Round Robin Assessment of Radar Altimeter LRM and SAR Retracking Algorithms for Significant Wave Height

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For evaluating the performance of retracker algorithms a Round Robin exercise is conducted to select two algorithms for both conventional, pulse-limited, low-rate mode (LRM) and synthetic aperture radar mode (SARM) altimetry
- Open to both internal and external teams
- Test datasets for both Jason-3 and Sentinel-3A covering up to 21 months of data
- Different open-ocean and coastal scenarios with various sea state conditions are selected

Round Robin Data
Level-1 Datasets to be retracked
- Jason-3 (J3)
  - 16 half-orbit, pole-to-pole tracks
  - 73 cycles (covering 21 months)
  - 1162 netCDF files in total
  - L1B waveforms available
  - Sentinel-3A (S3A)
  - 30 half-orbit, pole-to-pole tracks
  - 17 cycles (covering 13 months)
  - 512 netCDF files in total
  - L1A and L1B waveforms available (L1B including PLRM)

Reference Output used for Validation
- 2x Models: ERAS, ERAS-based hindcast, each for Jason-3 and Sentinel-3A (PLRM and SAR)
- L2 SGDR datasets: MLE-4 (Jason-3) and SAMOSA (Sentinel-3A)
- In-situ buoy data

Methods
Outlier Analysis
- is_nan: original NaN value, qual_flag, or sea_ice_flag set as NaN
- Not_in_range: Sample is out of range (0.25, 25) m
- Median Absolute deviation (MAD): Per sample: \( \text{SWH} = \text{median}_\text{closest} \times 3 > 3 \times \text{MAD}_\text{closest} \times 20 \)
- Three sigma: The difference between the sample and the expectation value of the closest 20 points > 3*sigma

Noise Analysis
Definition of noise: A noise value is defined as the standard deviation of the 20 Hz SWH within a 1-Hz distance.

Comparison with Model
Model grid points and altimetry are coupled by considering the median of the SWH 20-Hz measurements from altimetry within the grid point.

Comparison with In-situ Data
Definition: buoys are grouped into “open ocean buoys” and “coastal (but exposed) buoys”. Statistics are separated accordingly.

Representation of Scales of Variability
Along-track spectra of SWH are calculated for open ocean segments of track of at least 1024 points (~330 km length) using Welch’s method.

Retracker validation framework: retrackval
- Fully-automated scripts, written in Python 3.x
- Hosted on TUM-GitLab
- Python package
- Python dependencies managed by conda environment
- Unit tests
- Platform-independent
- Easy-to-use: About 10 commands + validation can be run
- Computational speed: 6 hours @30 cores, 2.20GHz
- Source is available on request

References and Acknowledgements:
- ESA Climate Change Initiative Sea State Project, http://cci.esa.int/seastate