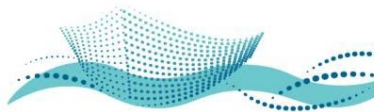




# TOPVOYS - Tools for Optimizing Performance of Voyages at Sea



3-years Project Started in October 2018



**MarTERA**  
ERA-NET COFUND

Atlantic Workshop Southampton 23-25 January 2019



Project Manager: Johnny A. Johannessen



Dr. Fabrice Collard



Dr. Jean-Pierre Maze



Dr. Marjolaine Krüg



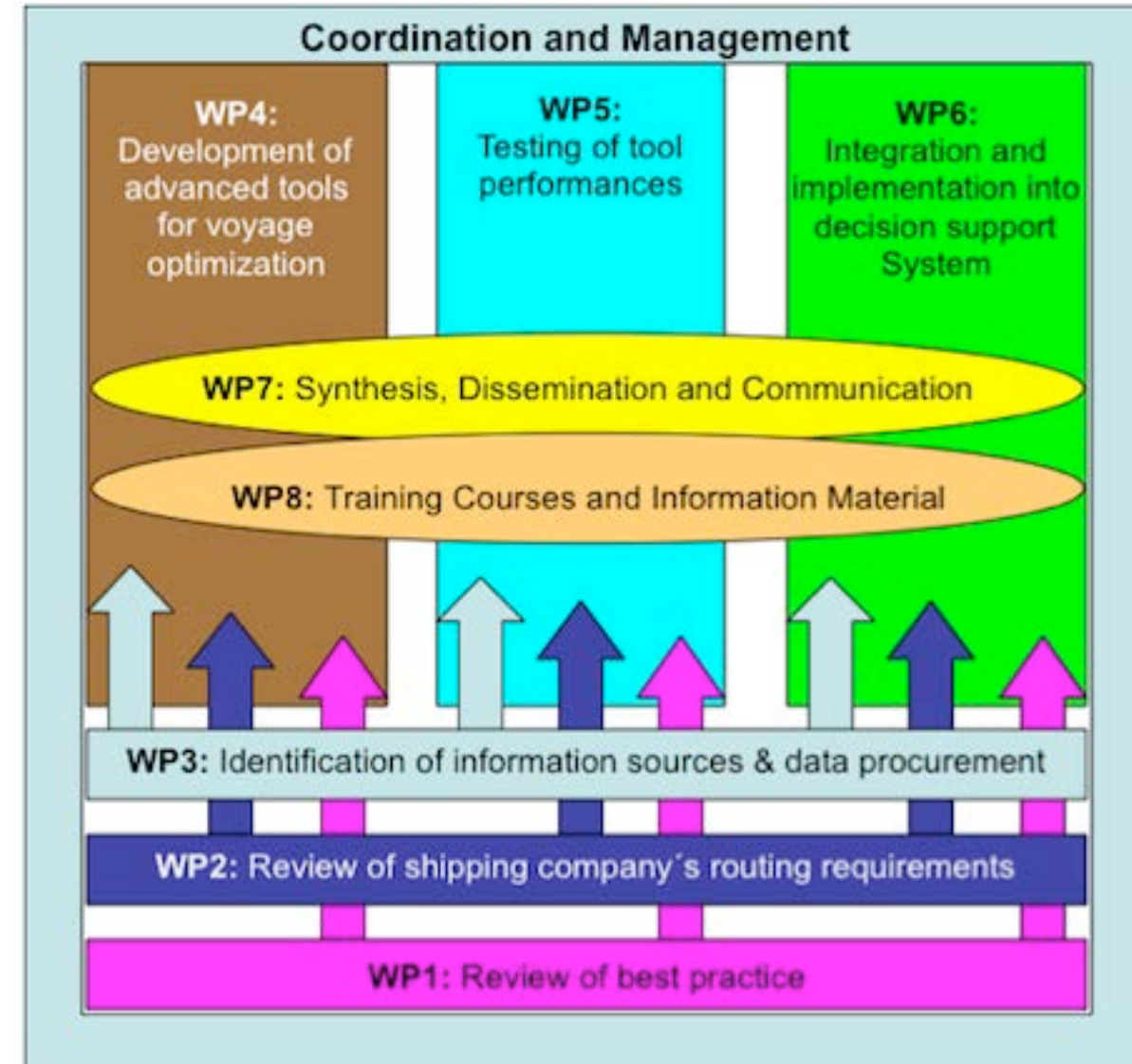
Dr. Oswald Frank



Dr. Joicelyn Rapp



Jan-Øyvind Svardal



Atlantic Workshop Southampton 23-25 January 2019



## Why Ship-routing

- Shipping companies are faced with environment-based requirements on reduction in CO<sub>2</sub> and NO<sub>x</sub> releases from ships;
- Reduced fuel consumption is cost saving and contributes to decline in emission;
- Ship routing should benefit from use of reliable observations of **waves, current and wave-current interactions** for reduced fuel consumption & emissions and for improved safety;
- Satellite observations are essential in this context;
- This will be tested in post-voyage analyses and real time routes with specific focus on:
  - North Atlantic Ocean crossings;
  - Voyages around Southern Africa;
  - Voyages from Europe to the Far East (e.g. China, South Korea, Japan);

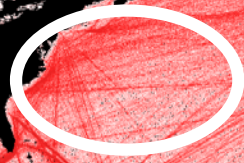


1700 century Benjamin Franklin map of the Gulf Stream

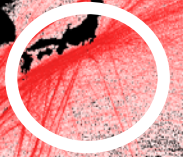


# Today's Map of Global Shipping Lanes

Marks areas of Strong  
wave-current interactions



Marks areas of Strong  
wave-current interactions



Marks areas of Strong  
wave-current interactions

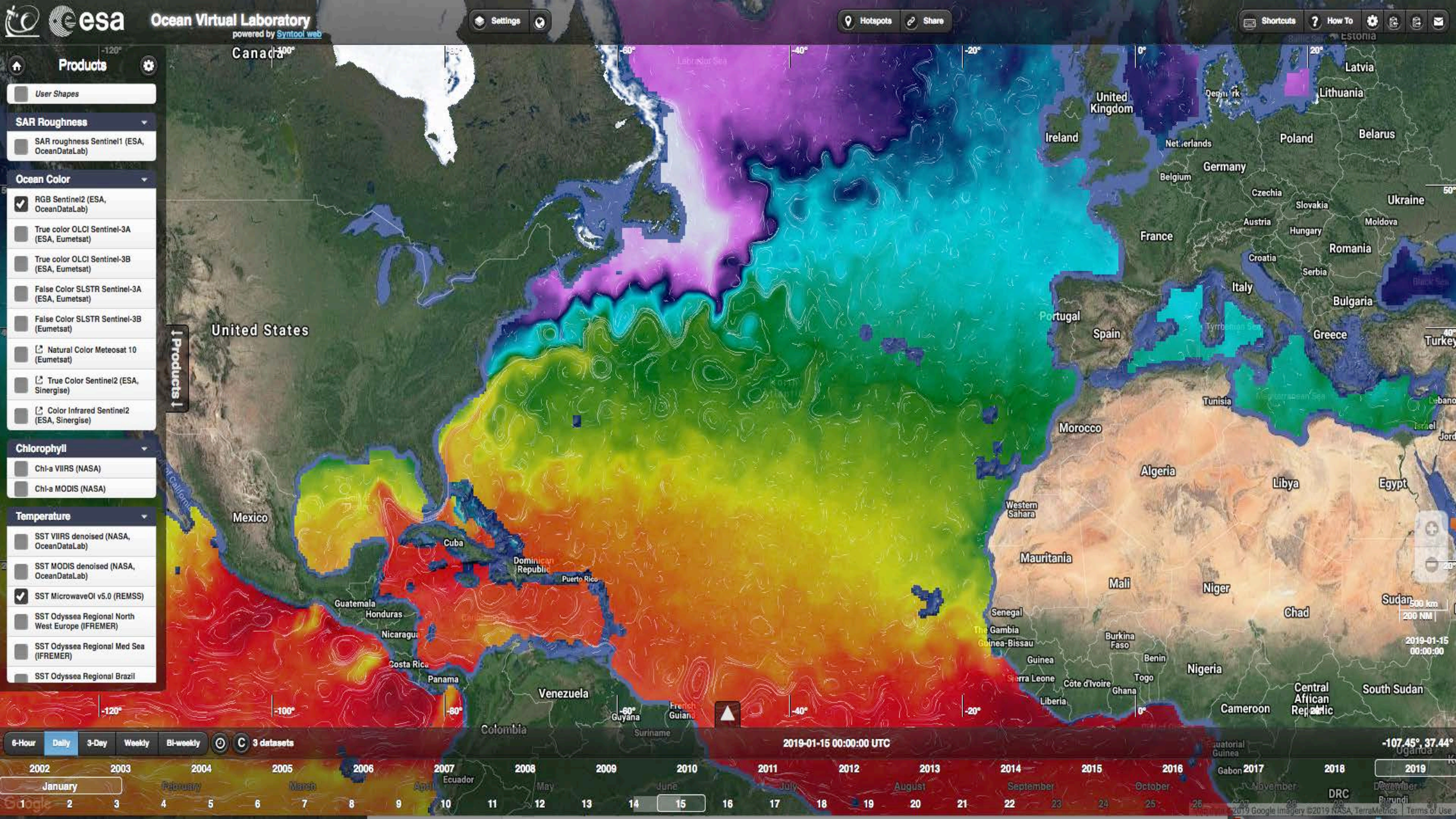




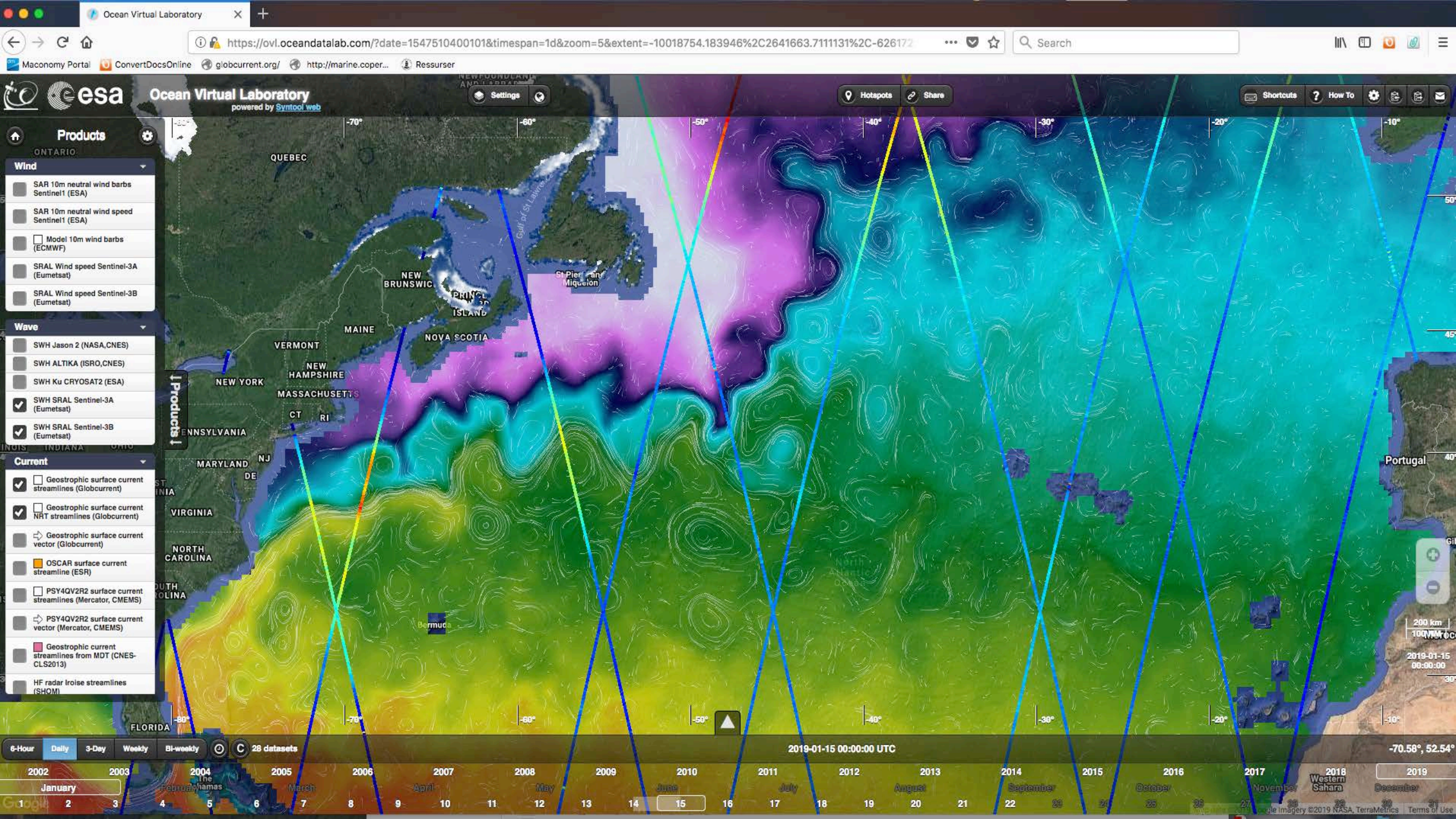
## TOPVOYS Main Goals and Approach

- Advance analyses tools and decision support system for voyage optimization.
- Combine marine weather analyses and forecasts including wind, wave and surface current conditions, ship characteristics and cargo requirements, with real time analyses of satellite data, including;
  - ❖ AIS
  - ❖ Altimetry for SWH and surface geostrophic current;
  - ❖ Radiometry for SST;
  - ❖ High-resolution imageries (SAR, infrared, spectrometer) for snapshots

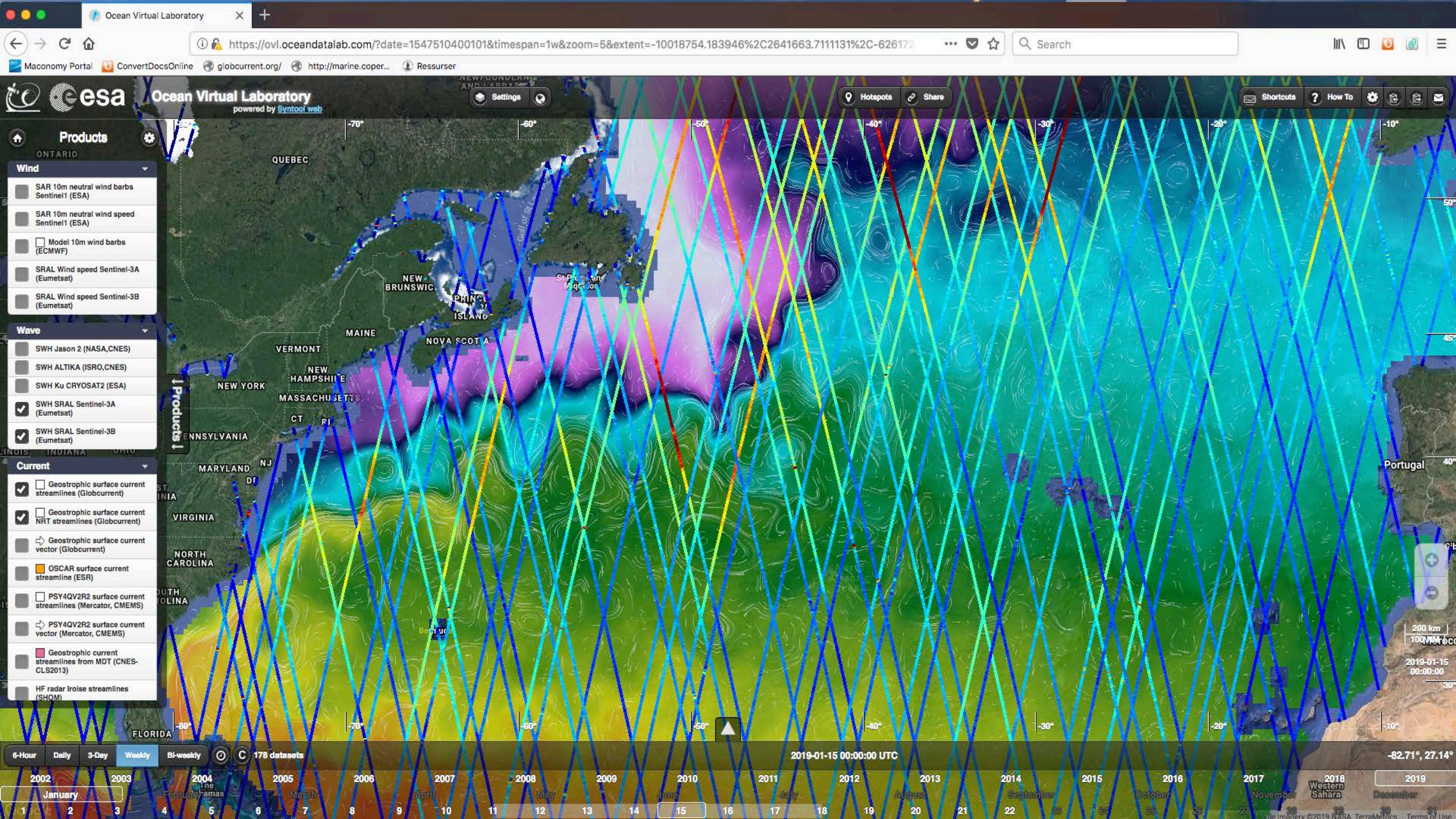




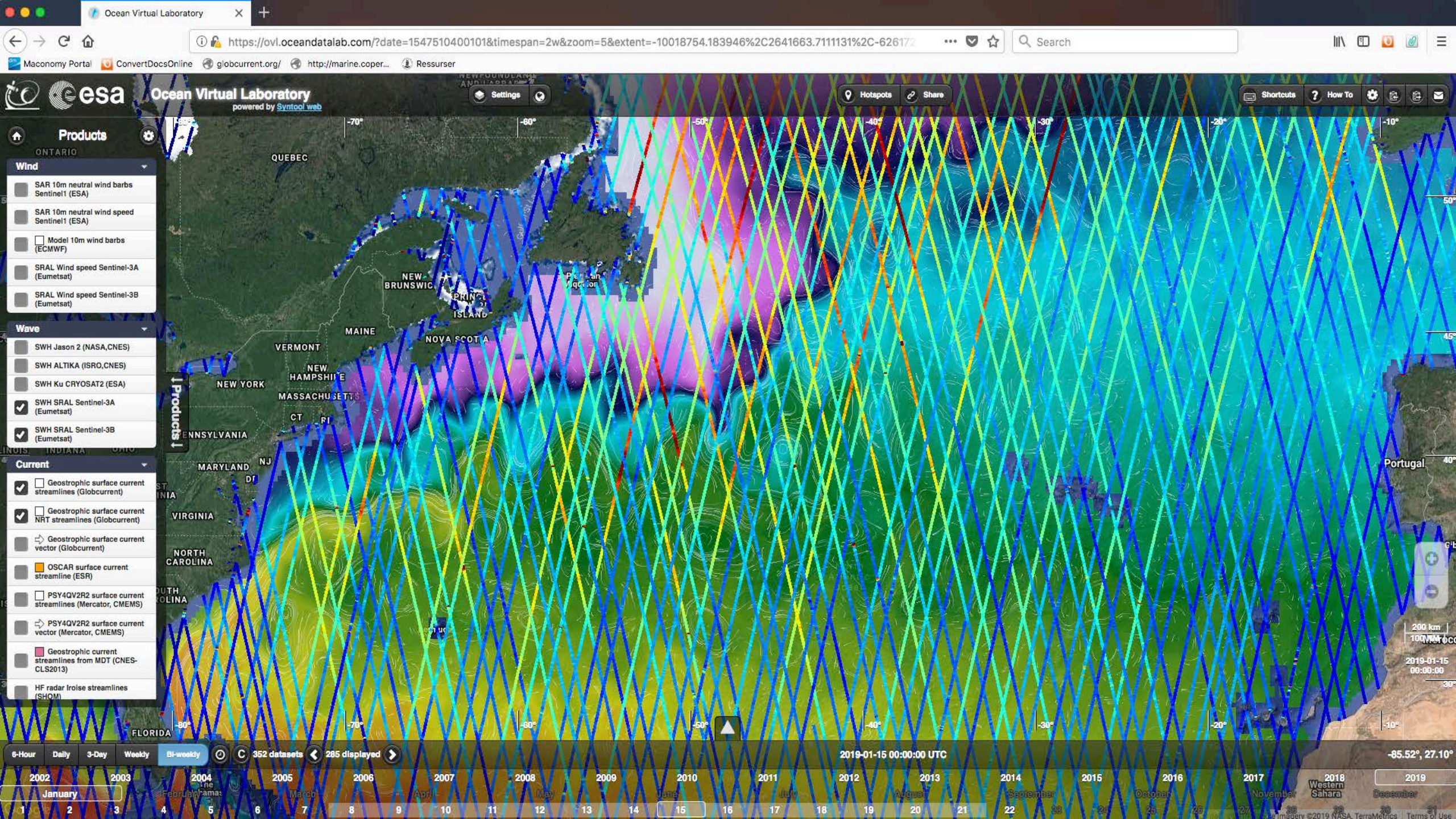












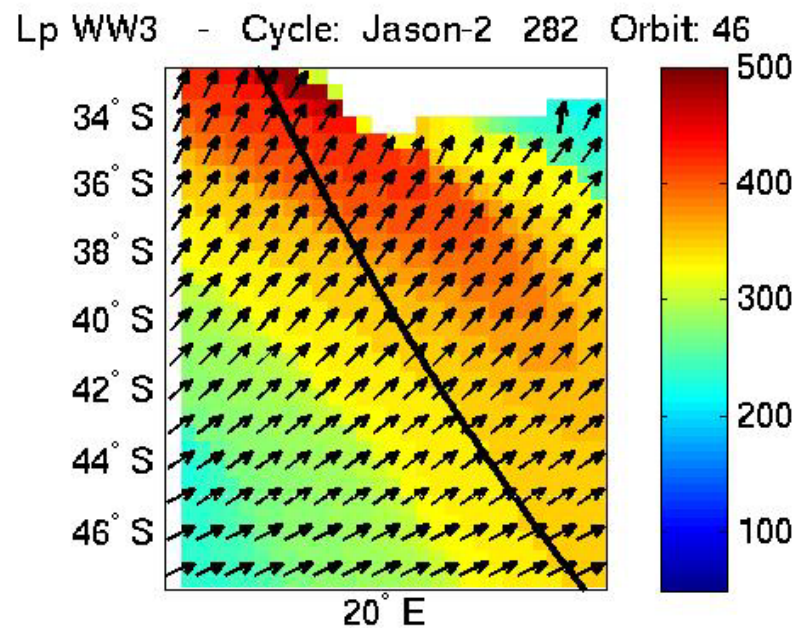
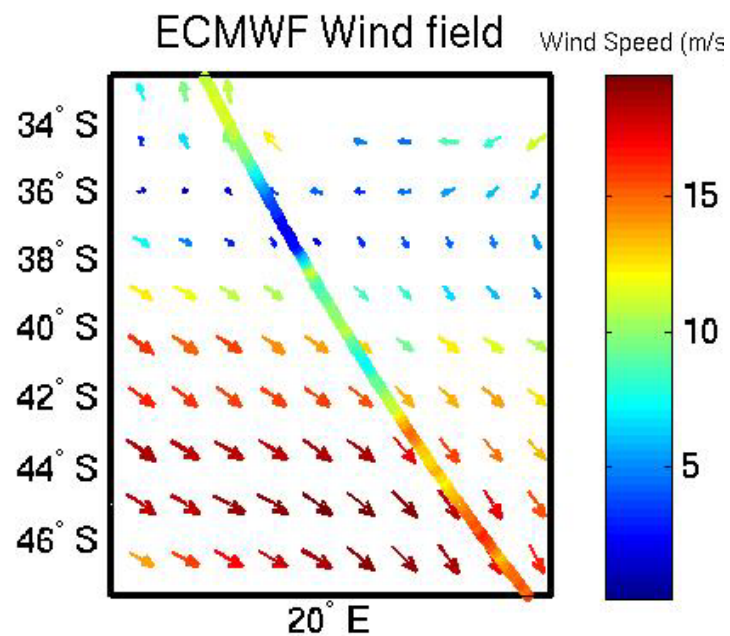


## An example

### Wave-Current interaction in the Agulhas Current region on 28-29 March 2016

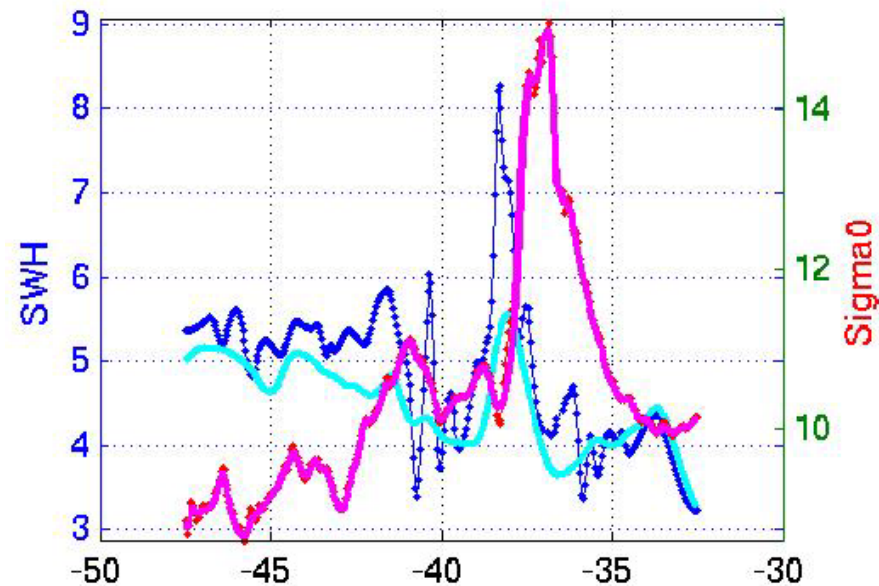
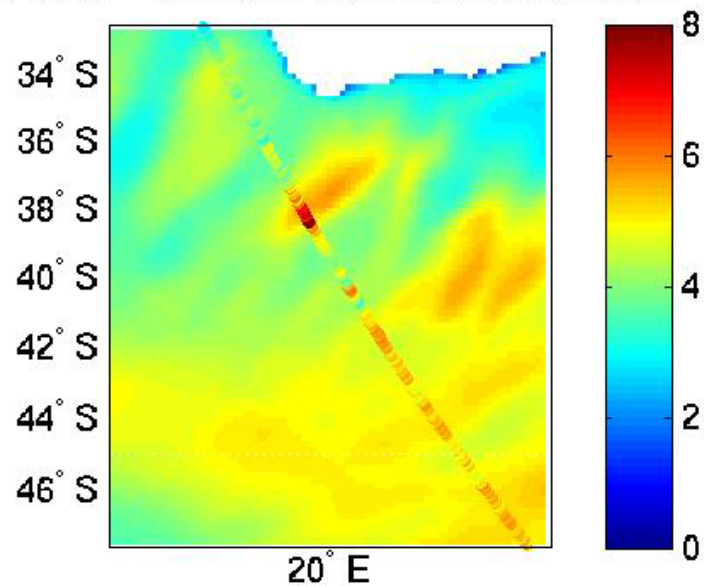
- ECMWF wind field
- WaveWatch III model sea state
- Altimeter SWH observations
- Simulated swell-current interactions





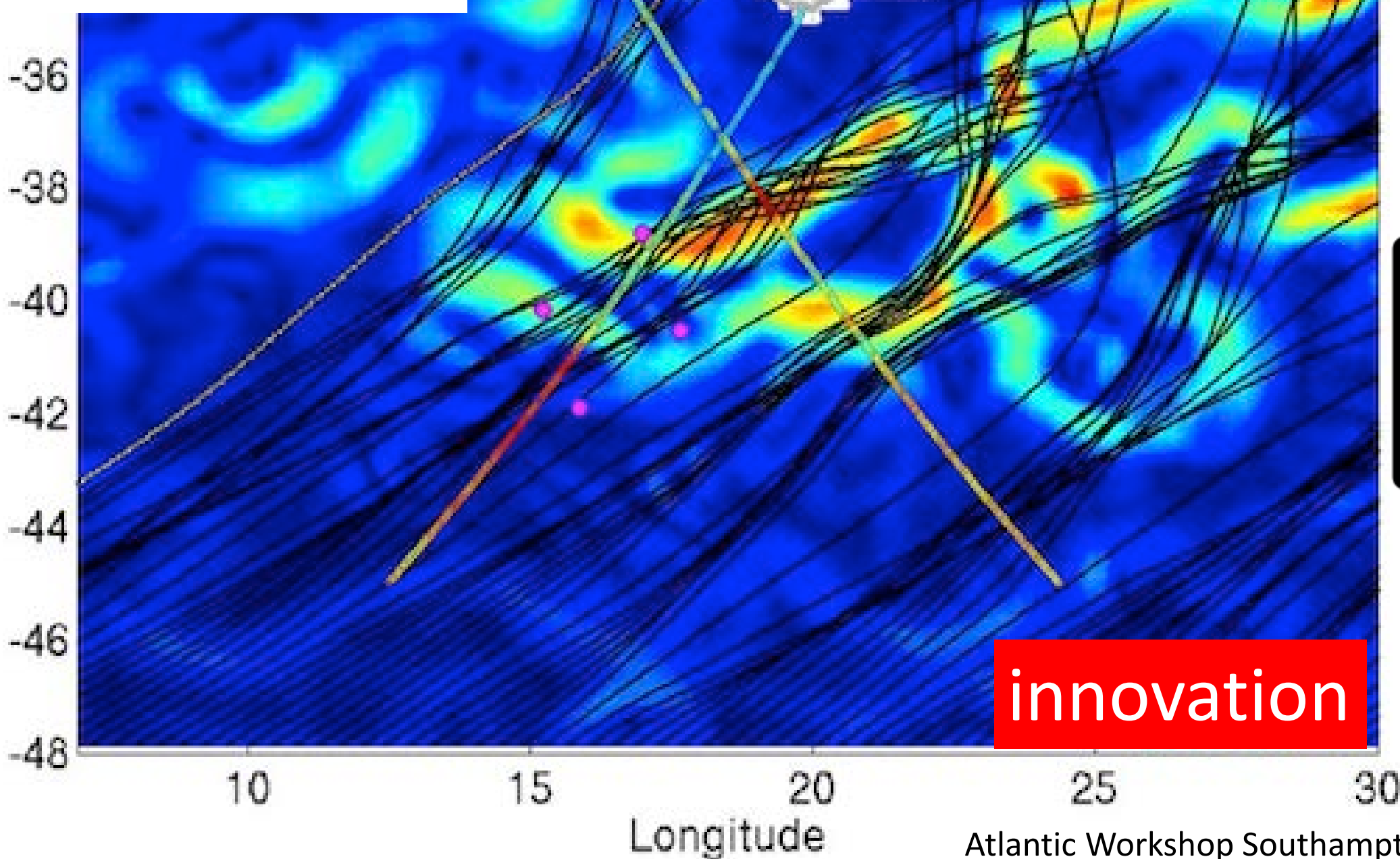
innovation

Hs WW3 - Altimeter Date 2016.02.29.03.17

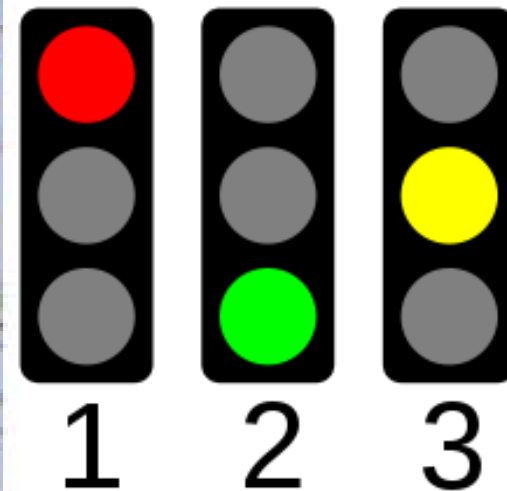




Wave-rays - black lines  
Surface current - colored

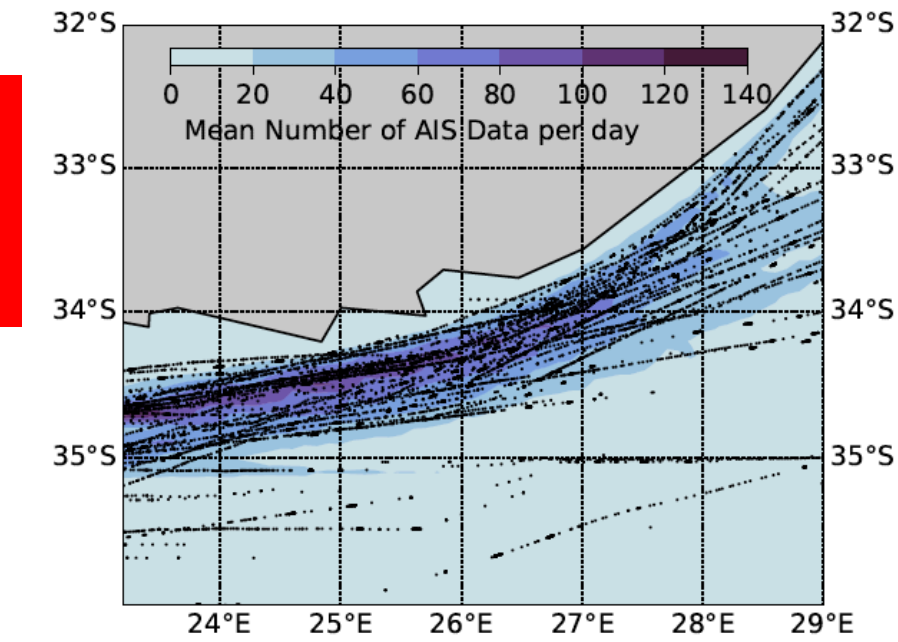


Traffic-Light  
System

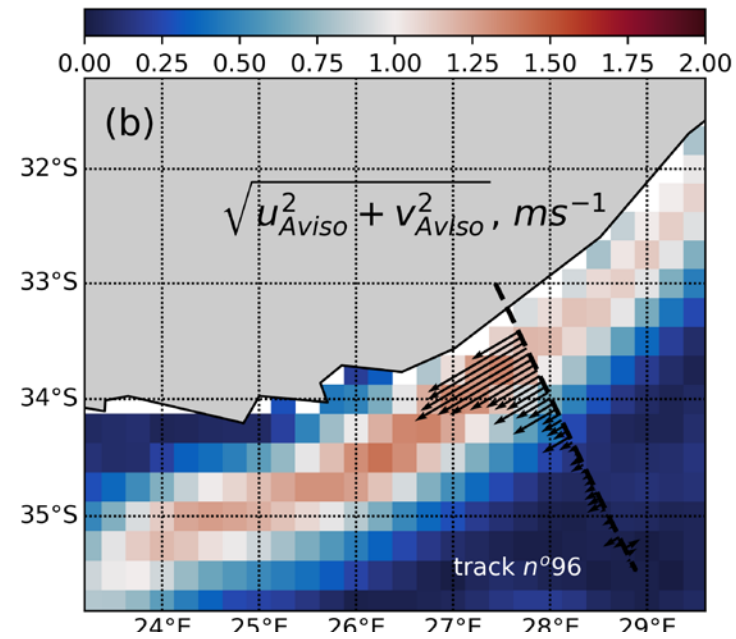




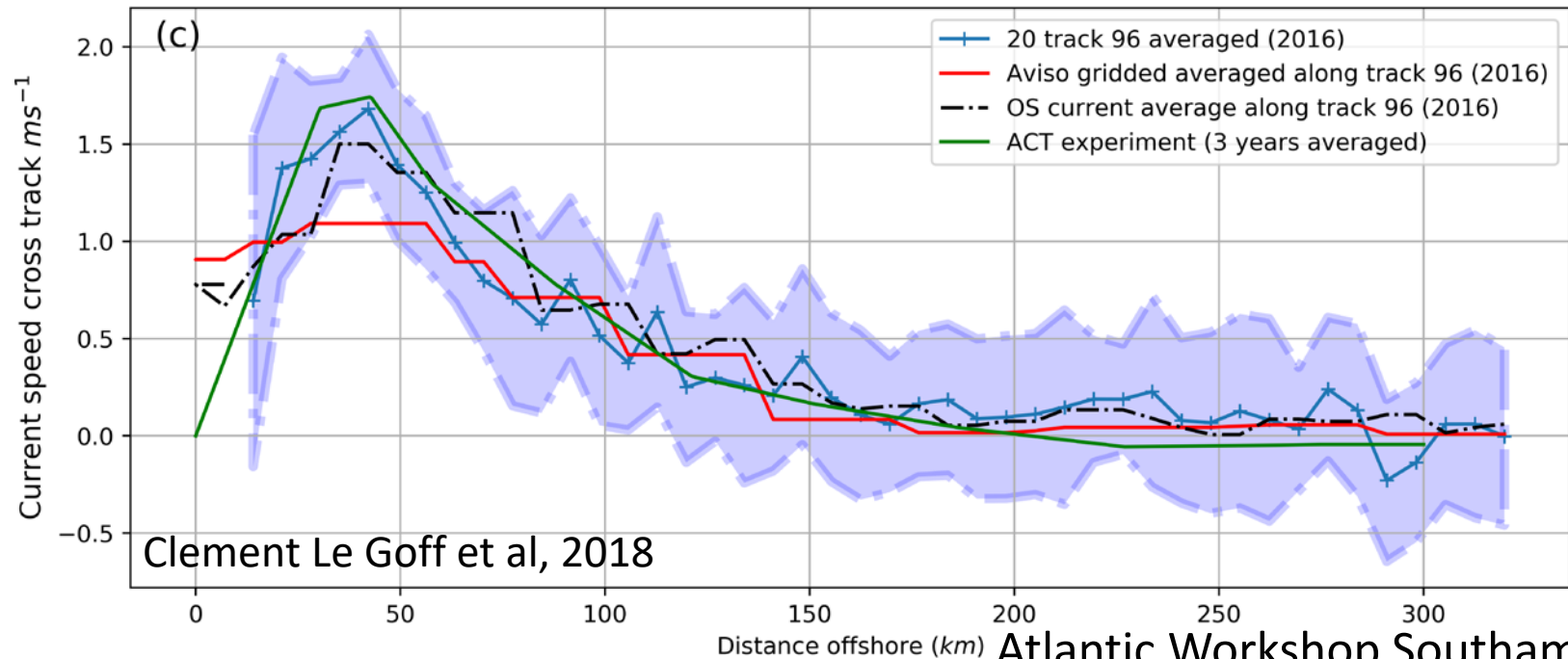
Ship density  
in Agulhas  
Current



Surface current  
observations



Real time  
use of AIS



innovations

Clement Le Goff et al, 2018



## TOPVOYS Outlook – next 6 months

- This TOPVOYS project is highly benefitting from active participation of 2 shipping Companies;
- Detailed knowledge of routing requirements and best practice;
- Select some recent reported difficult ship voyages and carry out reanalyses;
  - Run WW3 model with surface current input;
  - Reprocess altimetry SWH data and compute gradients and max/min wave height;
  - Overlay the SST field and surface current field;
  - Examine the AIS data
- Be present at a World Ocean Current user consultation meeting in ESA-ESRIN, 21-22 February 2019;





## **Recommendations** on future investments in the Atlantic Region.

- A multidisciplinary Atlantic Cluster on Marine Litter might be timely;
- Shipping companies should be invited to take part (e.g. in-situ water sampling);
- Surface current and waves are essential physical ocean variables;
- How can satellite-based imaging spectrometry contribute?
- First step might be to call for a brainstorming meeting.