the emergency services acquired a precise knowledge of the evolution of the spill by means of a formidable effort, which involved maritime rescue ships, exploratory flights of Search and Rescue aircrafts and the work of many people.**
- **The implementation of protocols that take advantage of the information provide by models under this kind of emergencies, could save millions, since the management of the Oleg Naydenov spill cost 60 millions euros to the government coffers**

## Monitoring the coast: operational tools

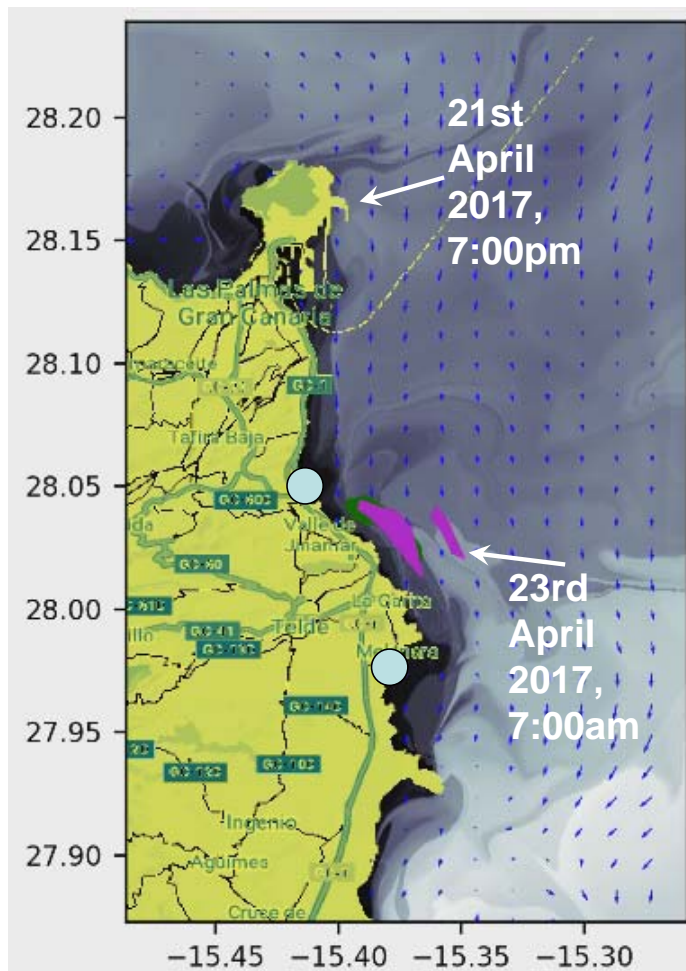
- Making these tools more operational is of great interest.
- Coastal areas offer many opportunities to deal with the management of coastal environmental problems:  
coastal waste, oil spills in harbors, algae blooms
- Dealing with coastal areas require building downscaled models which in turn require validation.
- IMPRESSIVE H2020 project:

*Integrated Marine Pollution Risk assessment and Emergency management Support Service In ports and coastal enVironmEnts*

<http://impressive-project.eu/>



## Monitoring the coast: operational tools



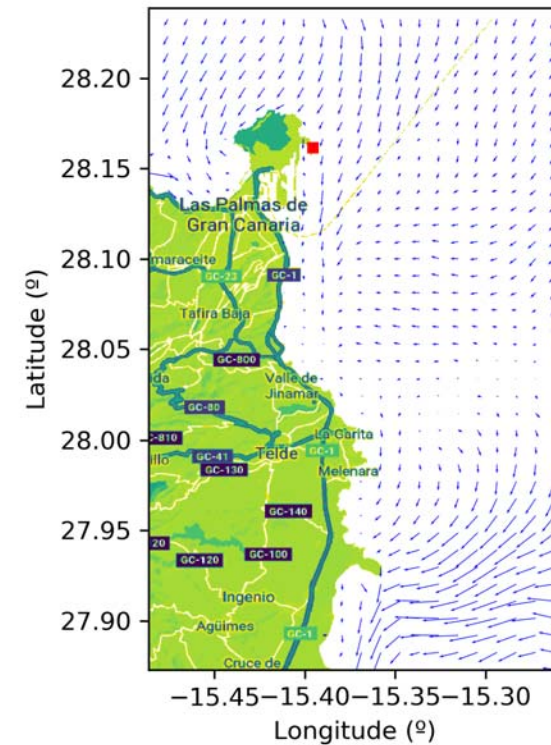
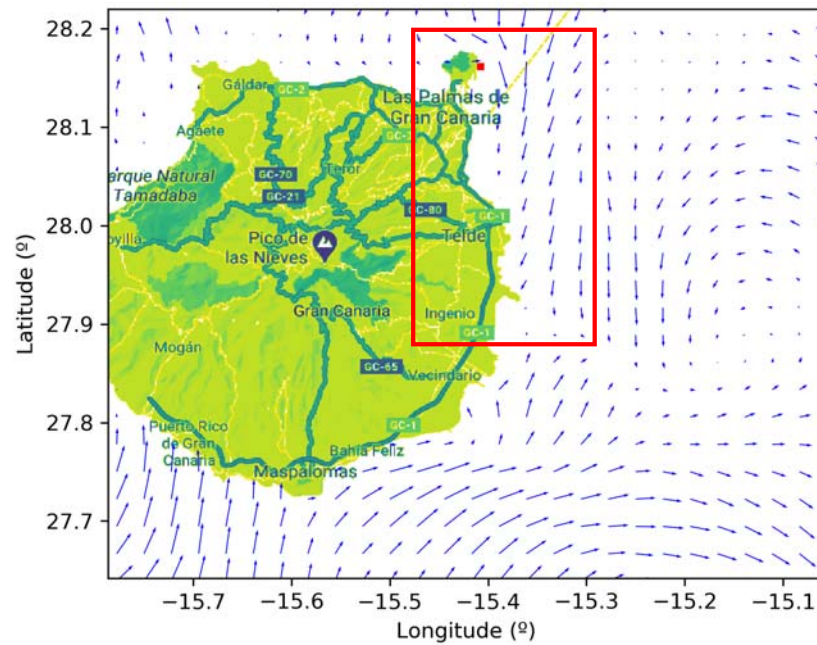
**The Ferry Volcan de Tamasite crashed into the Mandela Pier of Port of La luz on the 21st April.**

**After the crash, an oil conducting pipe broke, and oil poured into the ocean.**

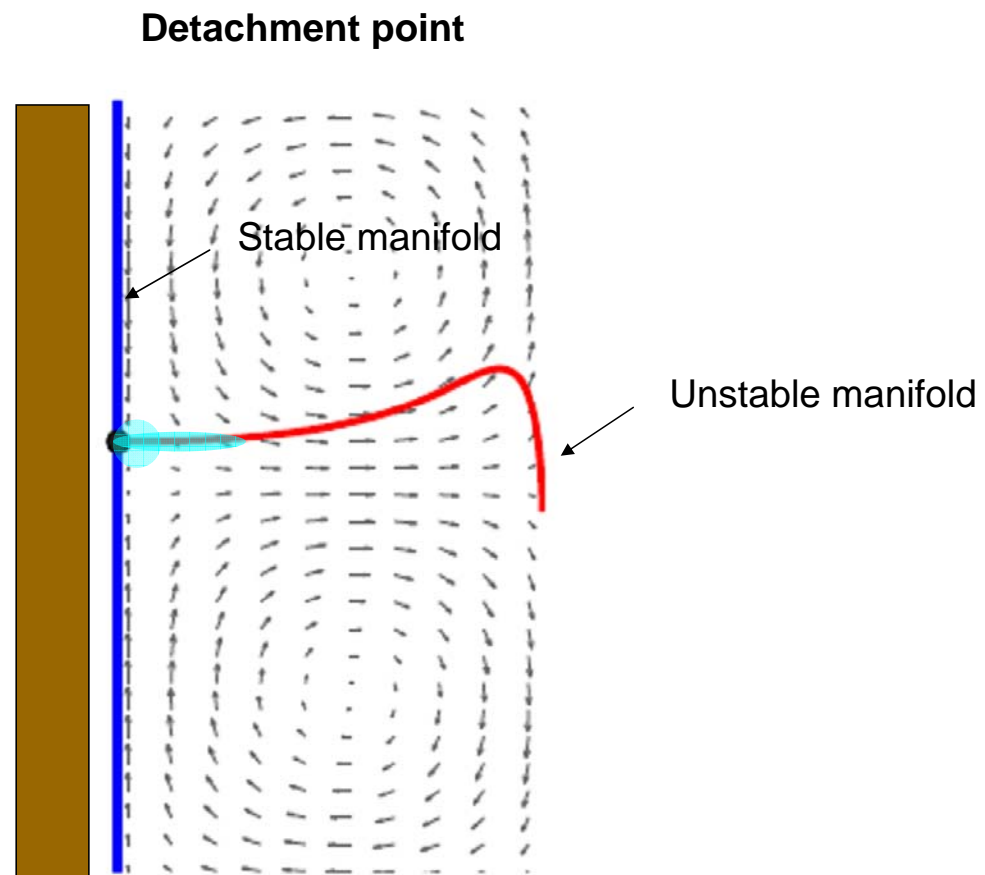
**On the 23rd of April at 7:00 am oil was teledetected at the south of the accident**



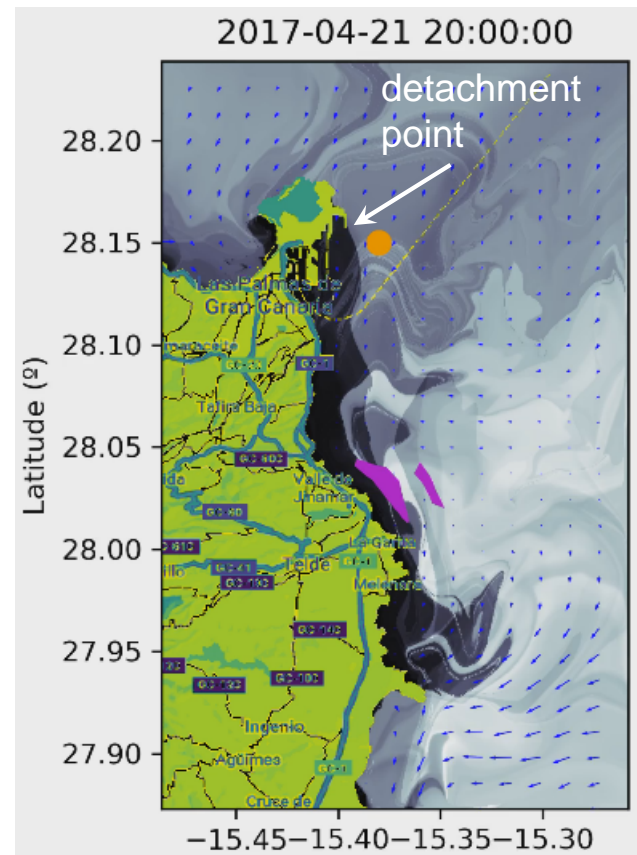
## Monitoring the coast: operational tools



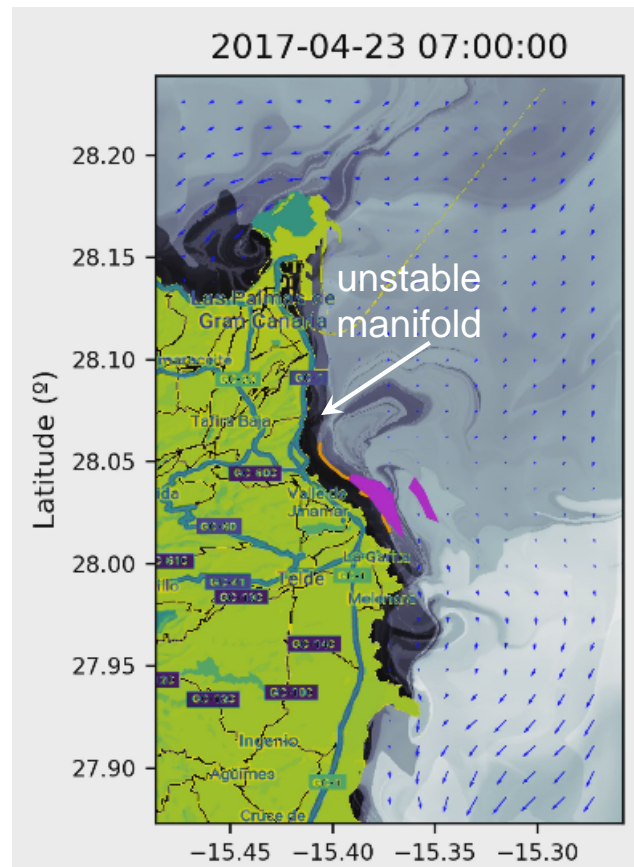
## Dynamical systems tools



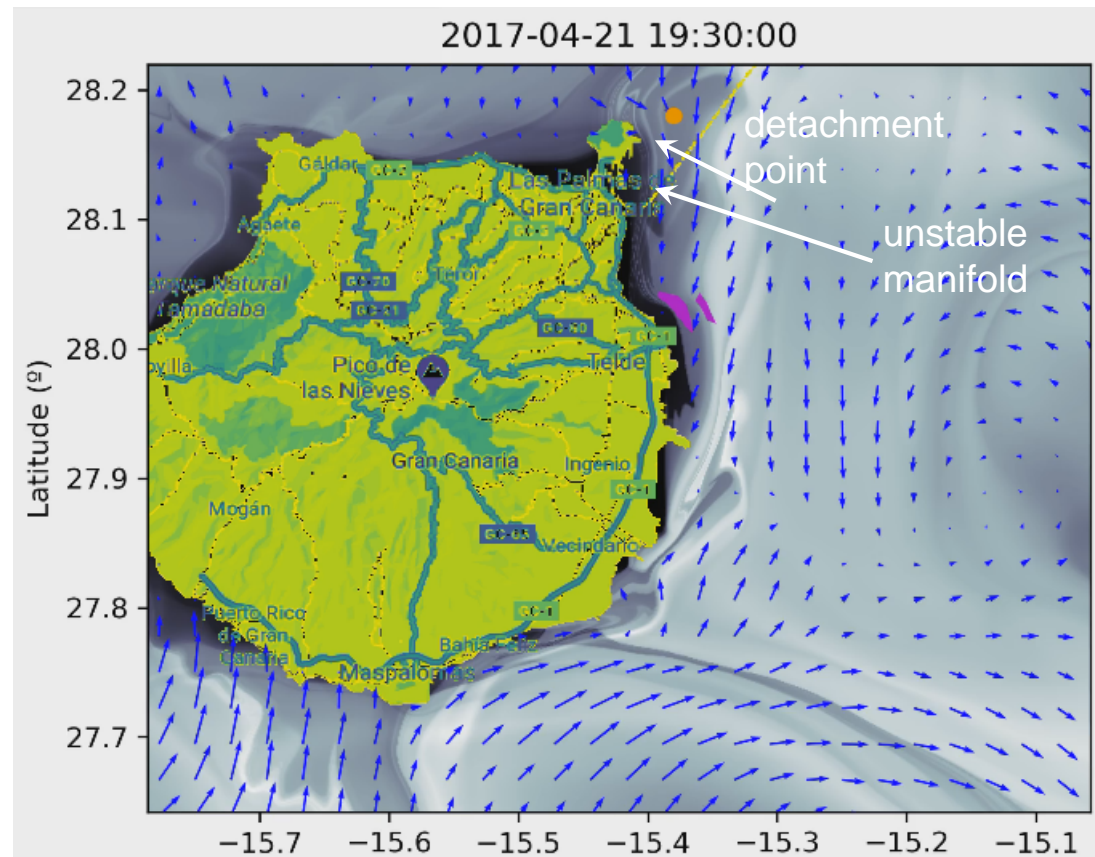
## Monitoring the coast: dynamical systems



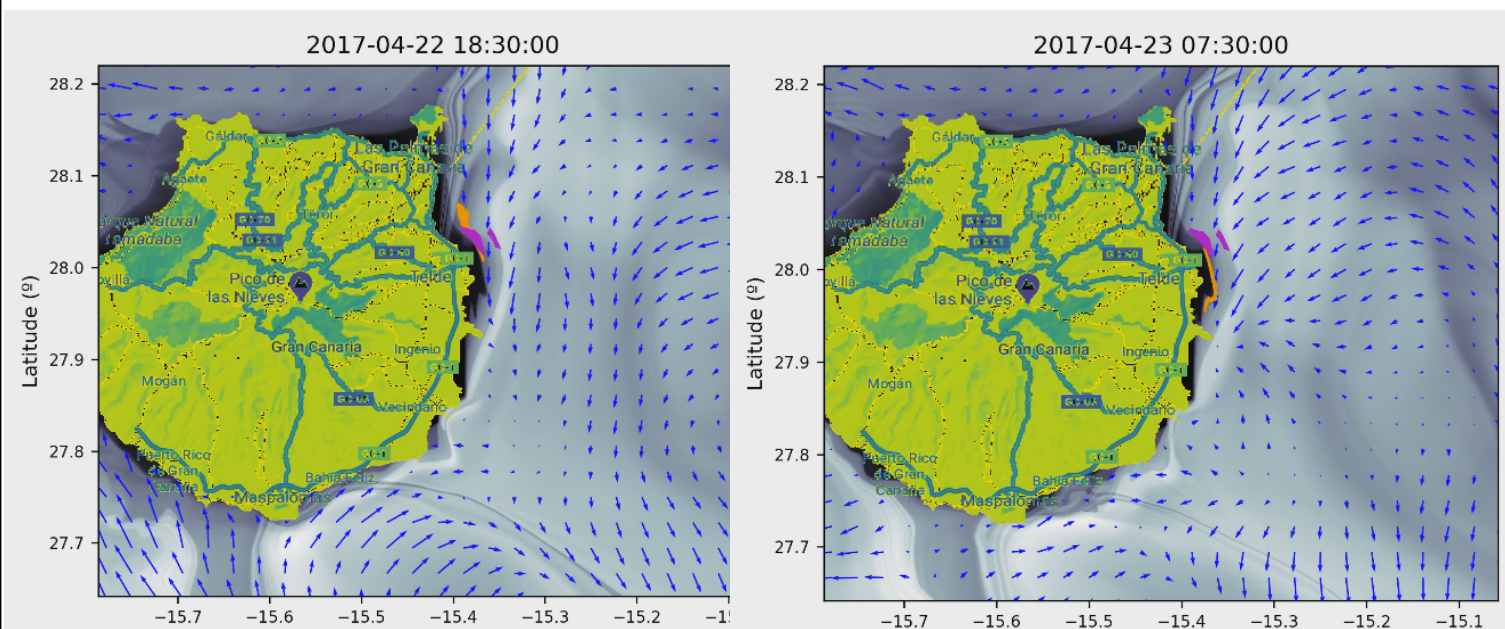
## Monitoring the coast: dynamical systems



## Monitoring the coast: dynamical systems



## Monitoring the coast: dynamical systems





## Conclusions

- **The availability of reliable ocean data and their analysis with dynamical systems tools:**
  - **have succeeded in important ocean challenges**
  - **have inspired the exploration of the operational capacity of these tools in coastal areas.**
- **This approach is supported by the sequence of events occurred after the crash of the Ferry Volcan de Tamasite that are accurately described by the models.**

## Future work

➤ Search for further operational opportunities for these tools

➤ **BEWATS project funded by Fundación Biodiversidad :**

*Monitoring coastal waste in protected coastal areas*

*<https://es-es.facebook.com/BewatsPL>*



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