

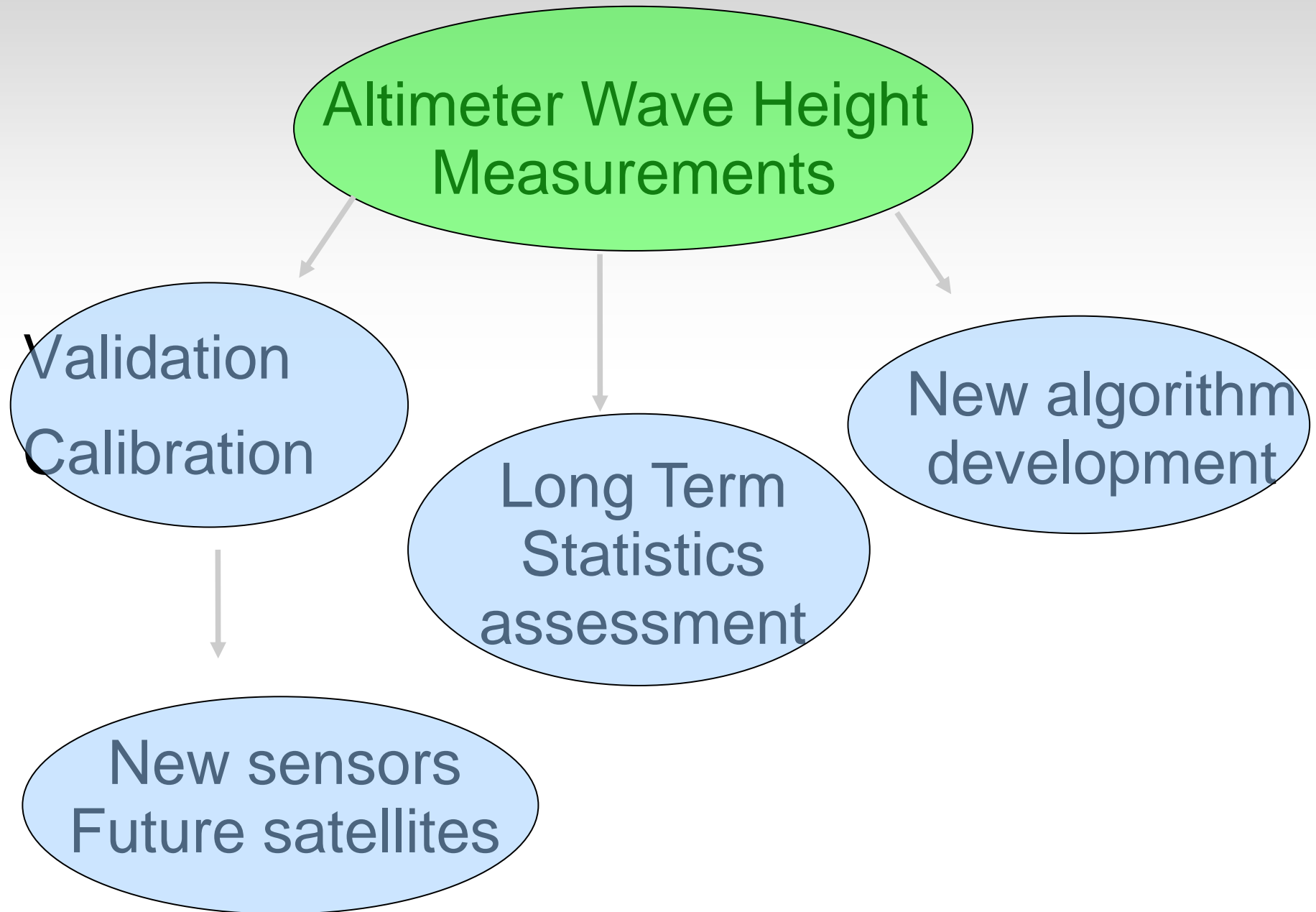
Wave buoy data for assessment of satellite altimeter wave height measurements

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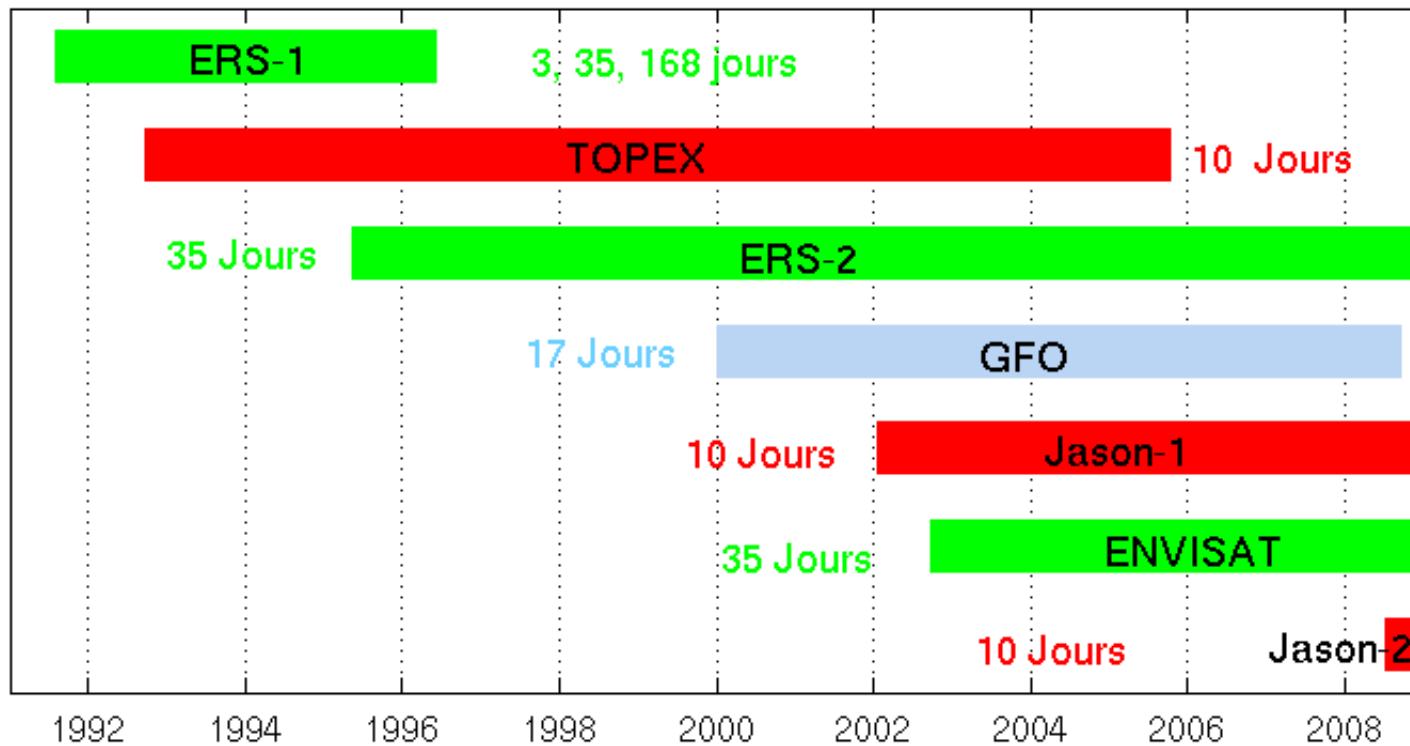
Use of wave buoy data for:



Some characteristics of *SWH* altimeter measurements

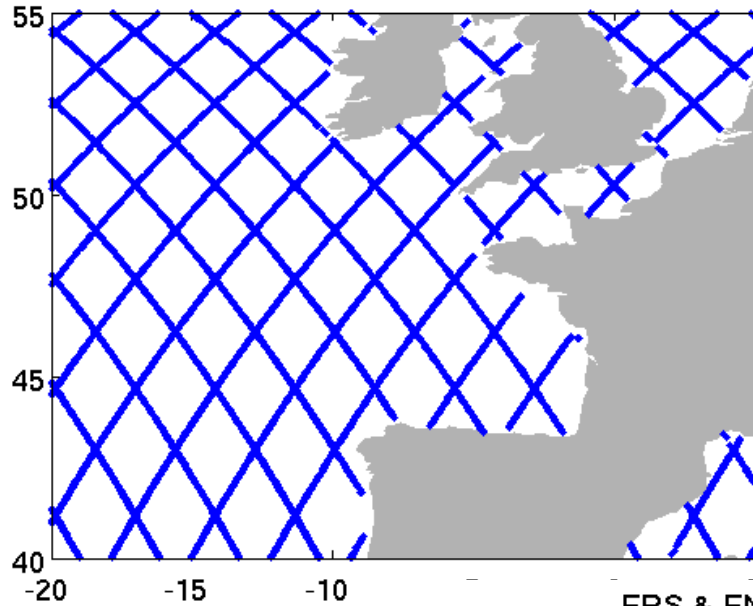
- Measurement along track at the nadir
- Resolution about 5 km to 7 km (1 Hz sample)
- 300 m on recent altimeters Jason-2
20 Hz sample
- But narrow cross-track footprint – few km
- SWH measurement accuracy about 10% rms

The various altimeter missions

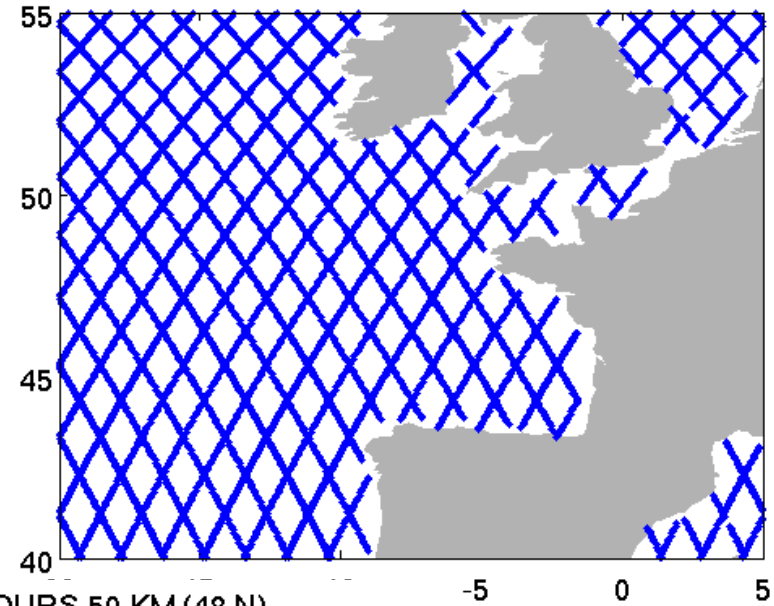


Altimeter ground-track patterns

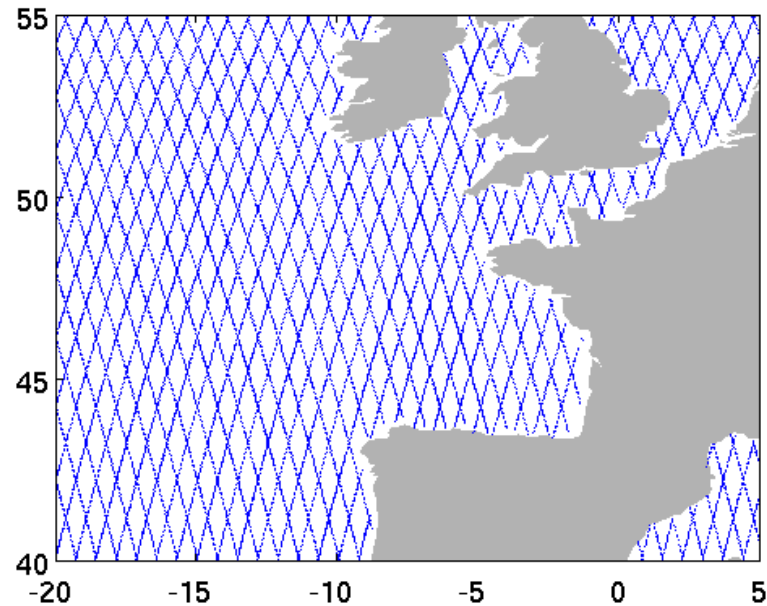
TOPEX & Jason 10 JOURS 210 KM (48 N)



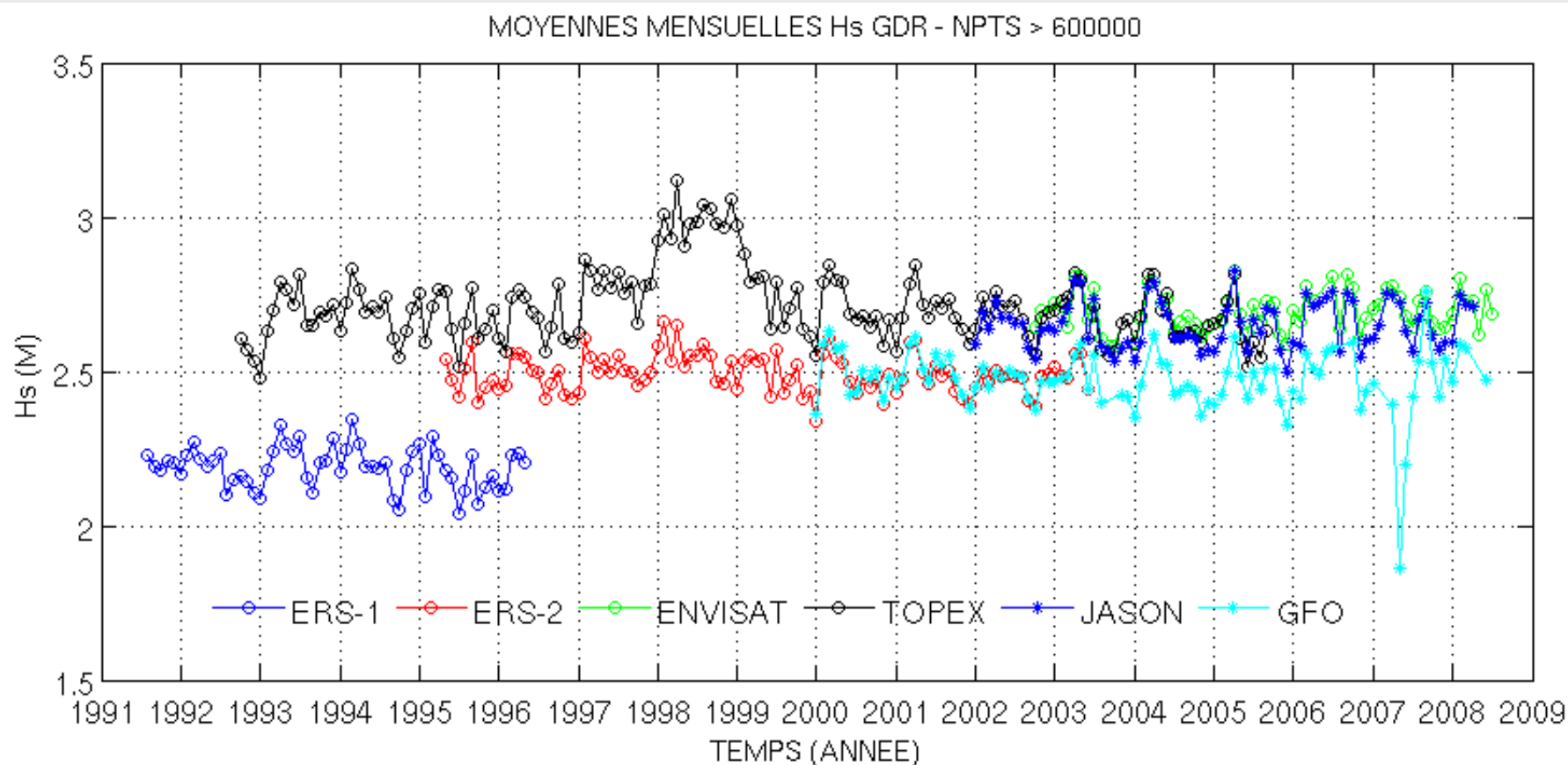
GEOSAT FO 17 JOURS 110 KM (48N)



ERS & ENVISAT 35 JOURS 50 KM (48 N)



Monthly mean *SWH* Global océans 66° N – 66° S

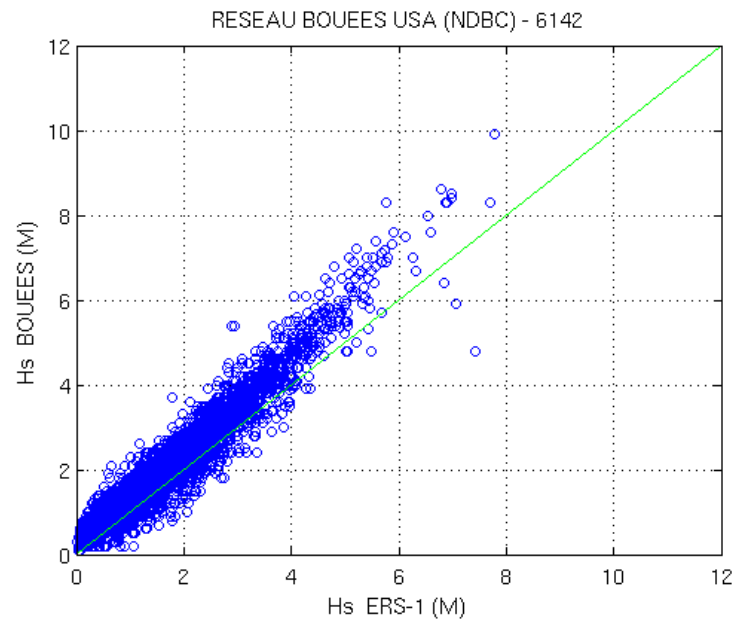
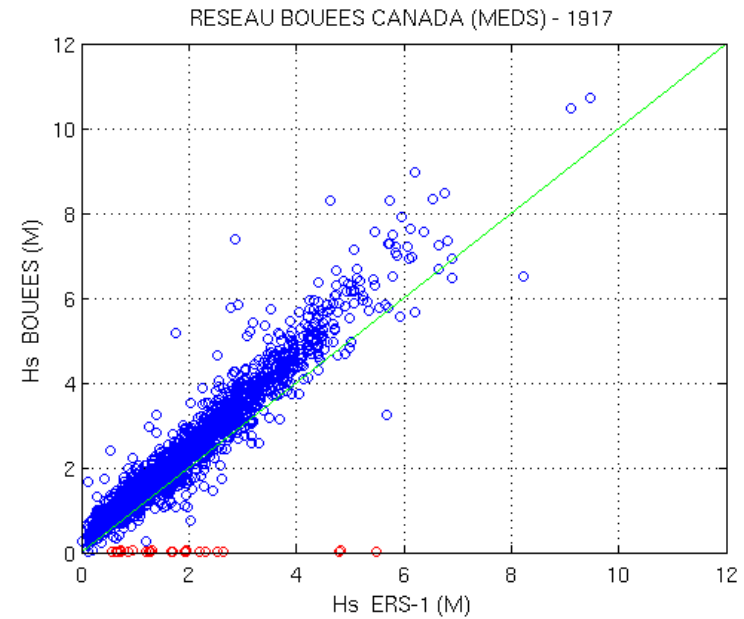
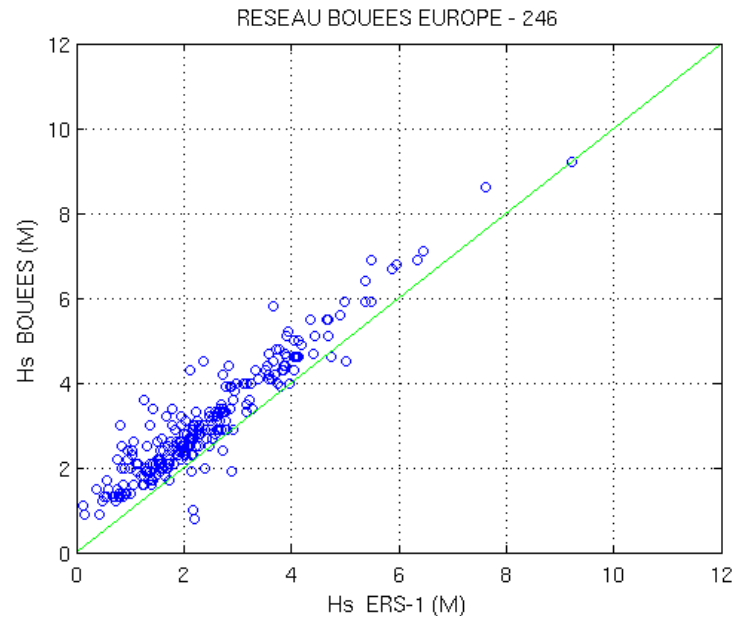


Calibration & Validation

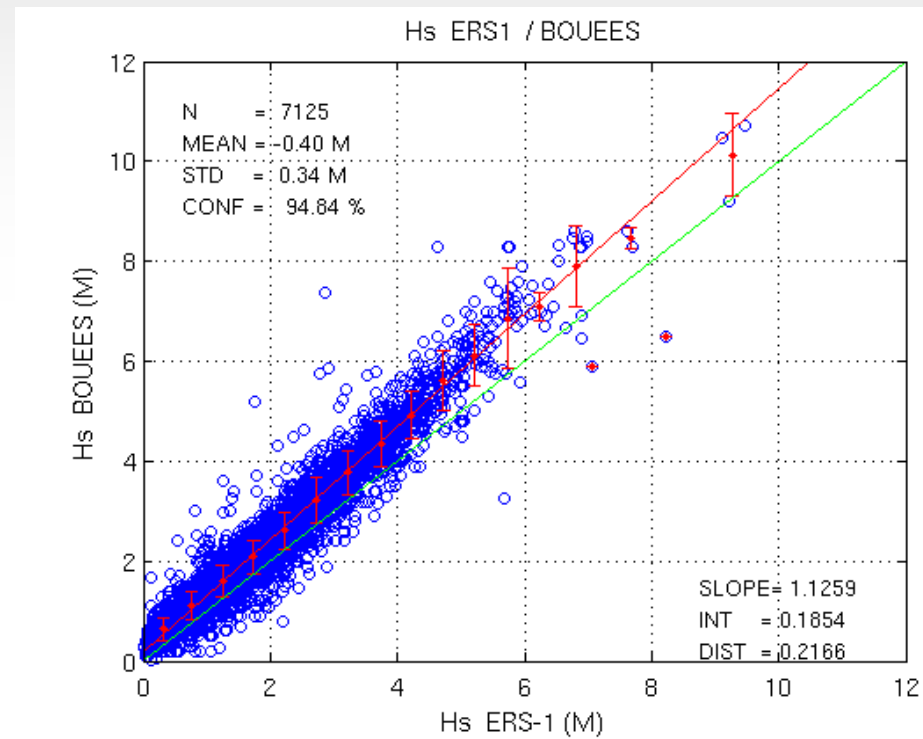
Using wave buoy data

- NDBC, MEDS, EUROPE, NORUT, EPPE
- Satellite tracks less than 50 km from the buoy location
- Time difference between satellite and buoy measurements less than 30 minutes
- satellite measurement averaged along-track over 50 km

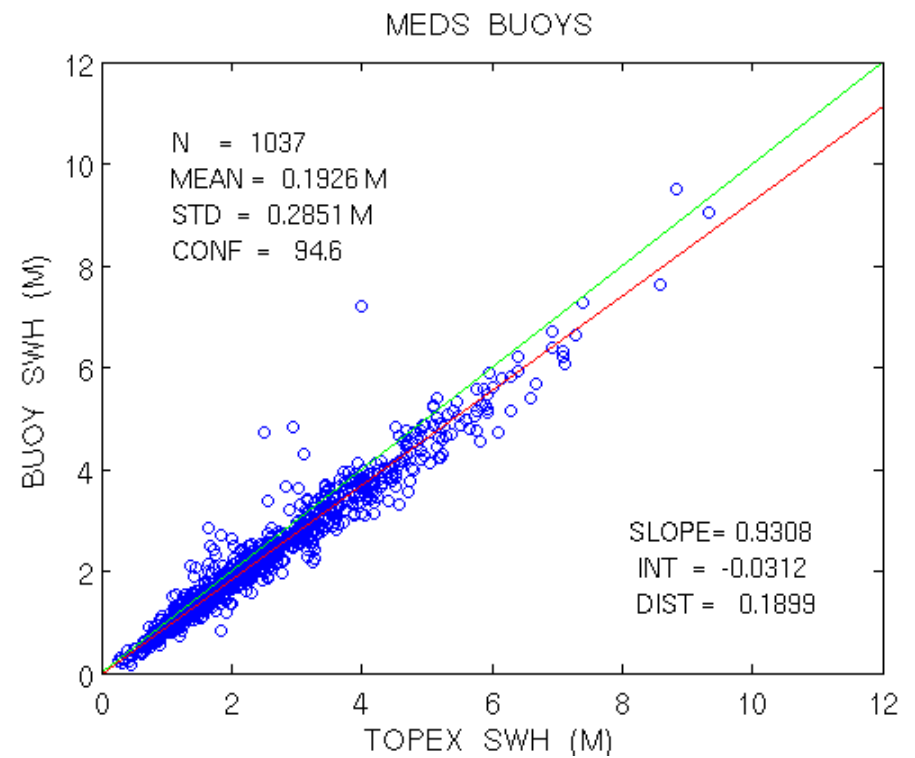
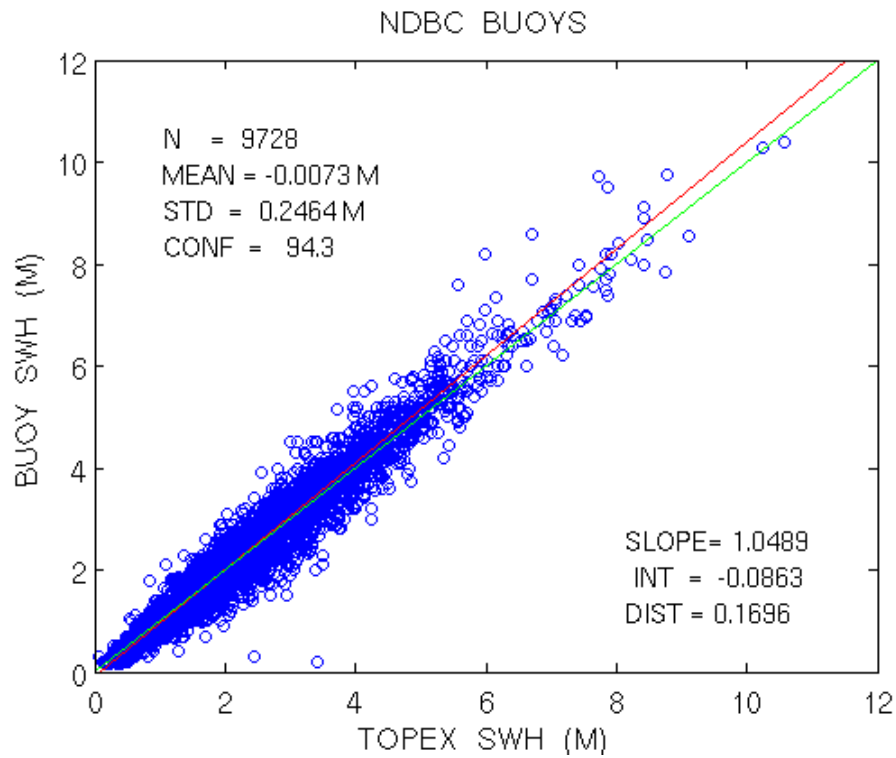
Example of validation – SWH ERS-1



Example of validation - SWH ERS-1

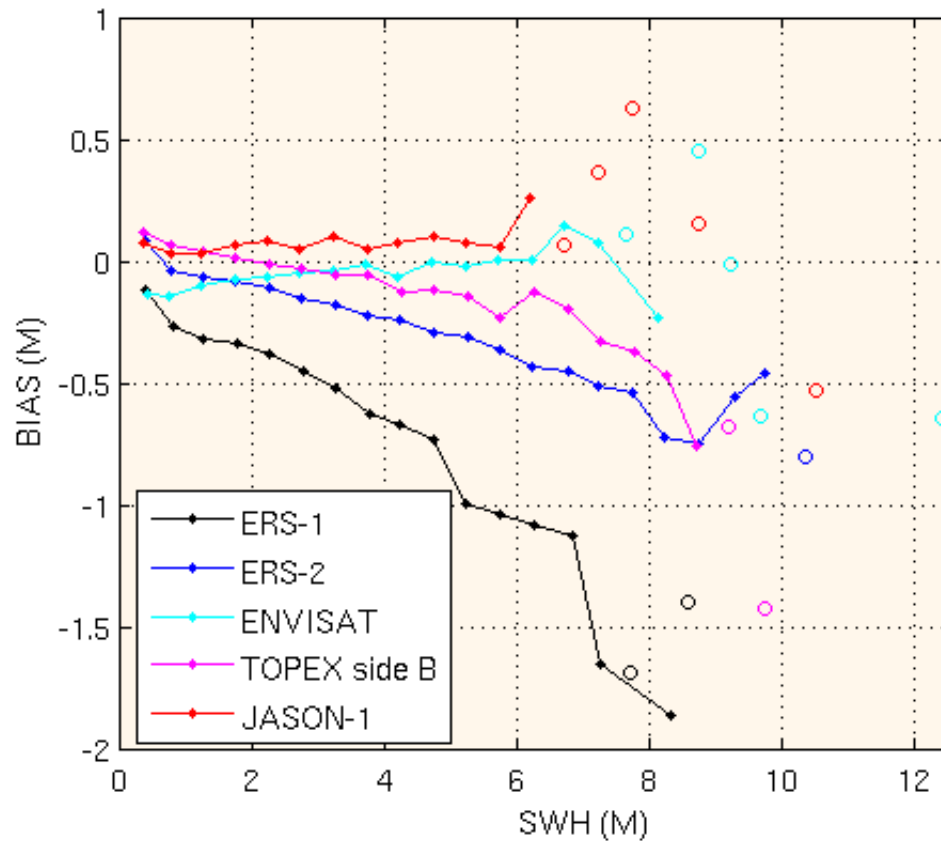


NDBC MEDS SWH bias TOPEX validation

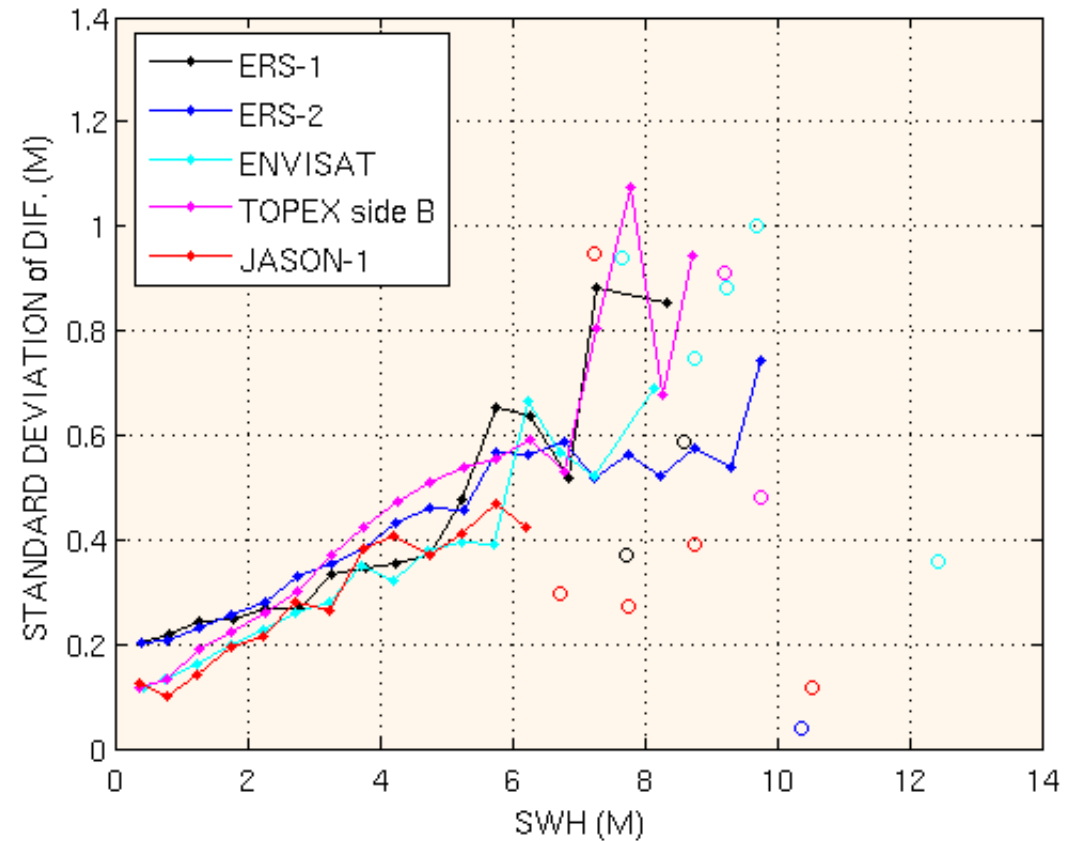


Altimeter validation results

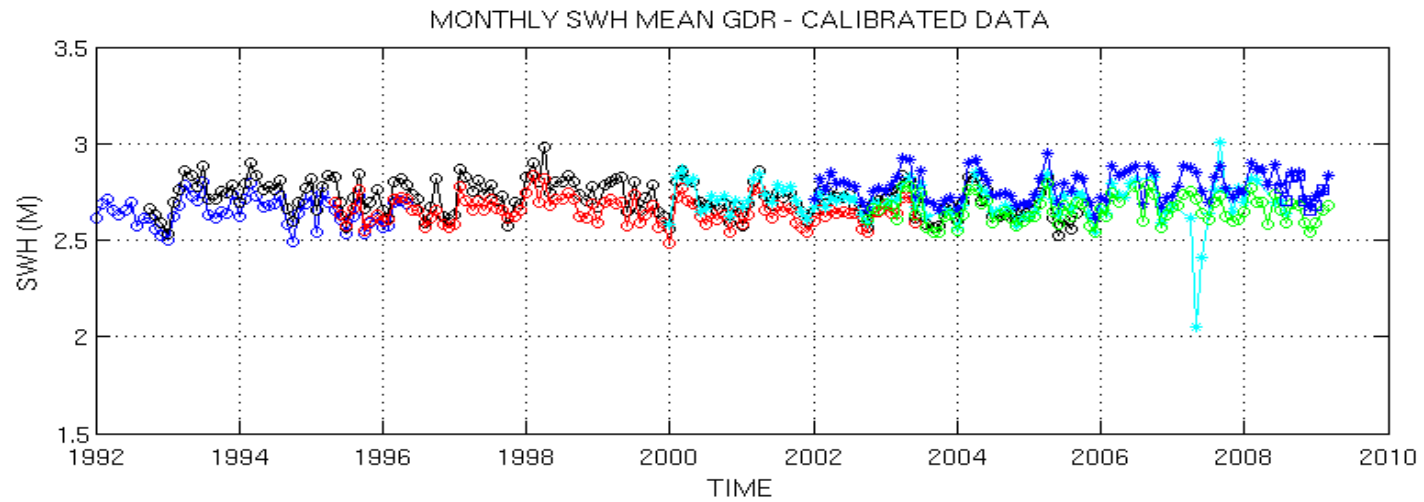
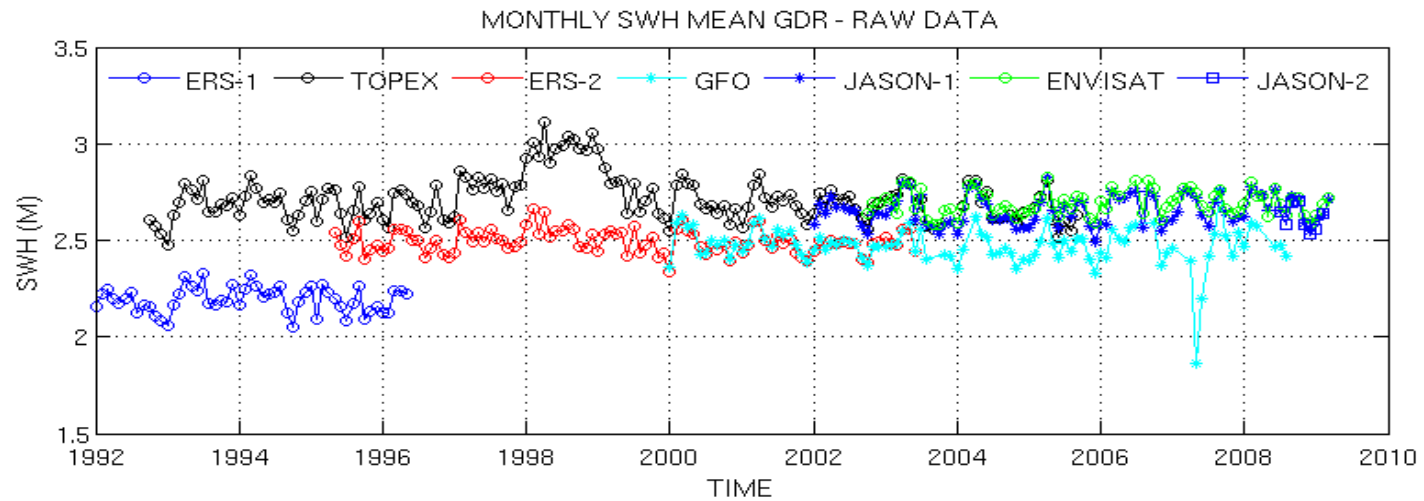
ALTIMETER - BUOY SWH BIAS



ALTIMETER - BUOY SWH STANDARD DEVIATION



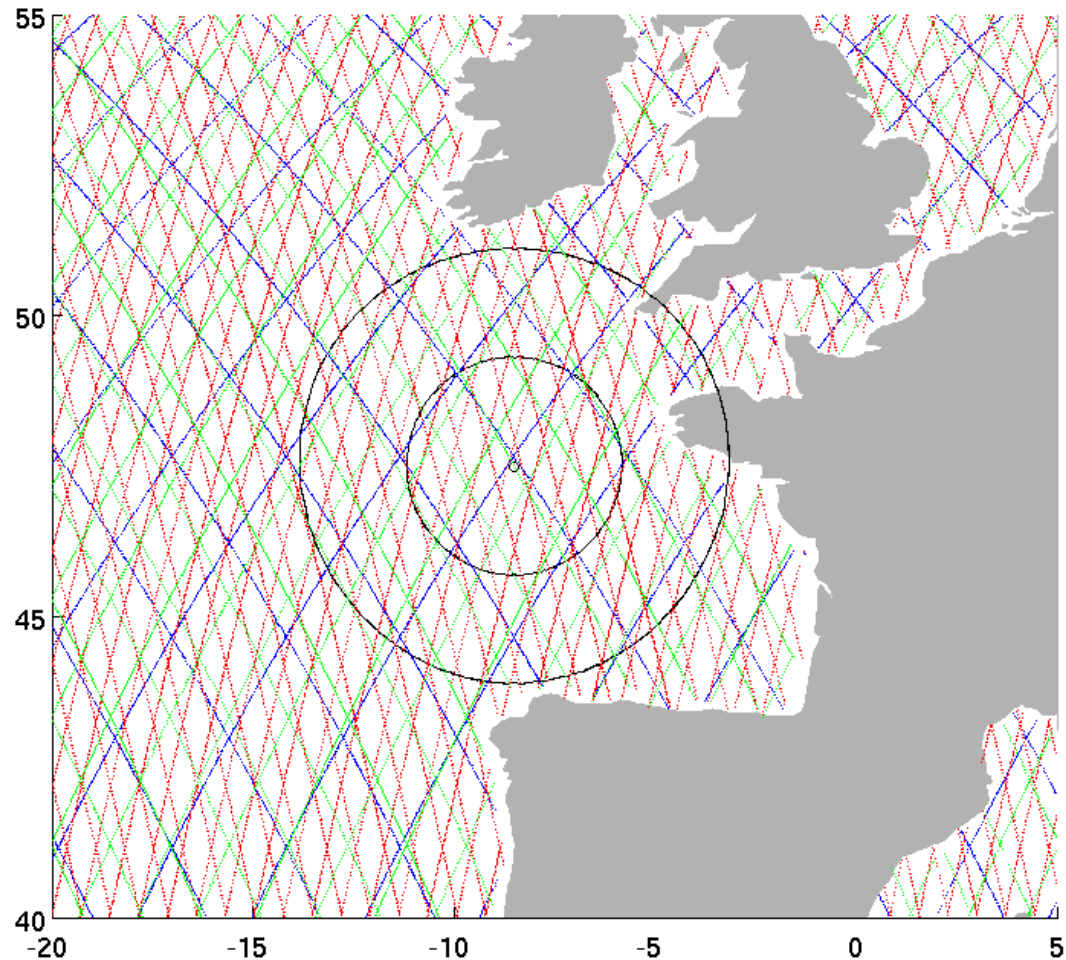
Monthly mean *SWH* global océans 66° N – 66° S



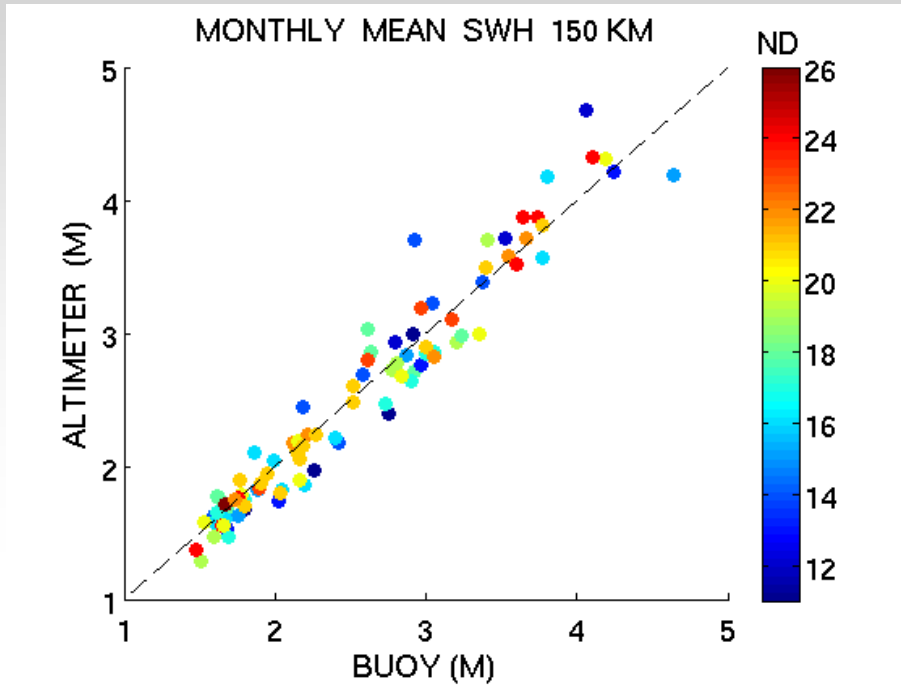
Altimeter *SWH* long term statistics

Virtual buoy?

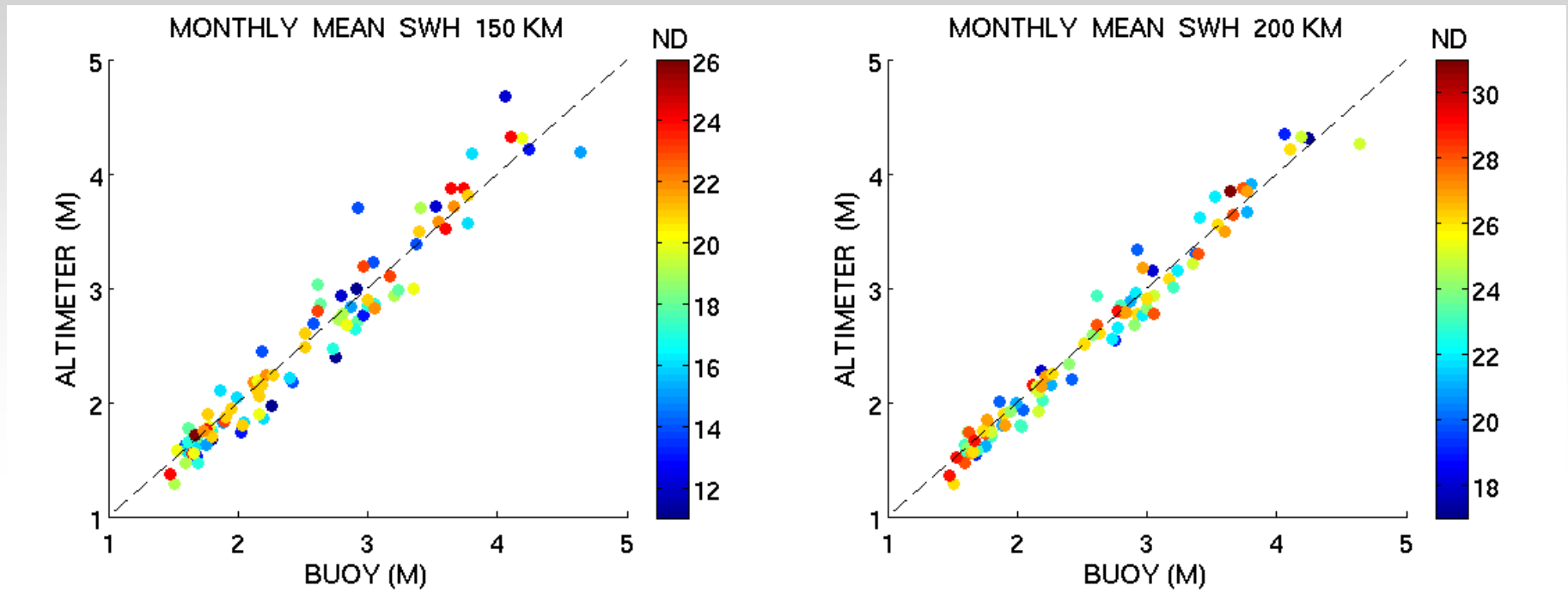
- Brittany buoy
- 200 & 400 km
- Jason
- GFO
- ENVISAT



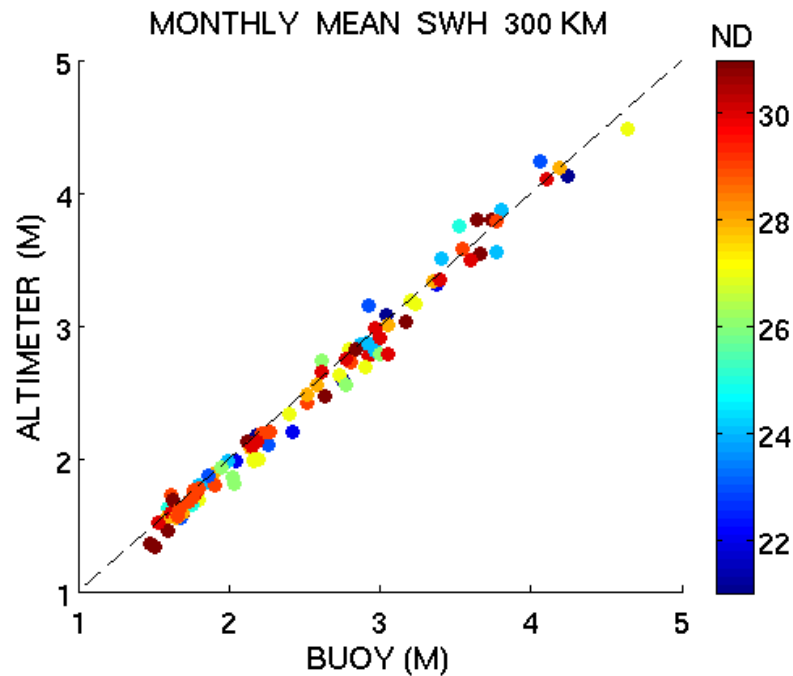
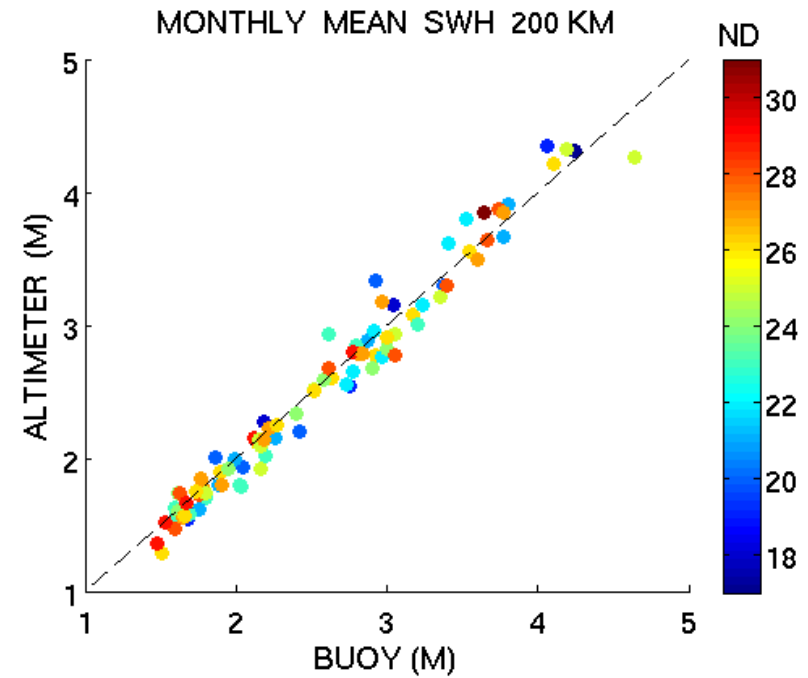
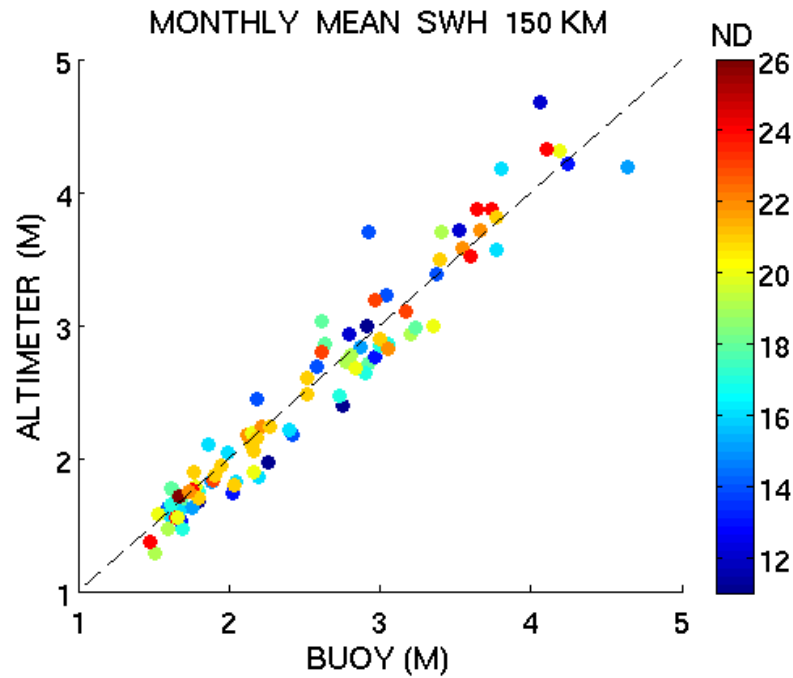
Monthly *SWH* - altimeters vs Brittany buoy



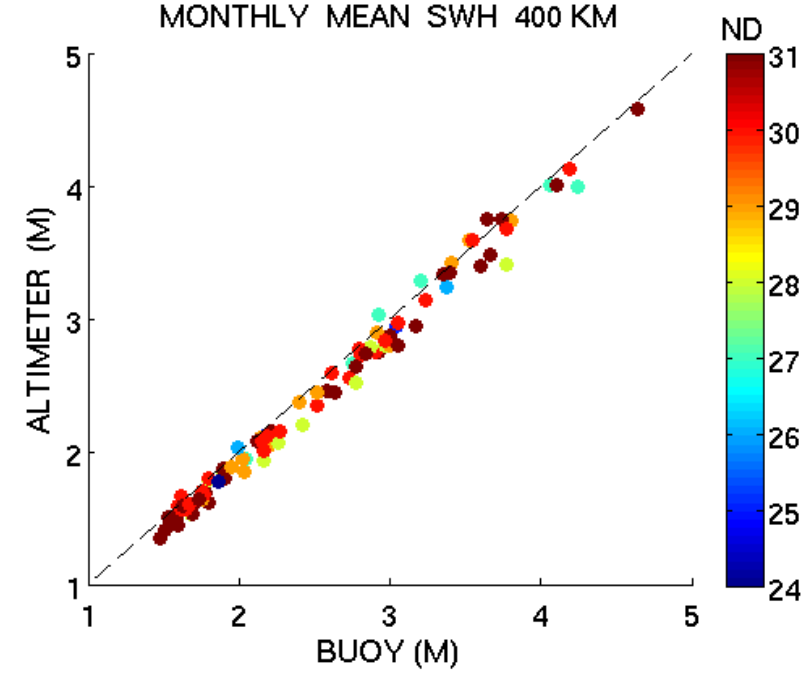
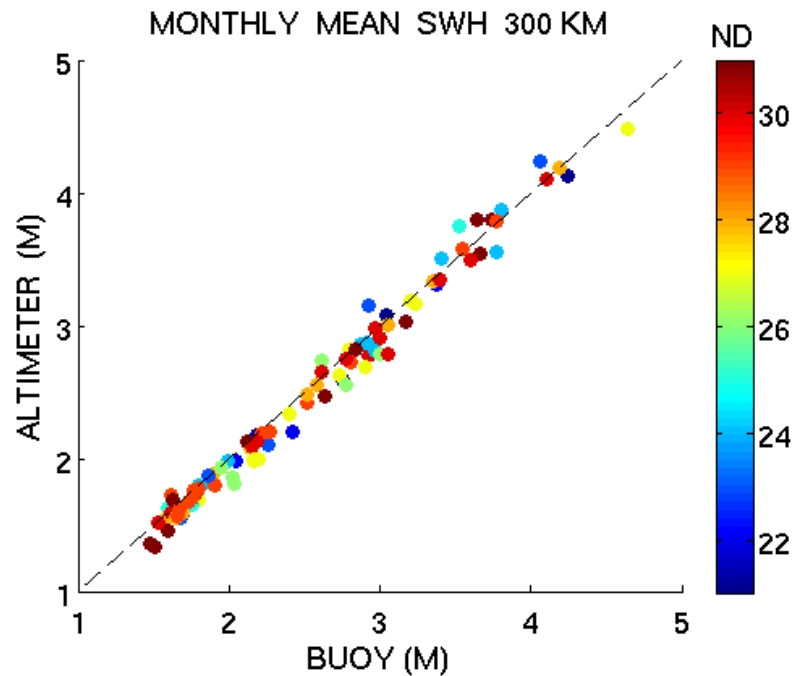
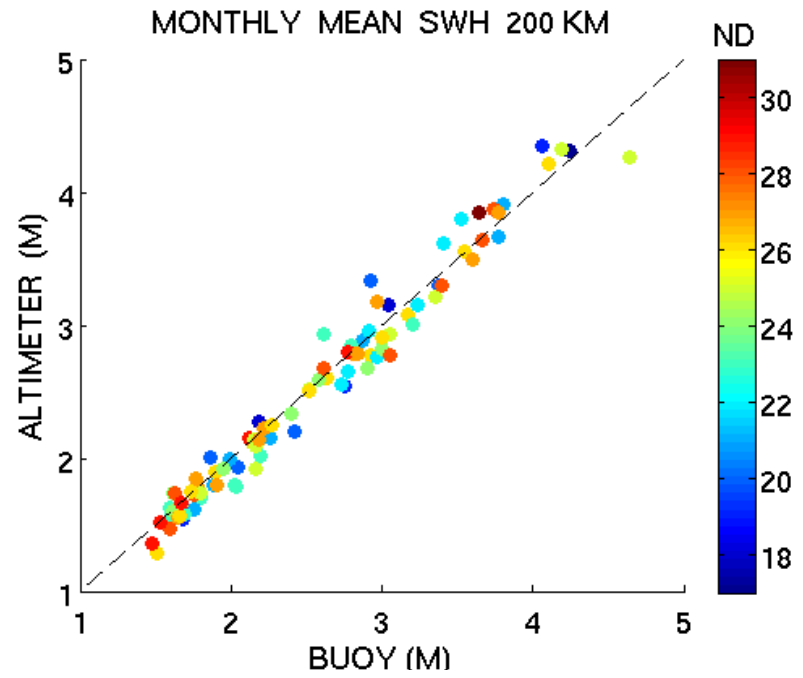
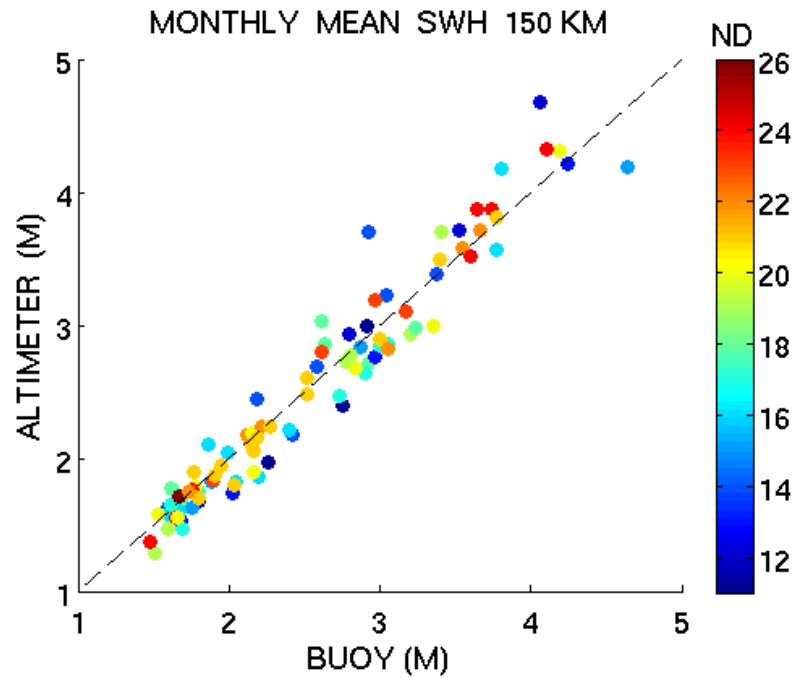
Monthly SWH - altimeters vs Brittany buoy



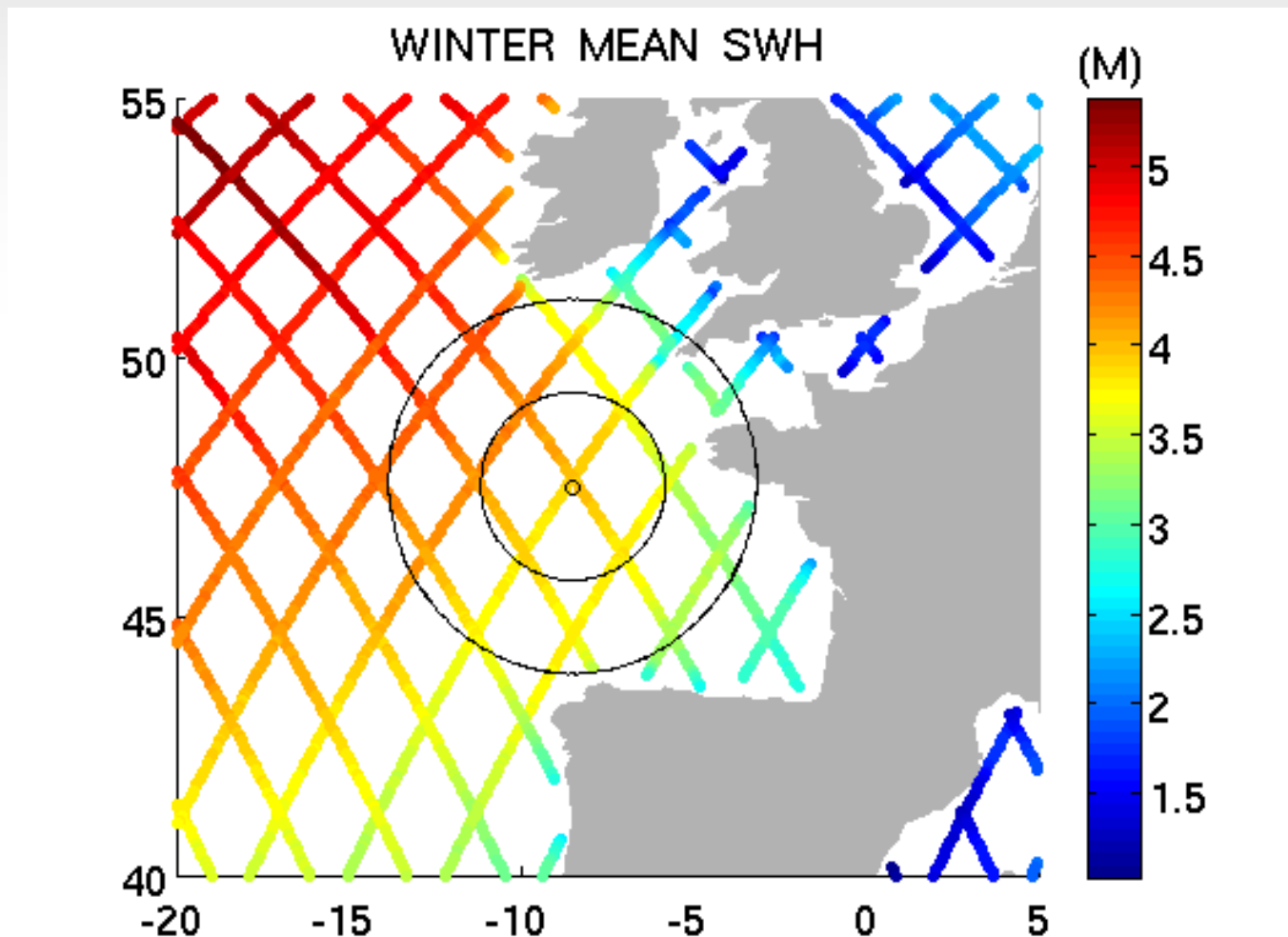
Monthly SWH - altimeters vs Brittany buoy



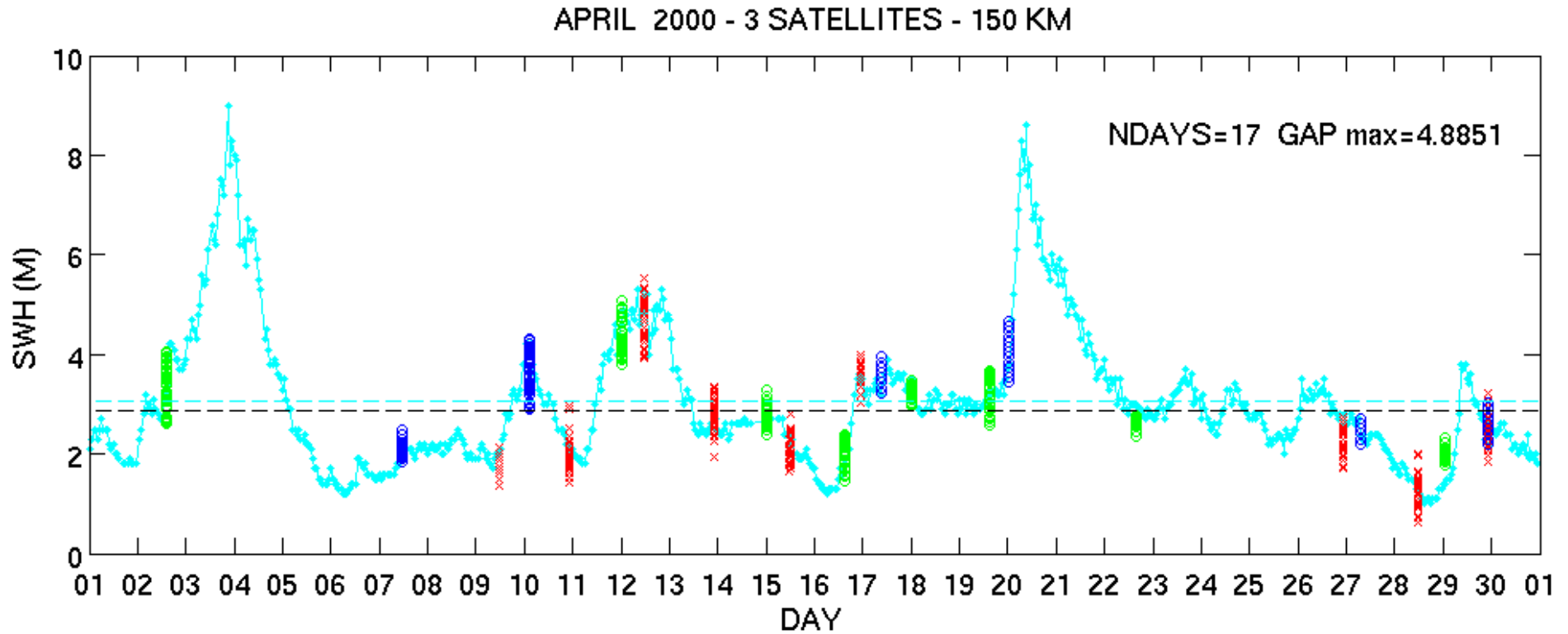
Monthly SWH - altimeters vs Brittany buoy



15-year *SWH* mean value along TOPEX and Jason ground tracks Winter

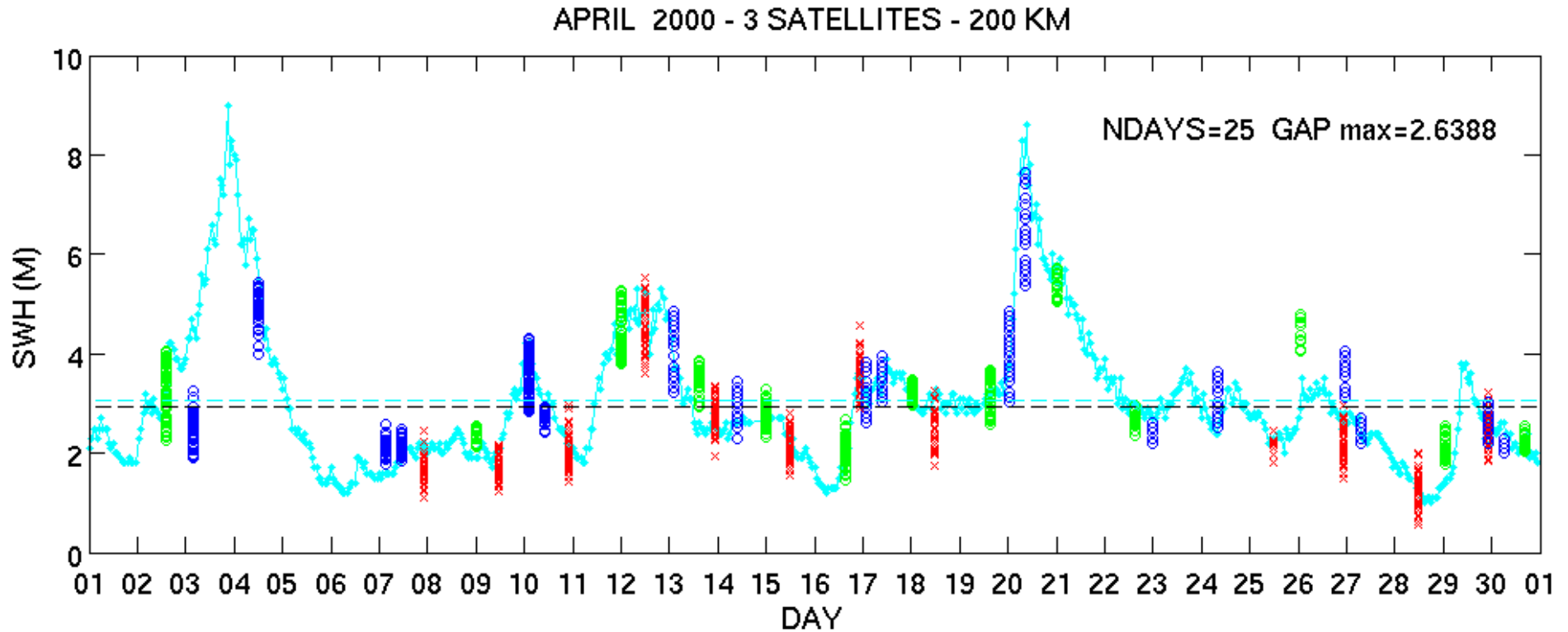


Altimeter & Brittany SWH April 2000



■ GFO TOPEX ERS-2

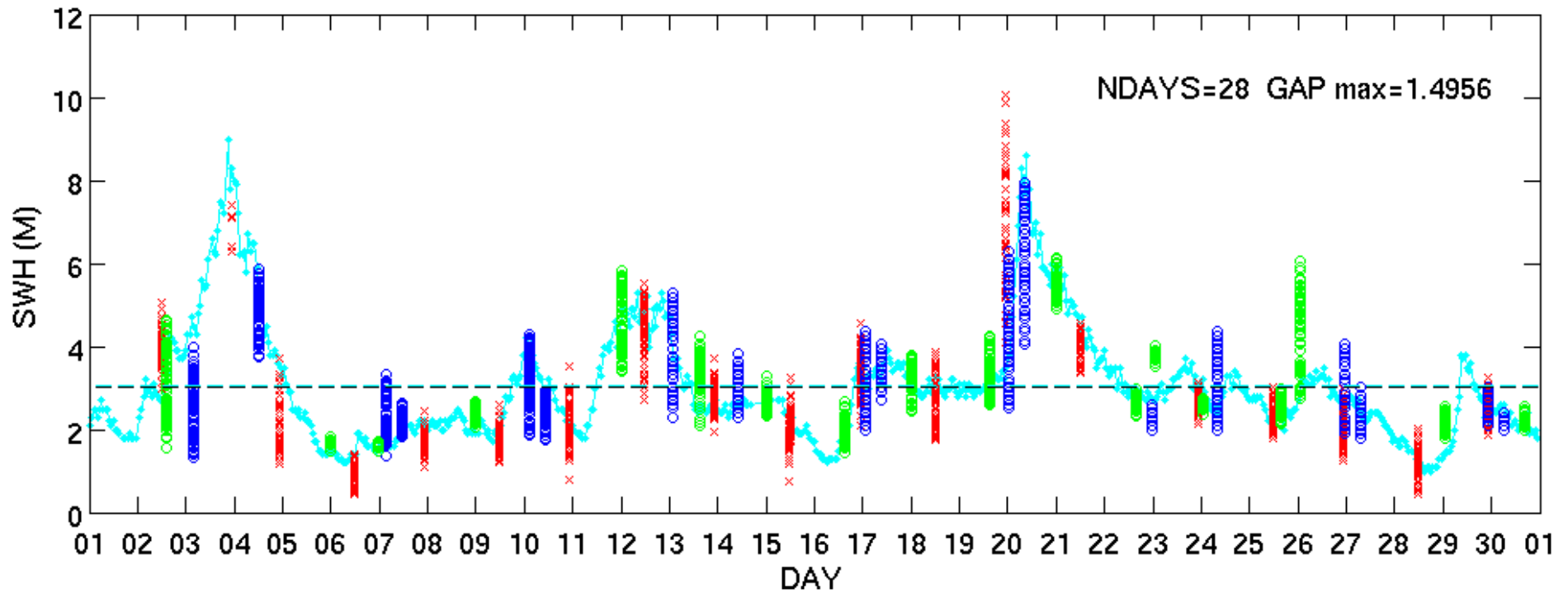
Altimeter & Brittany SWH April 2000



■ GFO TOPEX ERS-2

Altimeter & Brittany SWH April 2000

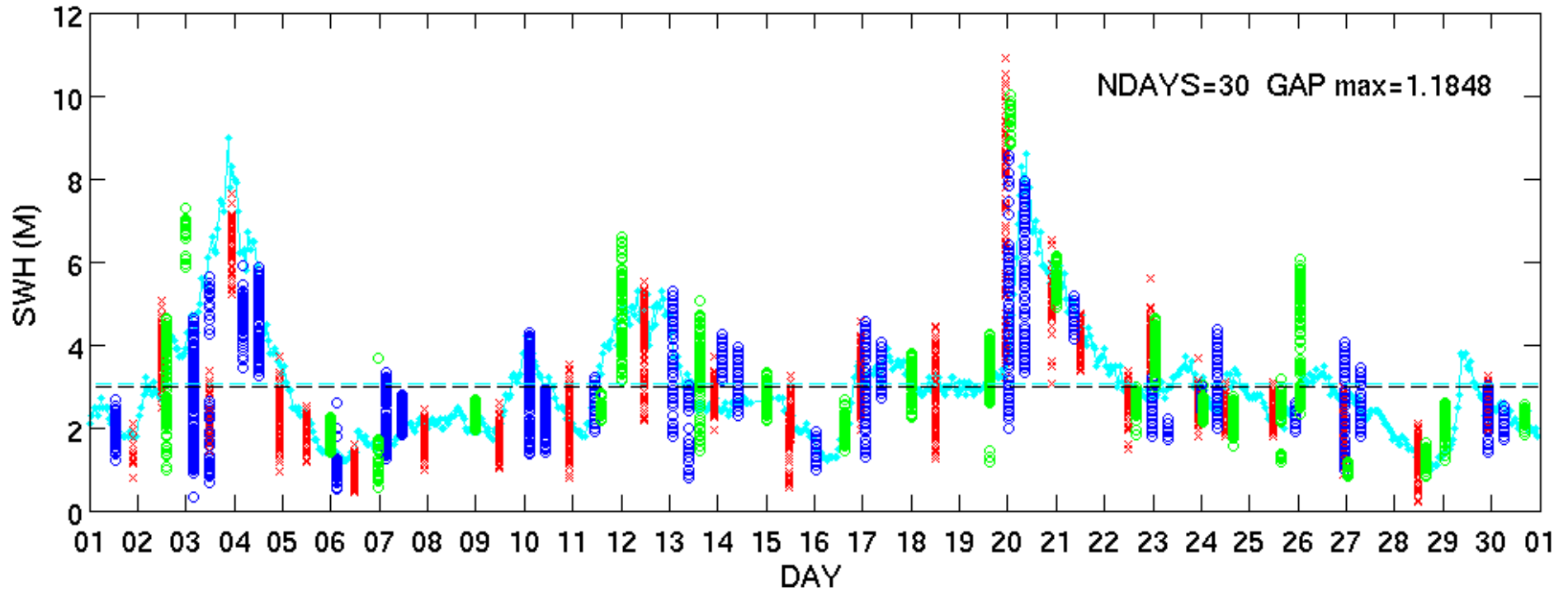
APRIL 2000 - 3 SATELLITES - 300 KM



■ GFO TOPEX ERS-2

Altimeter & Brittany SWH April 2000

APRIL 2000 - 3 SATELLITES - 400 KM

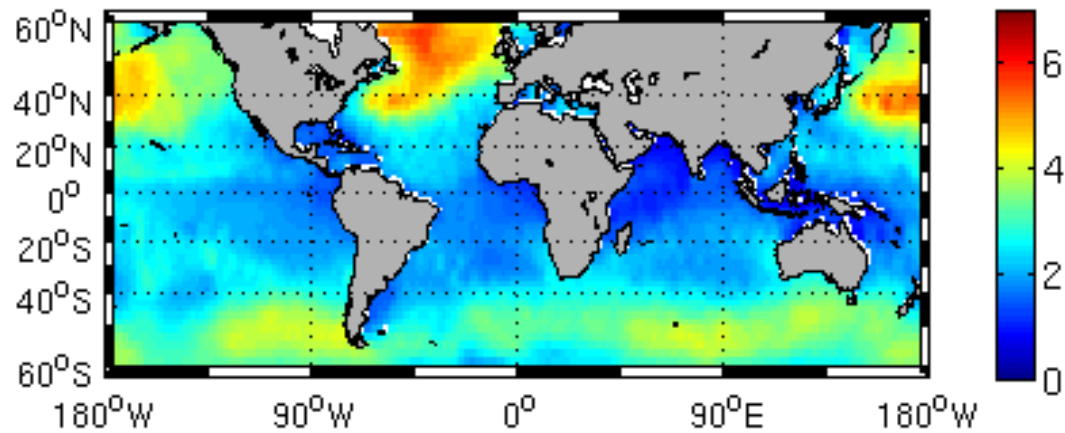


■ GFO TOPEX ERS-2

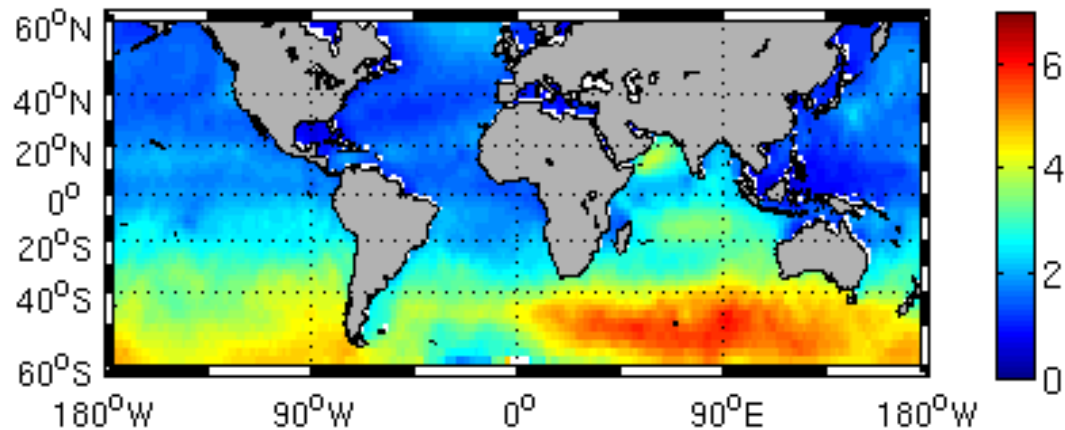
Altimeter Monthly Mean *SWH*

2°x2° 300 KM

ALTIMETER SWH JANUARY 2004



ALTIMETER SWH JULY 2004



Summary & concluding remarks

- **Wave buoys are essential for**
 - calibration validation of altimeter swh
 - Improvement of algorithms (wave period)
 - Future new sensors
- **Buoy data specific requirements**
 - Not too close to the coast (20 km), off-shore
 - In various locations (swell, wind sea, fetch)
 - Long time series (high sea state probability)
 - Validated data