Wave buoy data for assessment of satellite altimeter wave height measurements
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Use of wave buoy data for:

- Validation
- Calibration
- Long Term Statistics assessment
- New algorithm development
- New sensors
- Future satellites

Altimeter Wave Height Measurements
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

NDBC Buoys

- N = 9728
- MEAN = -0.0073 m
- STD = 0.2464 m
- CONF = 943
- SLOPE = 1.0489
- INT = -0.0063
- DIST = 0.1696

MEDS Buoys

- N = 1037
- MEAN = 0.1925 m
- STD = 0.2551 m
- CONF = 94.6
- SLOPE = 0.5308
- INT = 0.0312
- DIST = 0.1899
Altimeter validation results
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
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Monthly SWH - altimeters vs Brittany buoy
15-year \( SWH \) mean value along TOPEX and Jason ground tracks

Winter
Altimeter & Brittany SWH April 2000

APRIL 2000 - 3 SATELLITES - 150 KM

N_DAYS=17  GAP max=4.8851

- GFO  TOPEX  ERS-2
Altimeter & Brittany SWH April 2000

April 2000 - 3 Satellites - 200 KM

N DAYS = 25  GAP max = 2.6388

- GFO
- TOPEX
- ERS-2
Altimeter & Brittany SWH April 2000

APRIL 2000 - 3 SATELLITES - 300 KM

NDAYS=28 GAP max=1.4956

GFO    TOPEX    ERS-2
Altimeter & Brittany SWH April 2000

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GFO TOPEX ERS-2
Altimeter Monthly Mean SWH
$2^\circ \times 2^\circ$  300 KM
Summary & concluding remarks

- Wave buoys are essential for:
  - Calibration and validation of altimeter swh
  - Improvement of algorithms (wave period)
  - Future new sensors

- Buoy data specific requirements:
  - Not to close to the coast (20 km), off-shore
  - In various locations (swell, wind sea, fetch)
  - Long time series (high sea state probability)
  - Validated data