

A Global Coastal Altimetry Dataset for Coastal Dynamics and Sea Level Research



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Satellite Altimetry:-

Has provided more than twenty years of global measurements of sea level, wave height, wind speed & geostrophic circulation

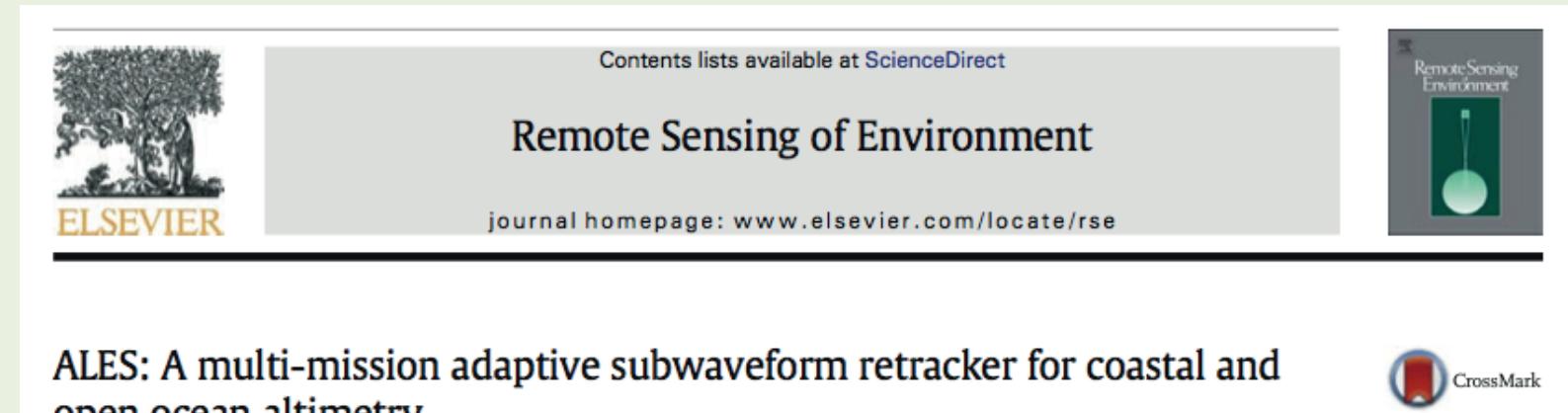
Standard practice does not consider data closer than 50 km from the coast, which means:

- poor knowledge of coastal circulation
- lack of comparability between tide gauges and satellite data
- no data available for synergy with coastal models.

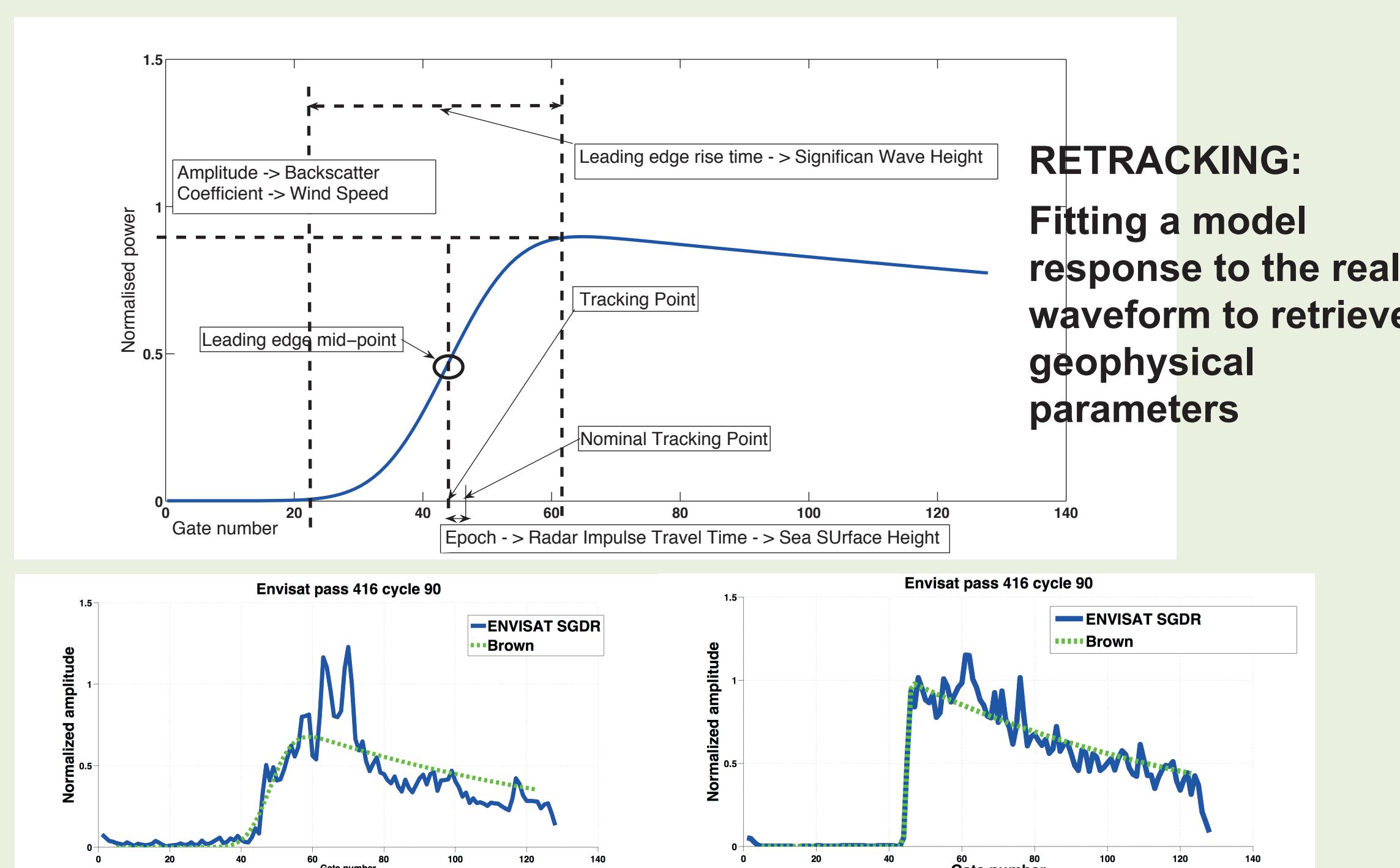
ALES :

a 3-year long effort to overcome the limitations of the radar measurements in the coastal areas and generate a validated and applicable product

Part 1: Design

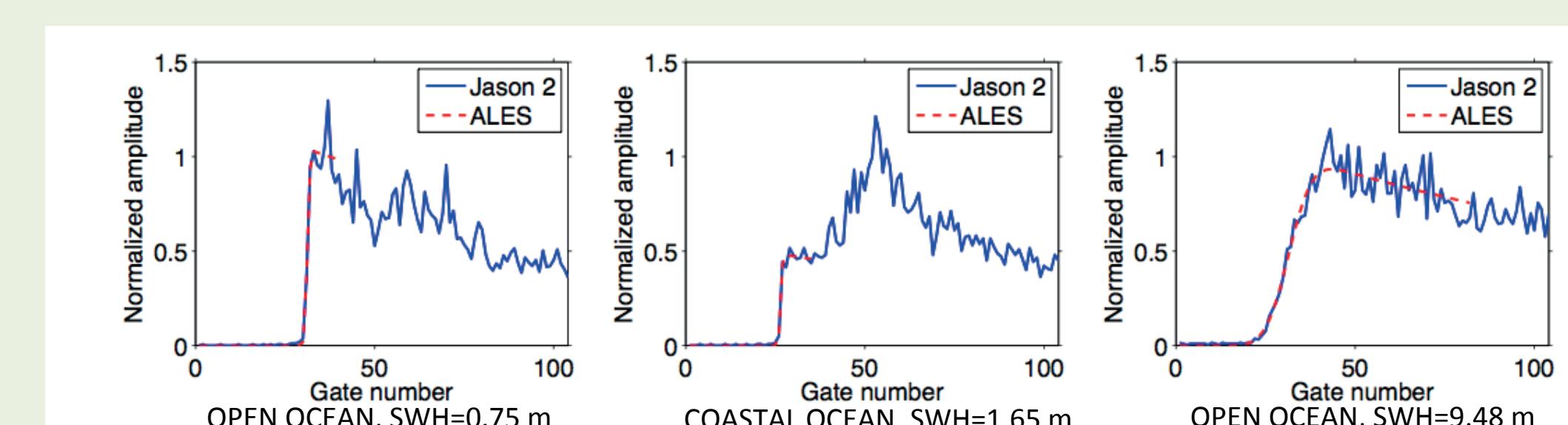


Take Home Message
ALES Retracks a selected part of the waveforms in order to:
Avoid spurious contributions from bright targets
Keep the same "standard brown" precision in the estimation

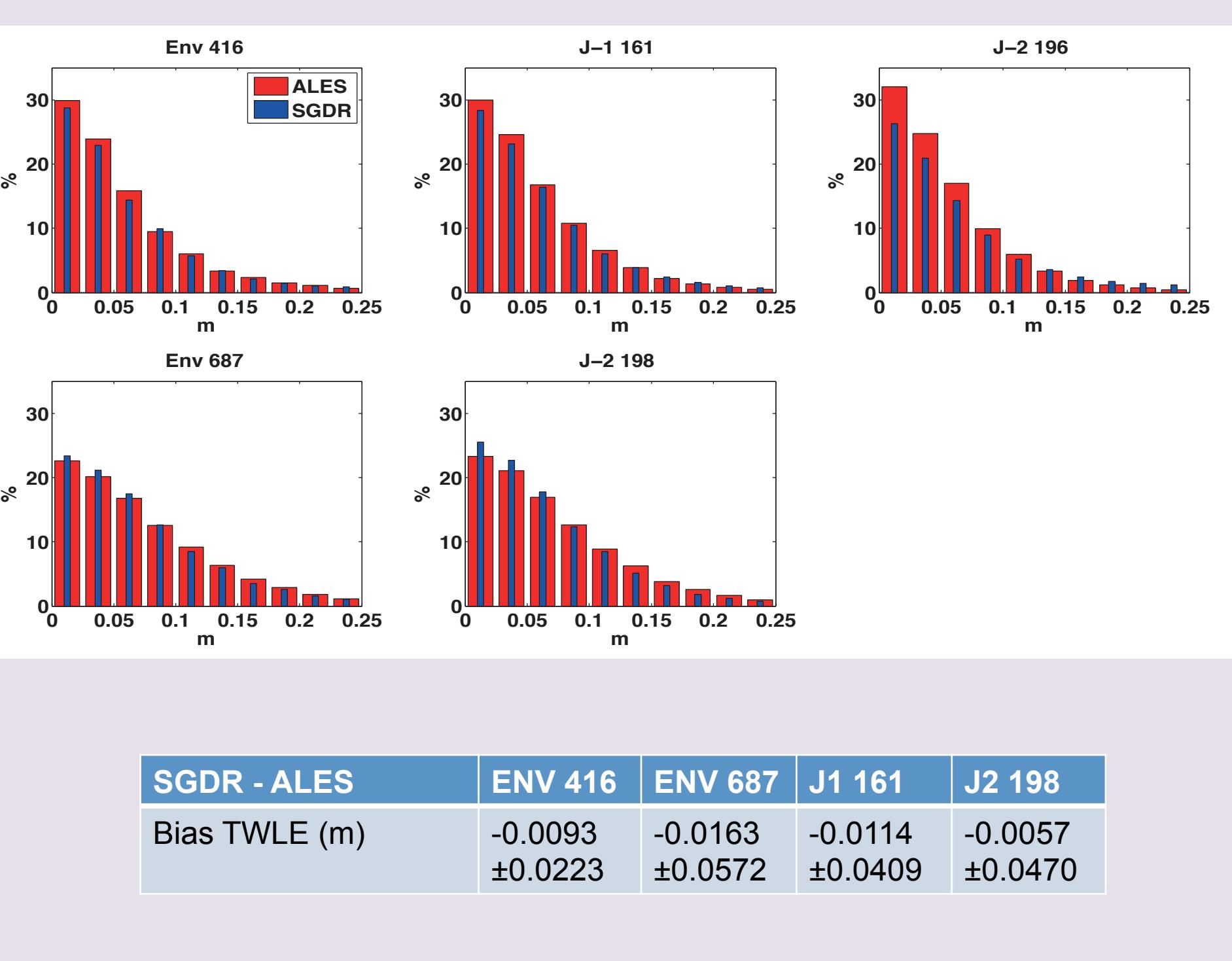


- 1) Leading Edge detection (based on difference of consecutive gates)
- 2) First pass: retracking of subwaveform up to the end of the leading edge
- 3) Adaptation of subwaveform depending on initial estimation of SWH
- 4) Second pass: retracking of new subwaveform and precise estimation of Epoch, SWH and Sigma0 Estimation:

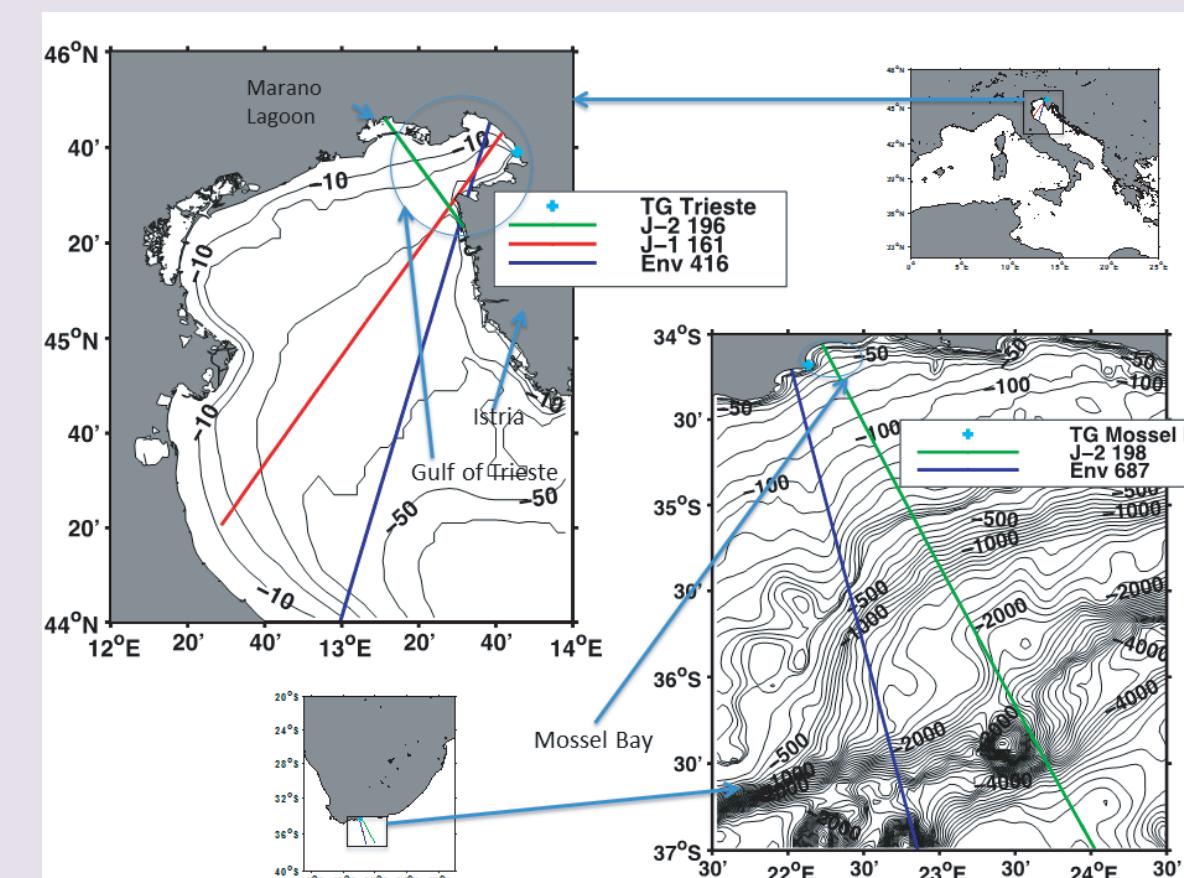
Least-Square Estimator, convergence found through Nelder-Mead algorithm [(Nelder & Mead, 1965), Halimi (2013)]



Part 2: Validation



Total Water Level Envelope (TWLE) → Sea Level including Tides



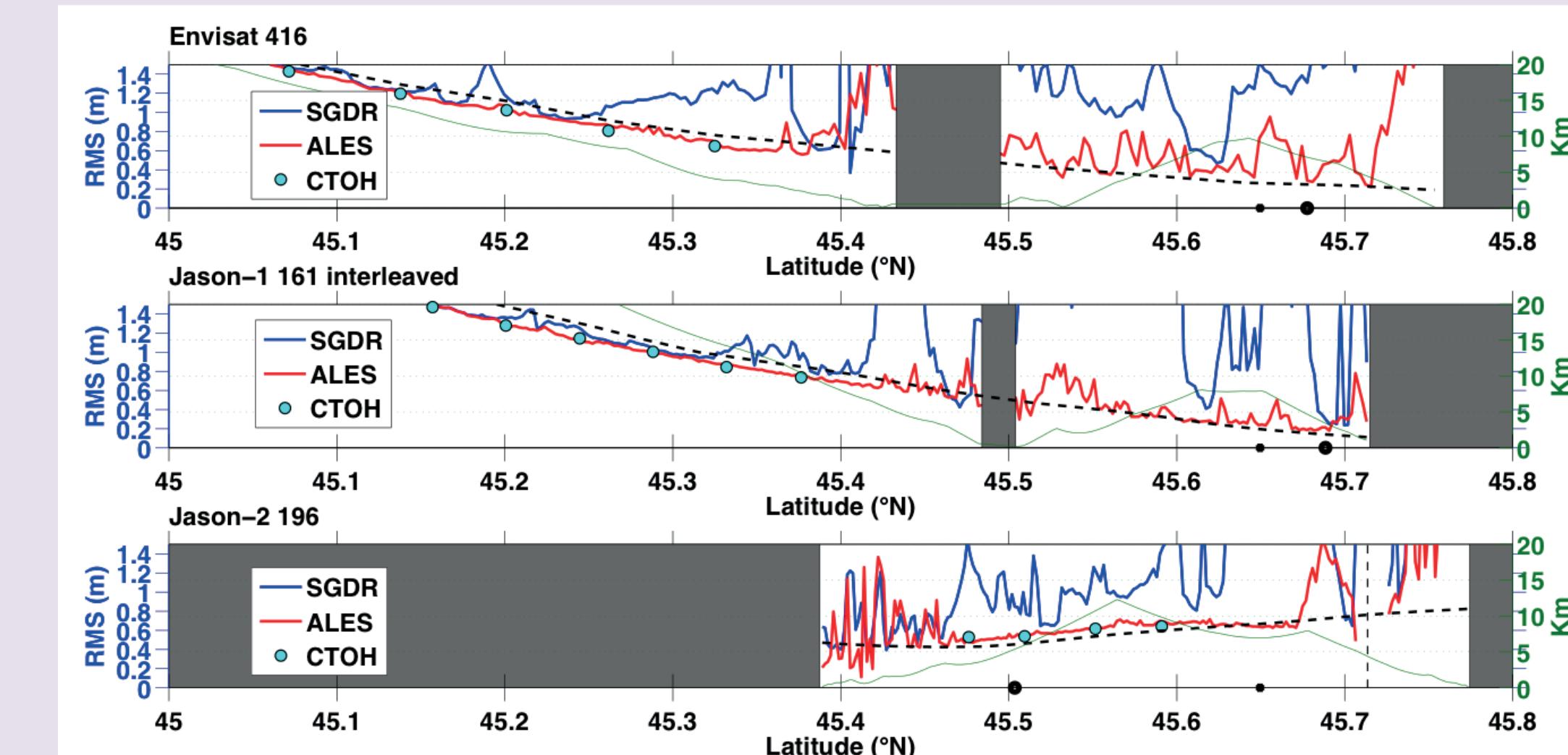
RMS (closest point)	ENV 416	J1 161	J2 296
SGDR - TIDE GAUGE	1.31 m	0.30 m	0.85 m
ALES - TIDE GAUGE	0.29 m	0.21 m	0.53 m

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Validation of Significant Wave Height From Improved Satellite Altimetry in the German Bight

Marcello Passaro, Student Member, IEEE, Luciana Fenoglio-Marc, Member, IEEE, and Paolo Cipollini, Senior Member, IEEE

RMSE NW Adriatic



* Absolute validation in NW Adriatic by referring all the sea level values to a common reference (ellipsoid)

* Outliers of ALES removed. SGDR evaluated in the same locations for the same points

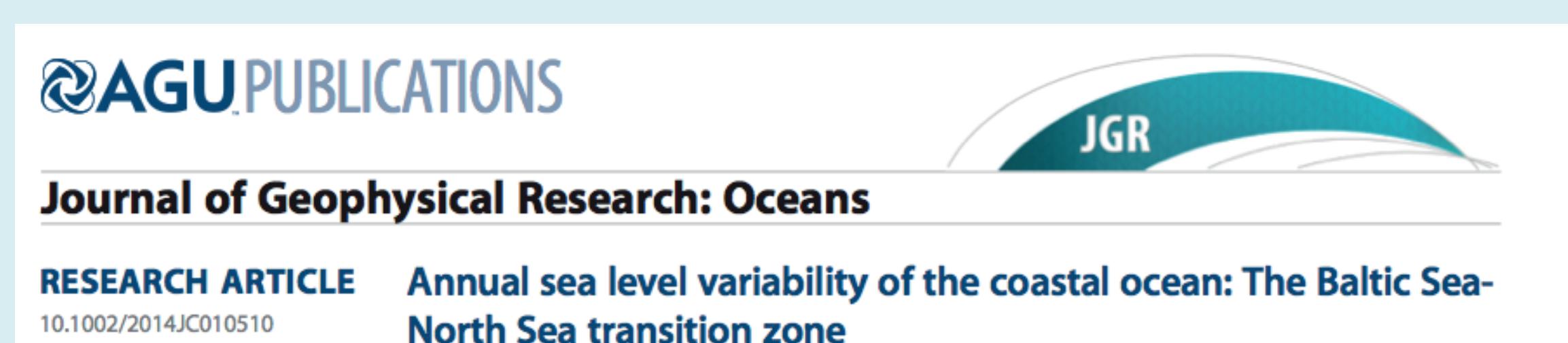
Take Home Message

ALES Can get to within ~3km of the coast
Can be used in the open ocean (no additional noise)

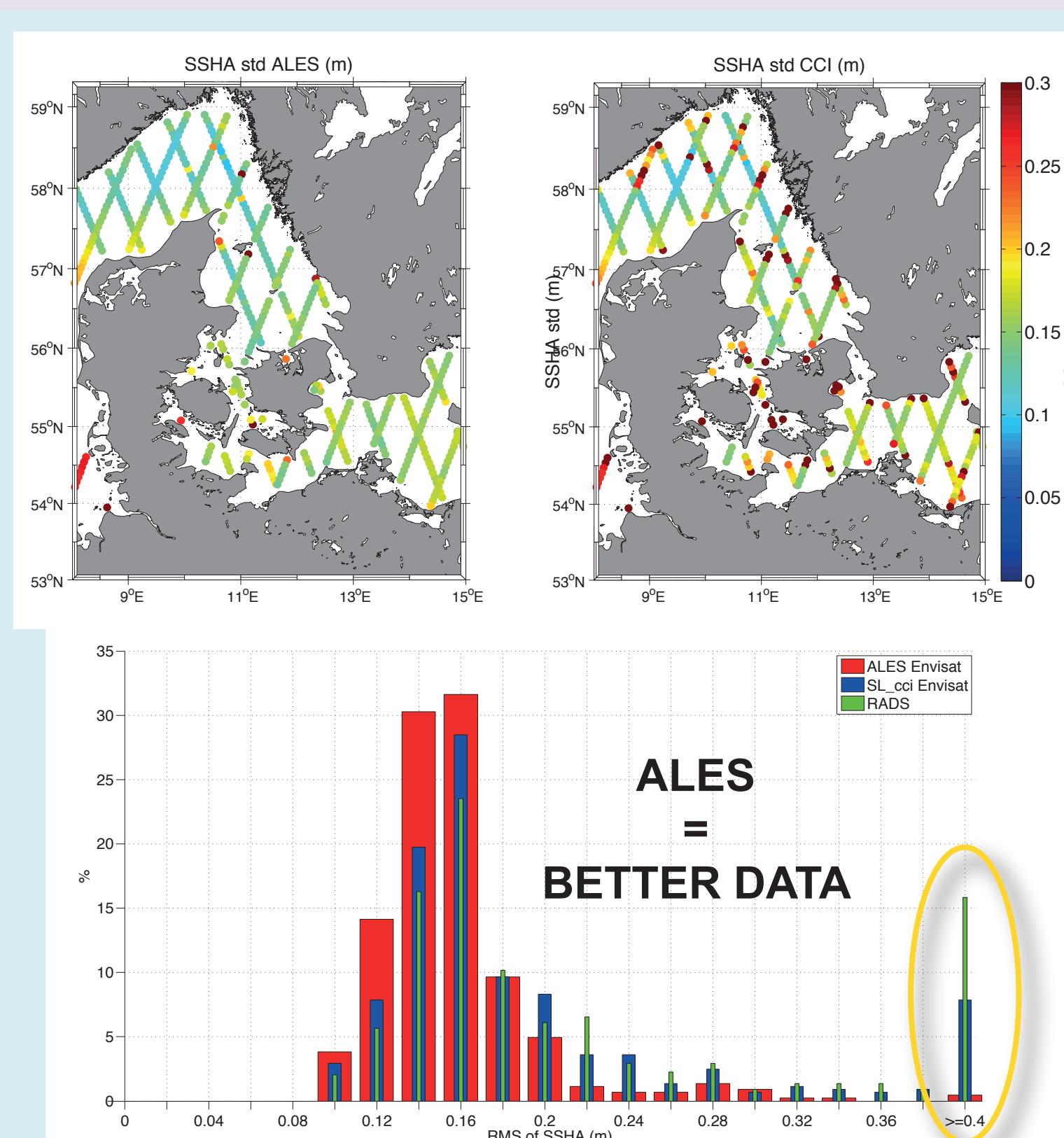
Can be "added" to open ocean standard data (bias ~1cm at 20Hz!)

Part 3: Application

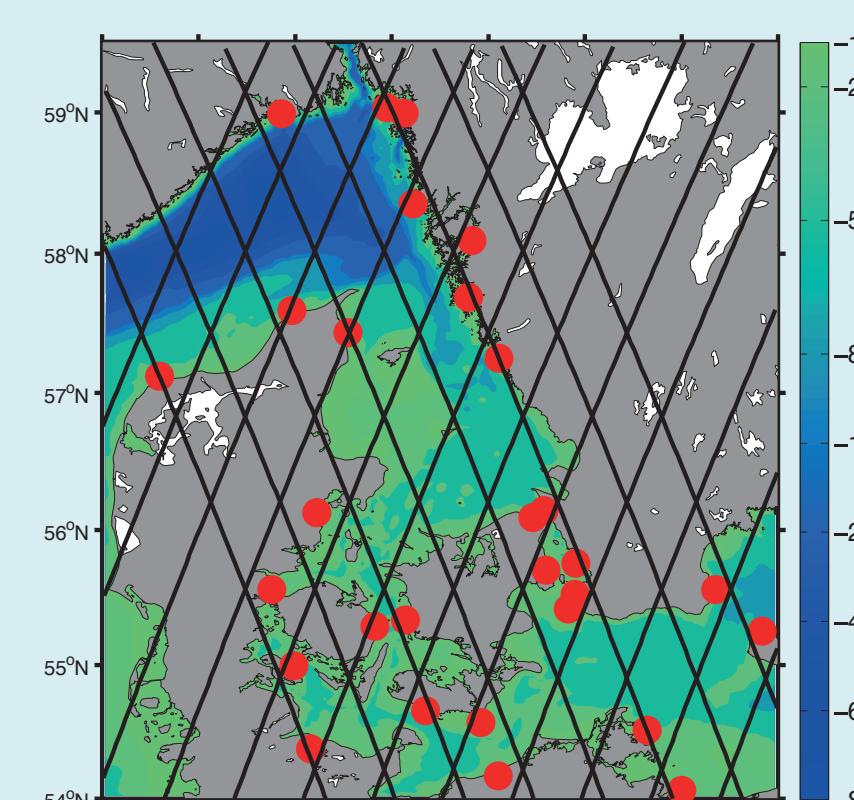
*work partially performed at ESA/ESRIN (co-supervised by Jérôme Benveniste)



Take Home Message
ALES Coastal Data (with state of the art geophysical corrections can be used to estimate sea level variability at a sub-basin scale



Estimation of the annual cycle of sea level: North Sea/Baltic Sea Transition

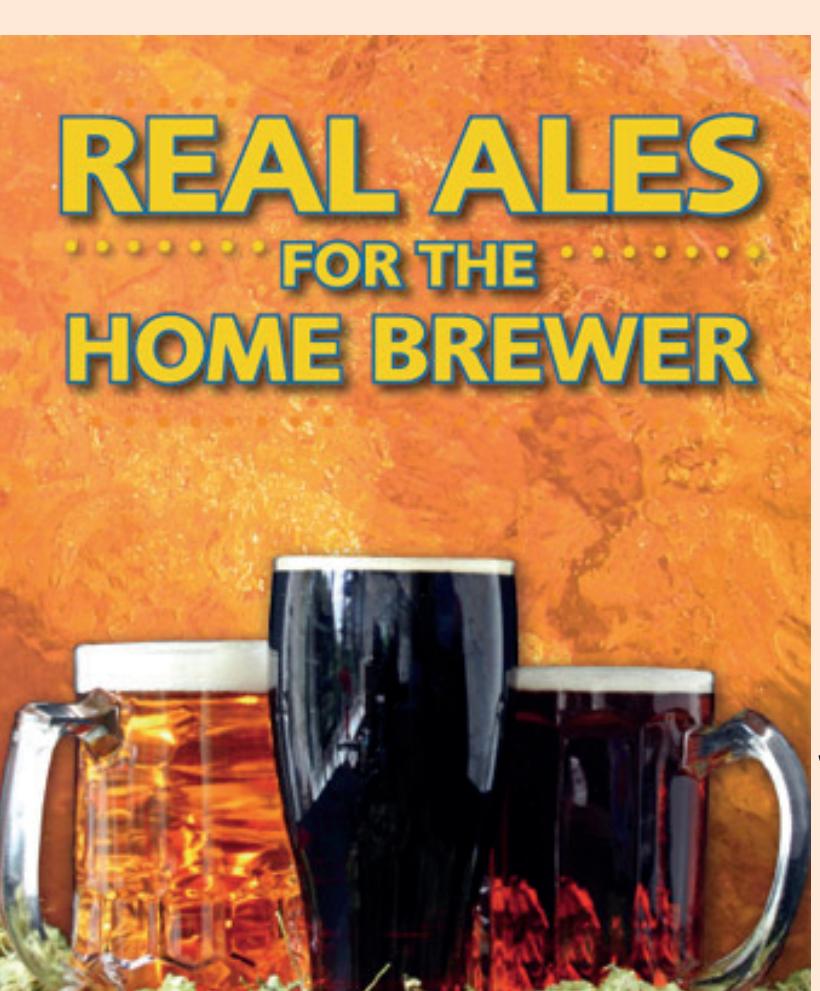


SEA LEVEL AMPLITUDE
(squares: tide gauges
Tracks: 1Hz points)

ALES:
reprocessed
coastal dataset
→ improves data
quality and
quantity

TOTAL SIGNAL (annual sinusoids)
ALES THE ONLY DATASET
WITH LESS THAN 1.5 cm
RMS error w.r.t TIDE
GAUGES

Part 4: Distribution



Users can investigate the transition from open ocean to coastal strip using data from a single file:

Sea Level Anomaly = Orbit altitude – Range_ALES – Geophysical Corrections - Mean Sea Surface – Tides – DAC

Geophysical corrections = Dry tropospheric correction + Wet Tropospheric Correction + Sea State Bias + Ionospheric correction

ftp://podaac.jpl.nasa.gov/allData/coastal_alt/L2/ALES

Processed source SGDR data globally within a 55km strip (50km offshore, 5km inland) using ALES
Created Coastal GDR (CGDR) files

Retained source SGDR file-naming conventions

CGDR files contain the full, global dataset of the original SGDR data

But...

the ALES variables are set to default values outside the coastal strip.

Essentially unchanged data content from original SGDRs...

...but with new ALES variables

ALES parameter	Jason-2 variable	ENVISAT variable
Err_ALES	wfm_fit_err_20hz_ku_ALES	hz18_ku_ALES_wfm_fit_err
Epoch_ALES	epoch_20hz_ku_ALES	hz18_ku_ALES_epoch
Range_ALES	range_20hz_ku_ALES	hz18_ku_ALES
SWH_correction_applied	net_lstr_corr_swh_ku_ALES	hz18_ku_ALES_swcat
SWH_ALES	swh_20hz_ku_ALES	hz18_ku_ALES_bscat
Sigma0_ALES	sig0_20hz_ku_ALES	hz18_ku_ALES_bscat
SigmaC_ALES	width_leading_edge_20hz_ku_ALES	hz18_ku_ALES_leading_edge_width

ALES' FIRSTS (to our knowledge!)

- first global coastal-retracked dataset to include multiple missions

- first retracked dataset to be used in a peer-reviewed research on regional sea level variability

Thanks to the collaboration with PODAAC, now freely available online

JASON-2 already available

ENVISAT under testing

Jason-1 awaiting GDR version E

Processing tested on AltiKa

Coastal GDR Handbook available

Let's make the ALES community wider!!!