DLR

esa

living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

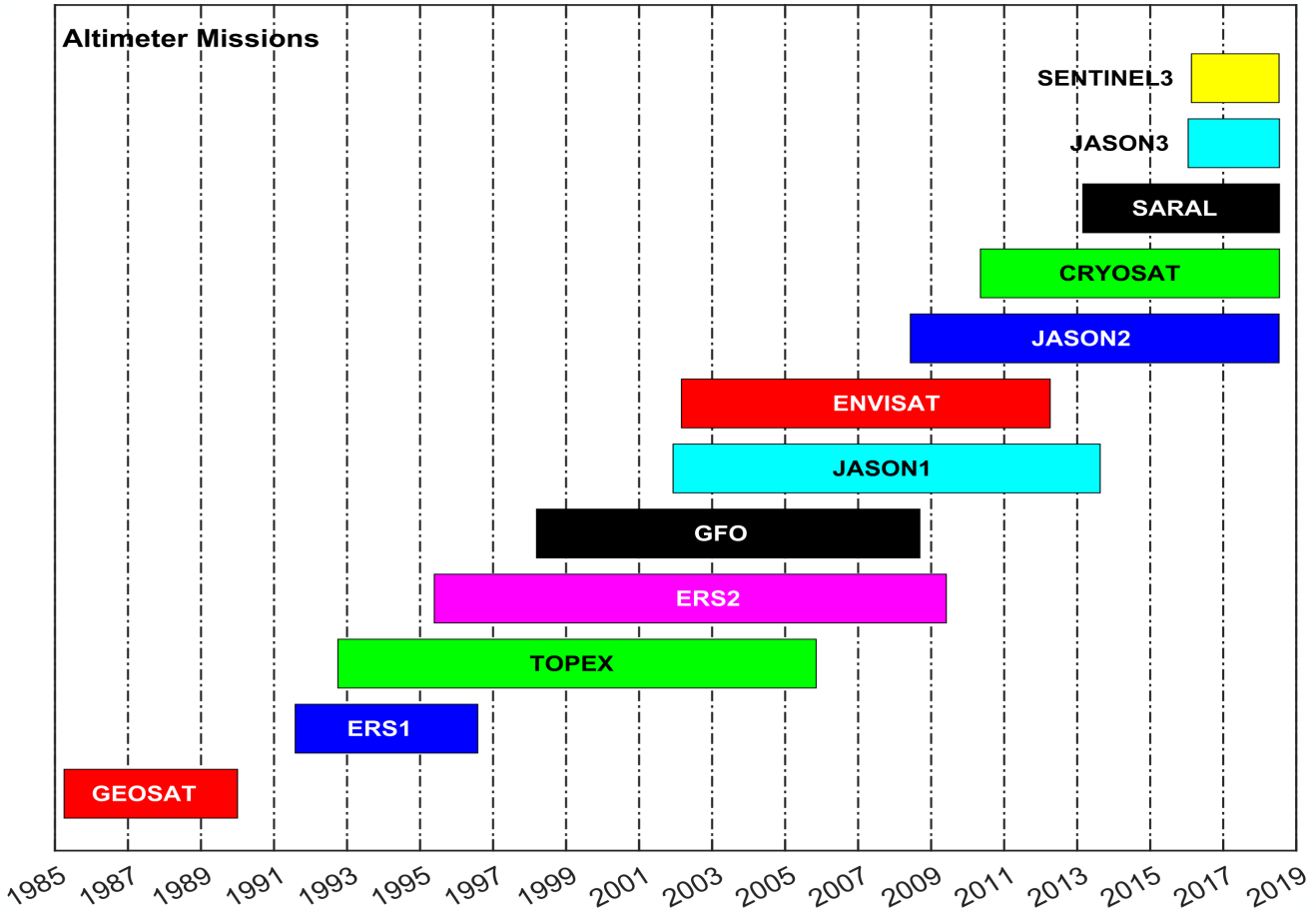
EUMETSAT ECMWF EUSPA

Can we accurately infer trends in wave height from multi-mission altimeter data?

Ian Young and Agustinus Ribal
University of Melbourne

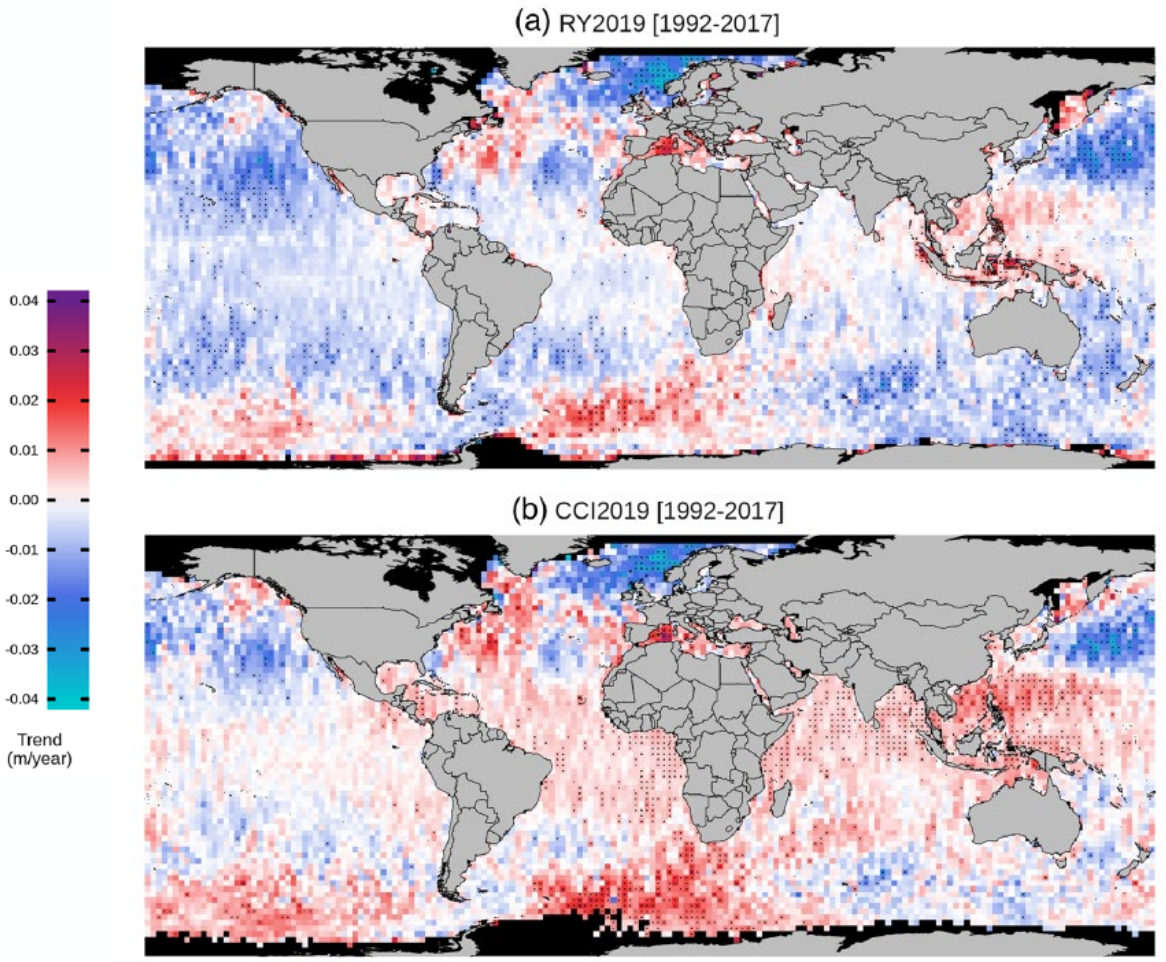
26 May 2022

Multi-satellite altimeter missions



Trend calculation requires consistent calibration across missions

Trend differences between datasets



Ribal & Young (2019)

Alt-buoy calibration

Dodet et al (2020)

GLOBWAVE +

Alt-Alt calibration

Timmermans et al. (2020)

Calibration impacts

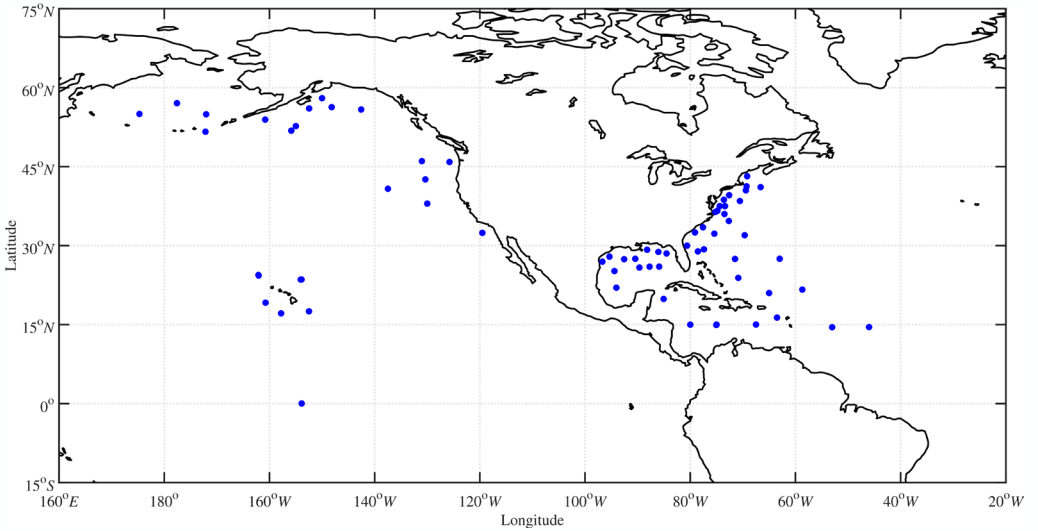
- Does altimeter-buoy calibration result in discontinuities between altimeter missions that impact trends?

Test

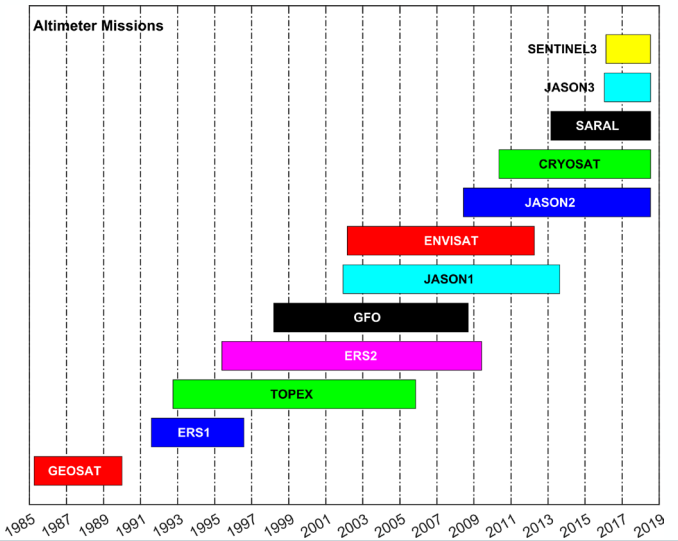
- Take uncalibrated dataset of Ribal and Young (2019)
- Calibrate against buoys (Alt-buoy calibration)
- Calibrate JASON1 against buoys and all other missions at cross-over points
- Do trends differ and why?

Calibration processes

Alt-buoy calibration

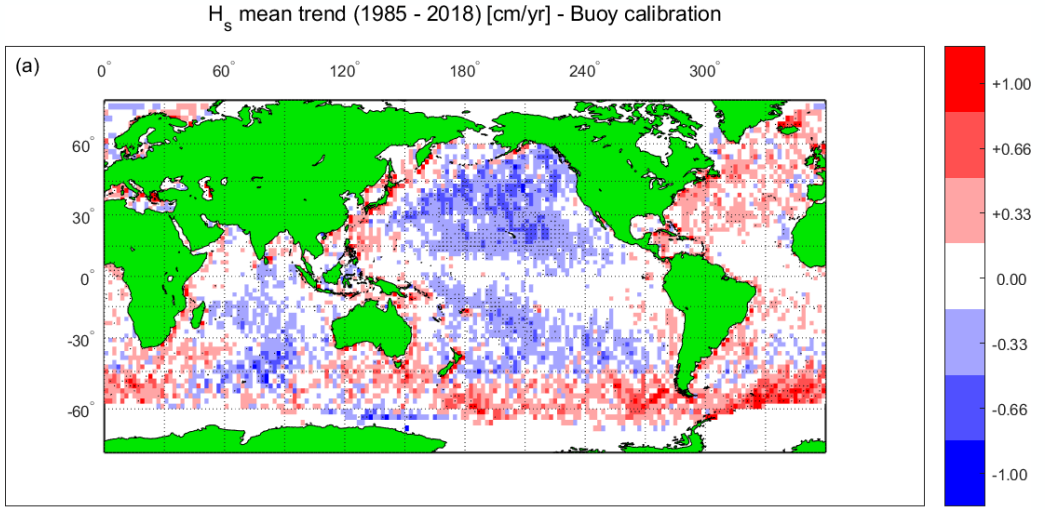


Alt-Alt calibration

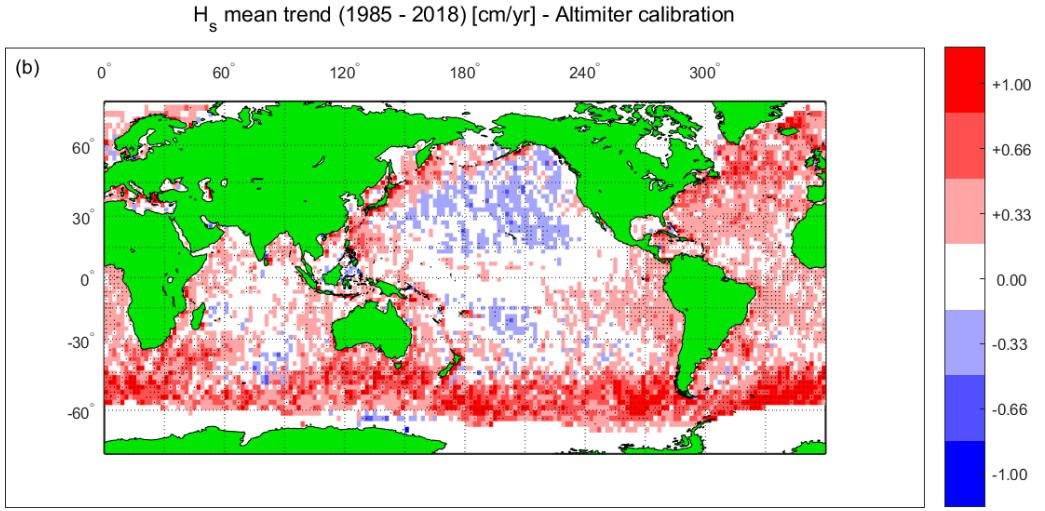


Trend results

Alt-buoy calibration



Alt-Alt calibration

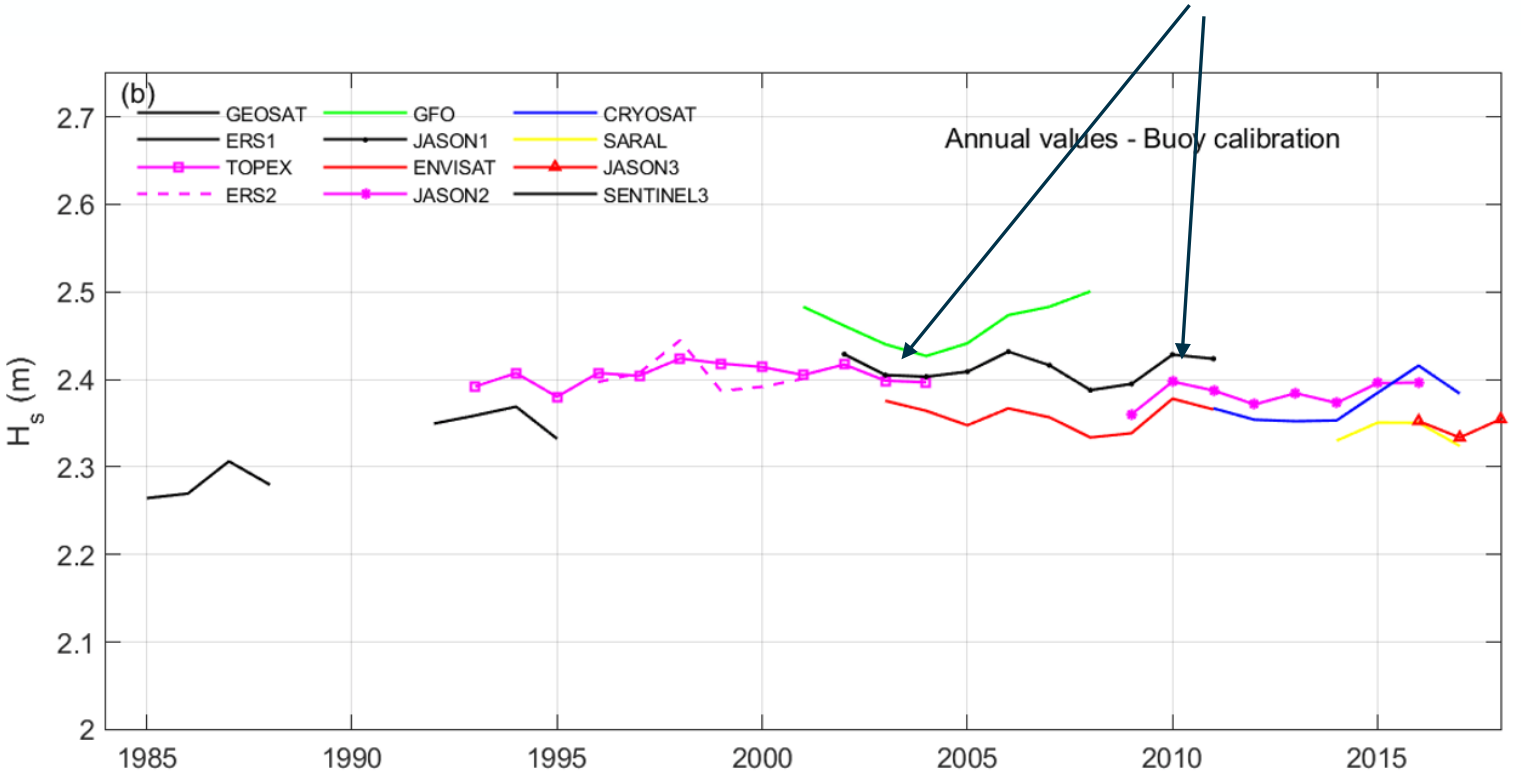


- Calibration has an impact

Altimeter-buoy calibration

- Does Alt-buoy calibration result in a non-stationary record?
- Find global annual means of Hs

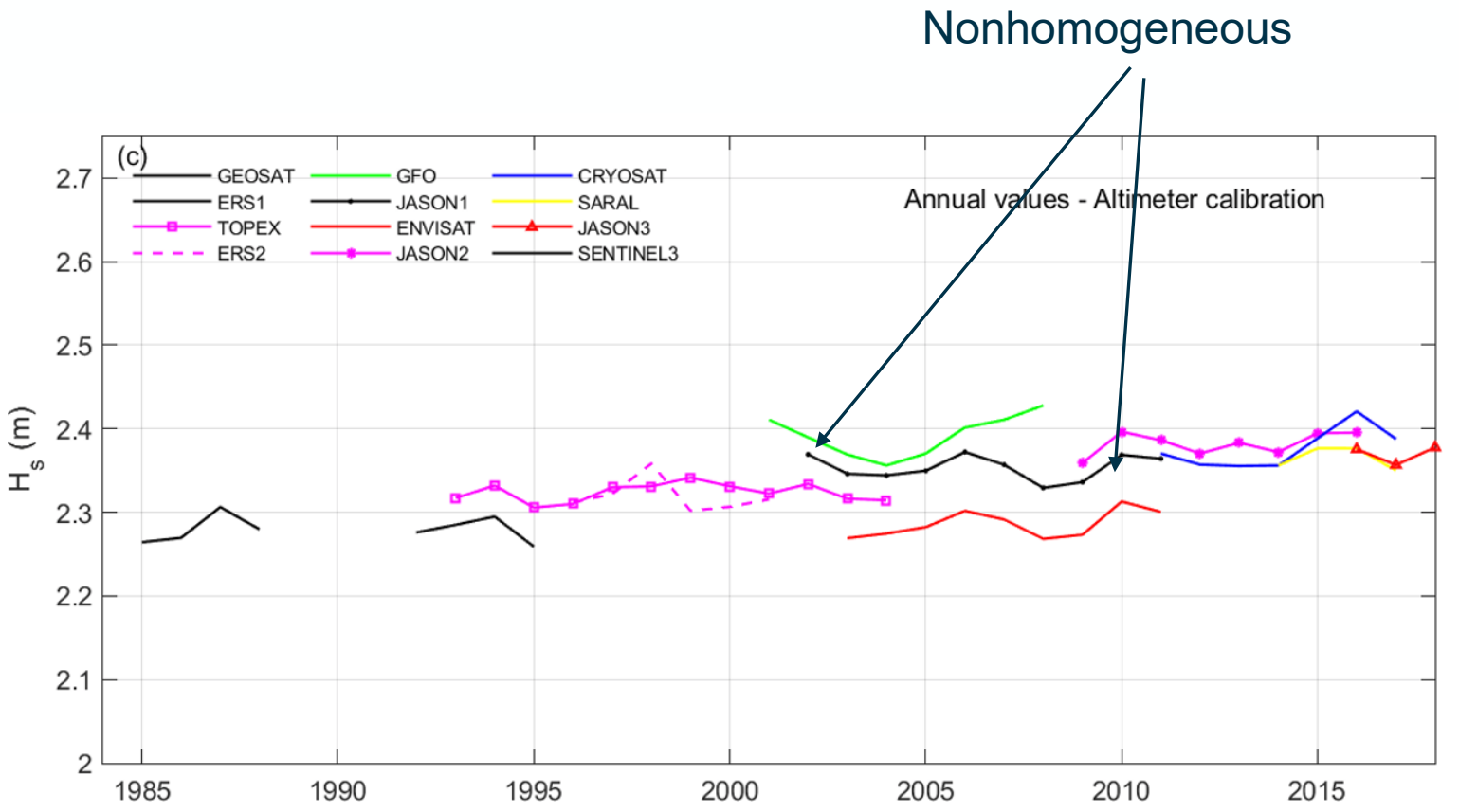
Nonhomogeneous



- Dataset non-homogeneous with discontinuities

Altimeter-altimeter calibration

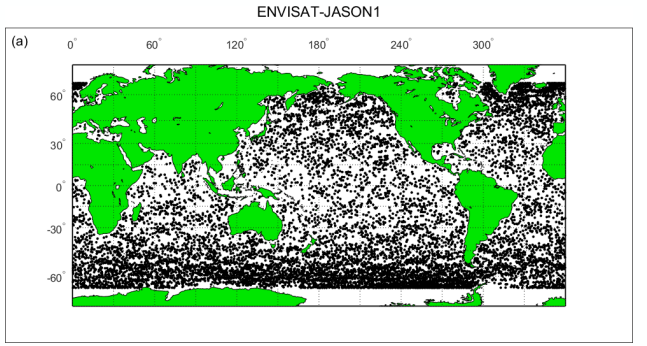
- Annual means from altimeter-altimeter record

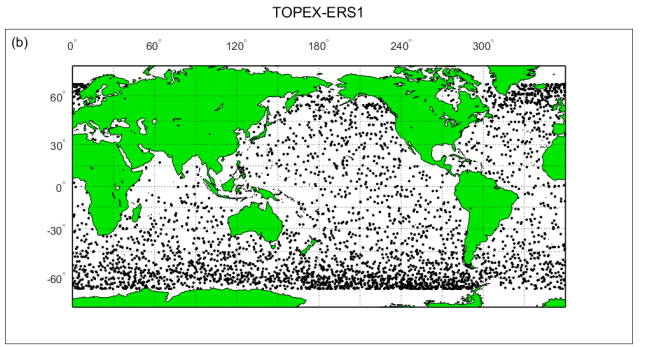


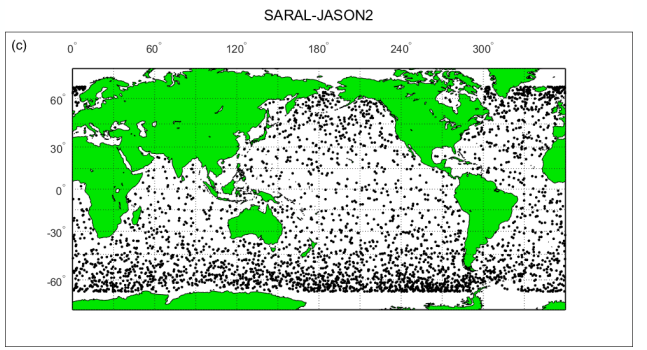
- Dataset still non-homogeneous with discontinuities
- How is this possible?

Altimeter-altimeter calibration

- Where are the calibration matchups?
- Grouped at higher latitudes.



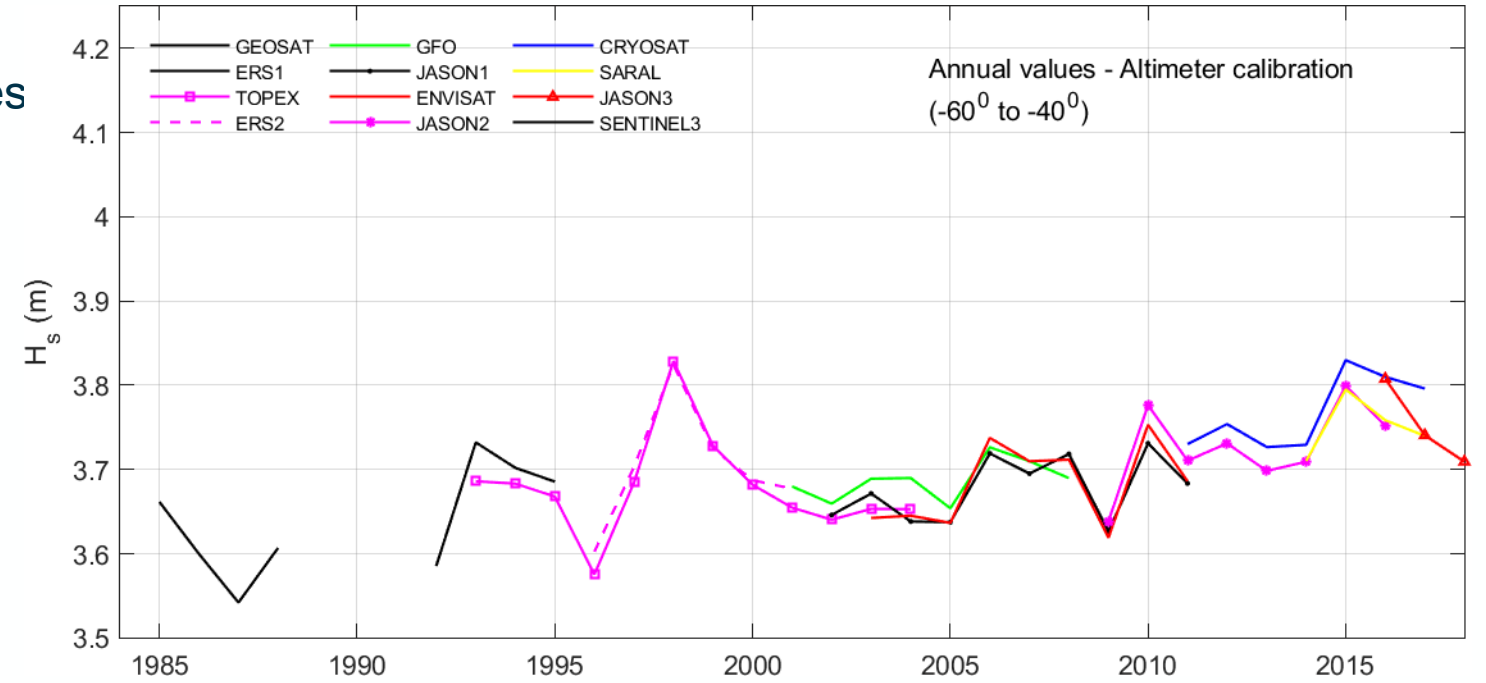




Altimeter-altimeter calibration

- Is the altimeter-altimeter dataset homogeneous at high latitudes?
  (where it was largelycalibrated)

- Annual means of latitudes from -40^0 to -60^0



- Dataset homogeneous in regions where it was largely calibrated.

Conclusions

- Both approaches result in non-homogeneous datasets.

- Appears to be a latitudinal impact on calibration
  - Wind speed
  - Wave age
  - Wind stress
  - Air-sea temperature difference – atmospheric stability
  - etc

Conclusions

- Altimeter-altimeter and altimeter-buoy calibrations give different trends
- Both, however, have issues with non-homogeneous datasets
- Limits multi-mission altimeter datasets to an accuracy of approximately 0.2cm/year.
- This is the approximate magnitude of the global trends in Hs!
- Questionable if multi-mission altimeter datasets can resolve the Trends in Hs.

Young, I.R. and Ribal, A., 2022, “Can multi-mission altimeter datasets accurately measure long-term trends in wave height?”, Remote Sensing, 14, 974.