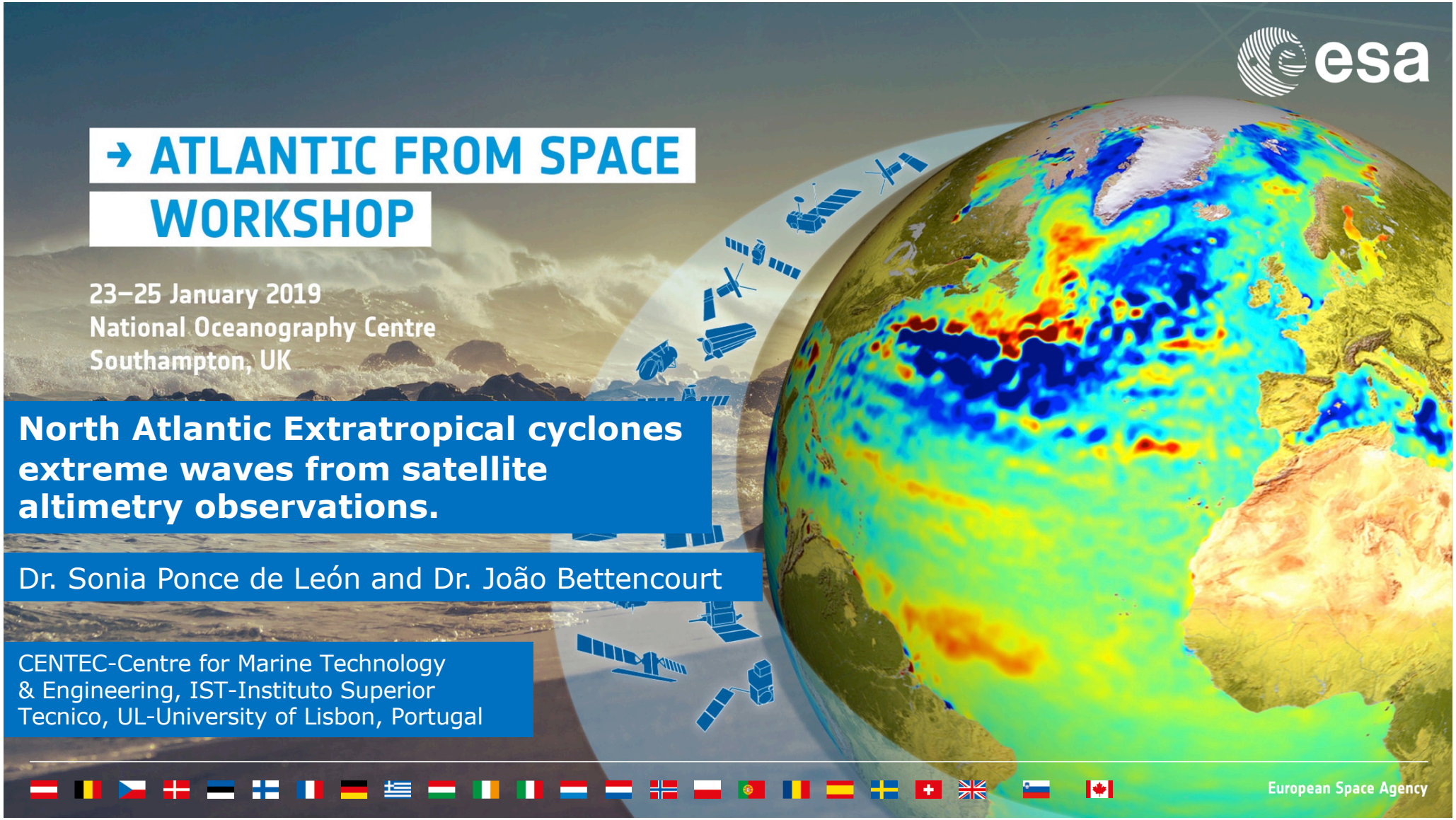
esa
→ ATLANTIC FROM SPACE
WORKSHOP
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National Oceanography Centre
Southampton, UK
North Atlantic Extratropical cyclones extreme waves from satellite altimetry observations.
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European Space Agency

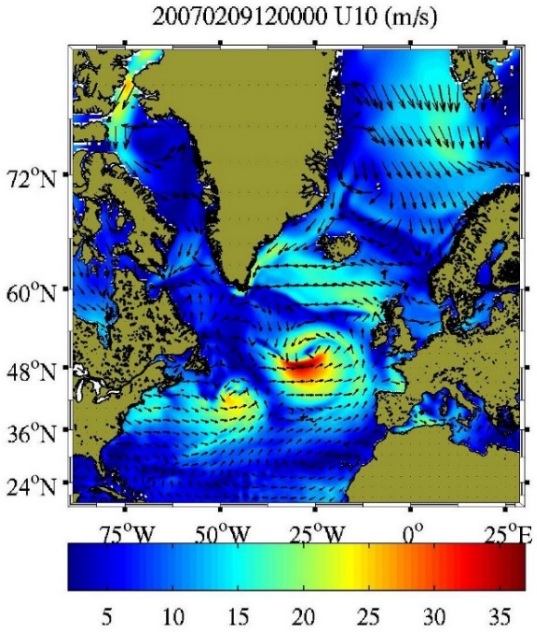
Introduction

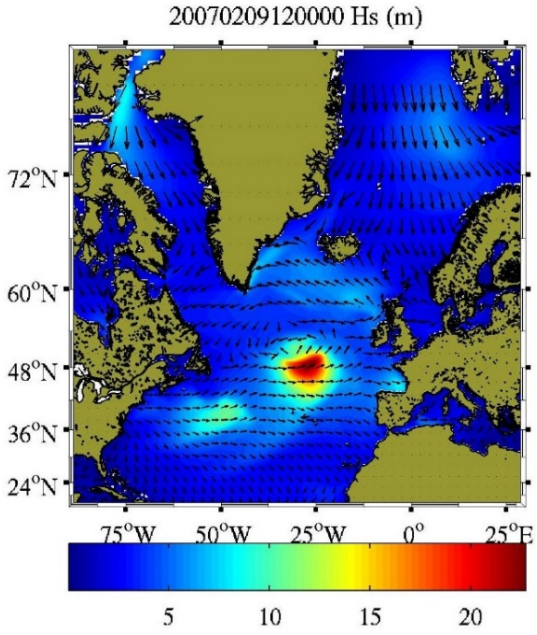
Why is it important the study of Extratropical Cyclones (ETCs)?

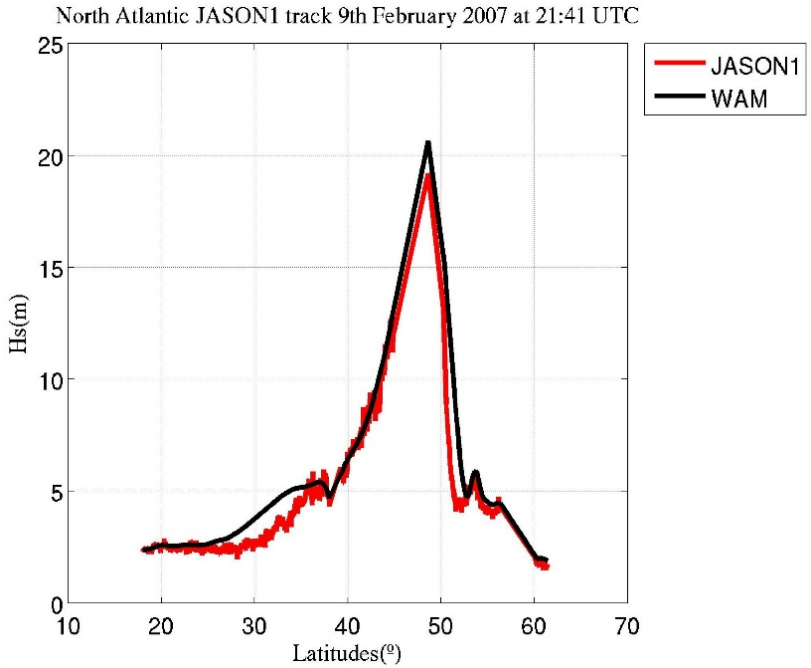
- Maritime safety, ship routing
- ETCs play a large role in determining wave conditions in western Europe
- Cyclone activity controls the synoptic variability

- Kita, Waseda and Webb (2018) [Ocean Dynamics]
- Ponce de León and Guedes Soares (2014) [Ocean Modeling]
- Mori (2012) [JGR]
- Rudeva and Gulev (2011) [MWR]
- Among many other authors

Introduction







Taken from:

Ponce de León and Guedes Soares (2014)

Extreme wave parameters under North Atlantic extratropical cyclones, Ocean Modelling 81, 78-88

http://dx.doi.org/10.1016/j.ocemod.2014.07.005

Data and Methods

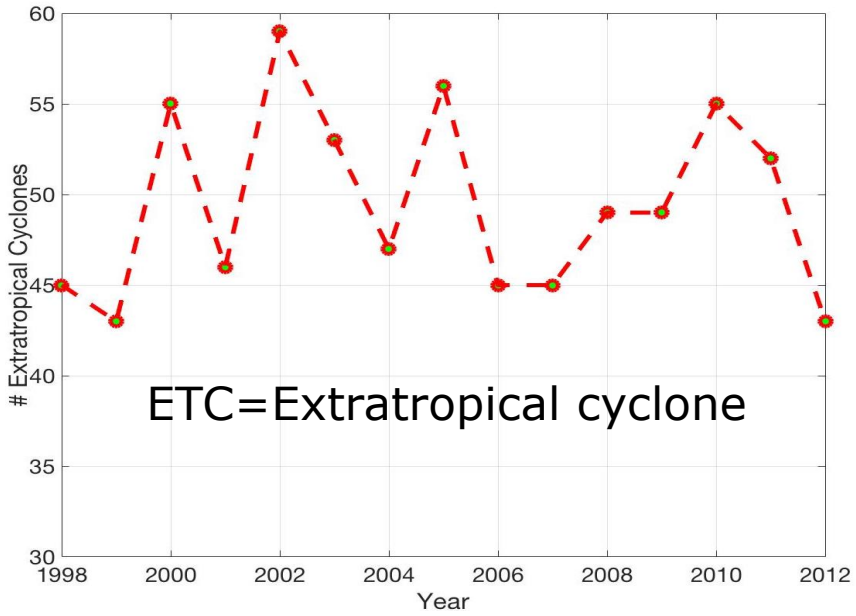
- The **Extratopical Cyclones** (**ETC**) **Database** consists of **58-year** (**1958 to 2016**) record of daily ETC characteristics for the Northern Hemisphere. The **ETC** data is obtained by the **Serreze et al. (1997)** algorithm from the daily **sea-level pressure** (SLP) fields of the **NCEP/NCAR reanalysis** dataset.

- The **GLOBWAVE Database** of **IFREMER,** is a uniform and quality controlled, multi-sensor set of satellite wave data with a consistent characterization of errors and biases.

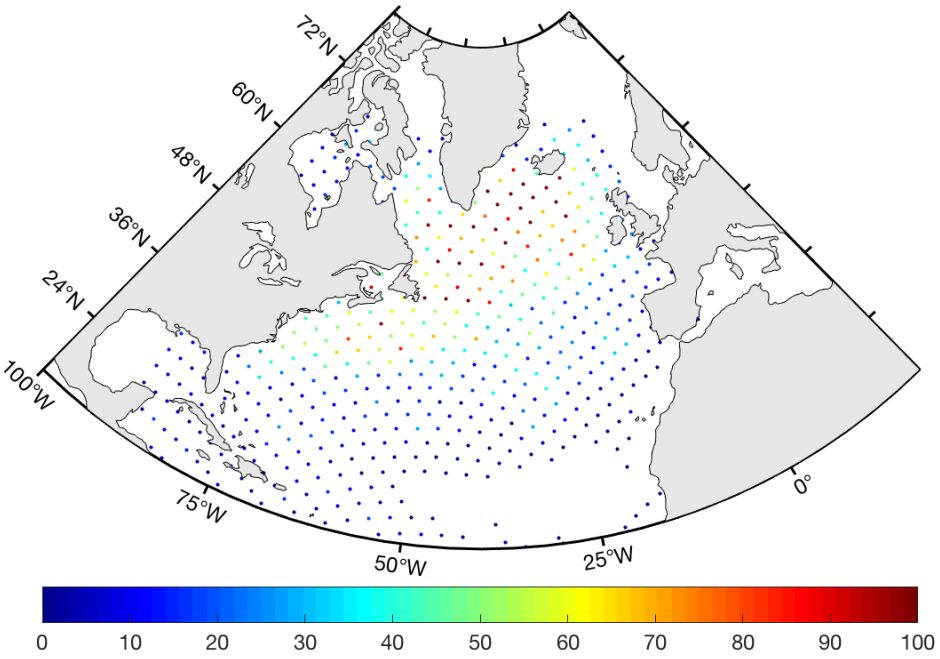
The data used in this study is the altimeter multimission **Hs** (*Significant Wave Height*) which is a merged global altimeter Hs data set from the six altimeter missions **ERS1&2**, **TOPEX-Poseidon**, **G**EOSAT **F**ollow**O**N (**GFO**), **Jason1** and **ENVISAT** (produced by **CERSAT/IFREMER**).

ETC selection

In the period 1998-2012 **742 ETCs** were selected (average **50** ETCs per **year**).



Track density of selected ETCs



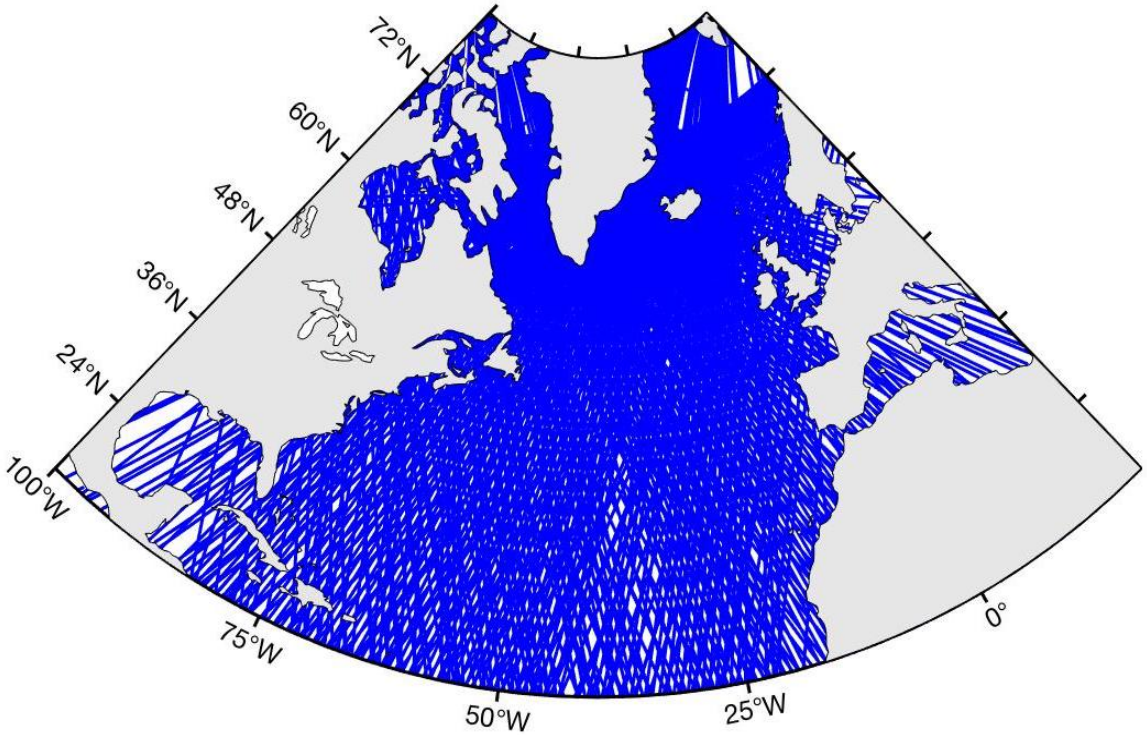
The track density of the selected ETC agrees with track density maps of several reanalysis ETC databases (review by Ulbrich et al., 2009).

Satellite data retrieval

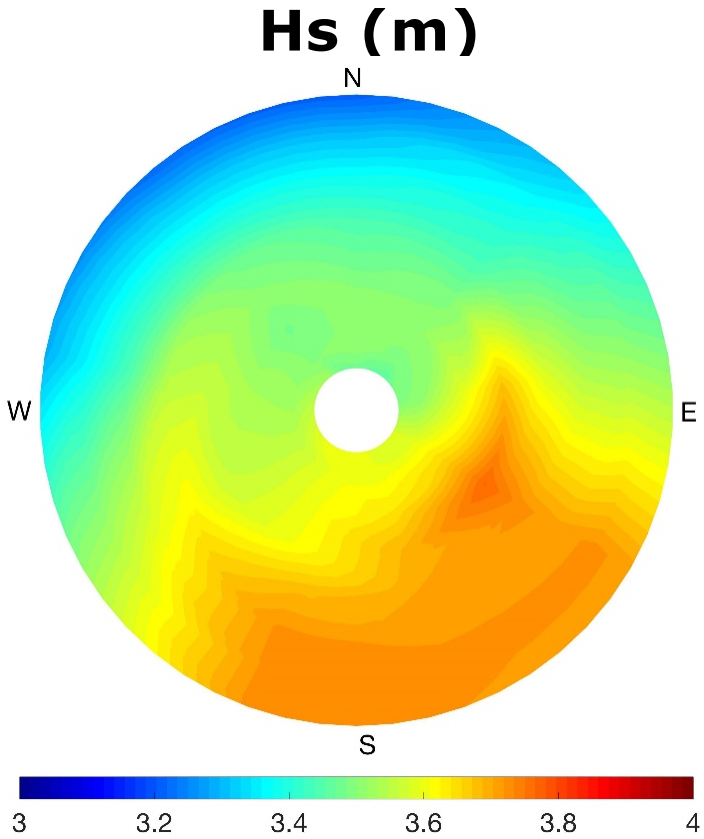
For the period 1998-2012 ~**22k data files** were retrieved and processed.

Mission	# Data files
ENVISAT	4663
ERS-2	4475
GFO	3246
JASON-1	6789
JASON-2	2835

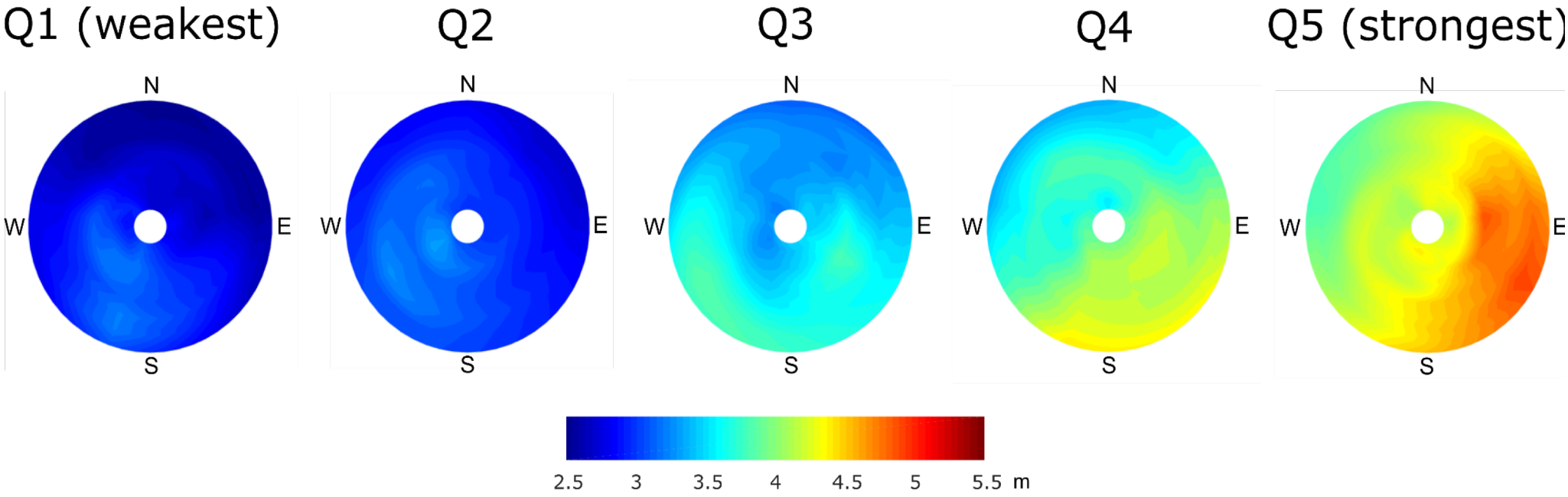
Altimeter tracks for 2002



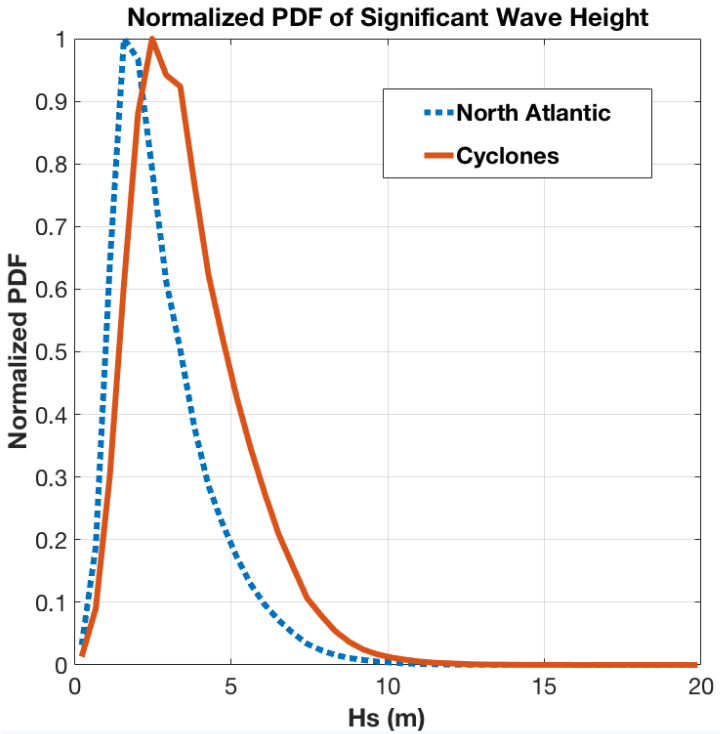
15 year ETC Hs composite maps

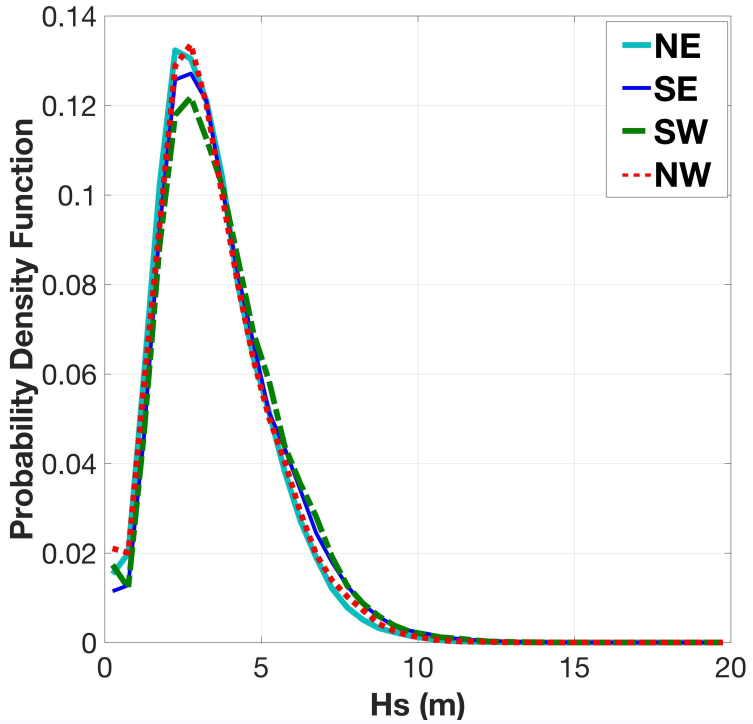


Hs composites vs intensity of the ETC



Hs probability density functions inside ETC





The normalized PDFs show that **inside the cyclones the probability of large waves is higher than on the North Atlantic**

Conclusions

- The Hs of North Atlantic extratropical cyclones considering a **15 year period of satellite altimetry** data was studied.
- The composite of all ETCs shows **higher Hs** in the **SE quadrant**, but there is a **high Hs variability** due to individual cyclone diferences.
- **Stronger ETCs** (Q5) have **higher Hs** in the **NE and SE sectors**; weaker ETCs (Q1,Q2) show higher Hs in the SW sector.
- During the **maximum strength stage** of ETCs, **Hs** averages can reach **5.5 m** in the **SE** and **SW** sectors.
- ETC have higher probability of large wave occurrence and the **most dangerous sector is the South East** where the **largest waves can be found**.

Recommendations

- Invest in the development of data products directed to a specific need/process.
- As an example integration of sea surface and atmospheric data to study extratropical cyclones and their wind waves.
- If possible, carry this integration all the way to the satellite design