Sea surface height variability observed by Ku and Ka-band altimeter data in the NW Mediterranean Sea

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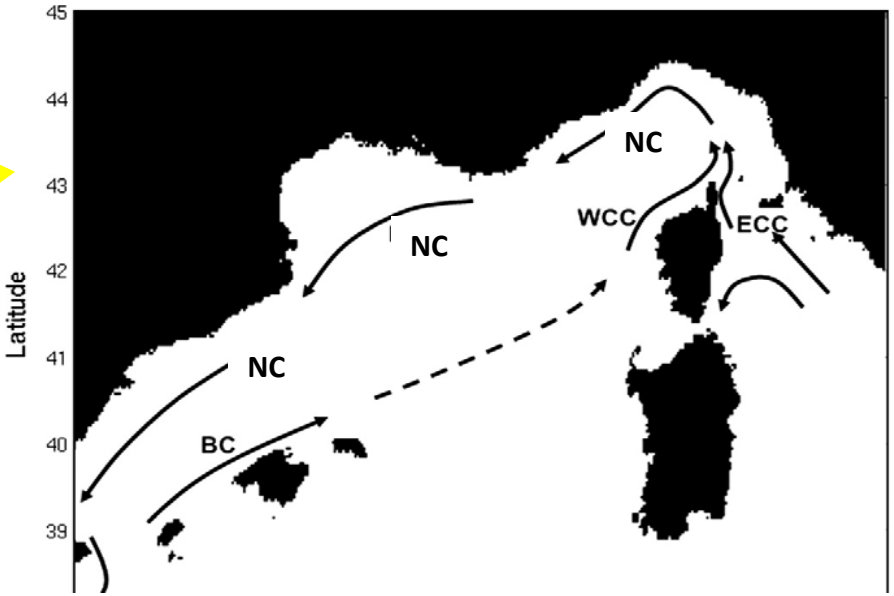
Objectives :

- SARAL/AltiKa Ka-band versus Jason-2 Ku-band SSHa data on a regional basis
- Any impact for the observation of the regional coastal circulation?
- Revisit the question of data editing for Ka-band altimetry

Region of interest: NW Mediterranean Sea



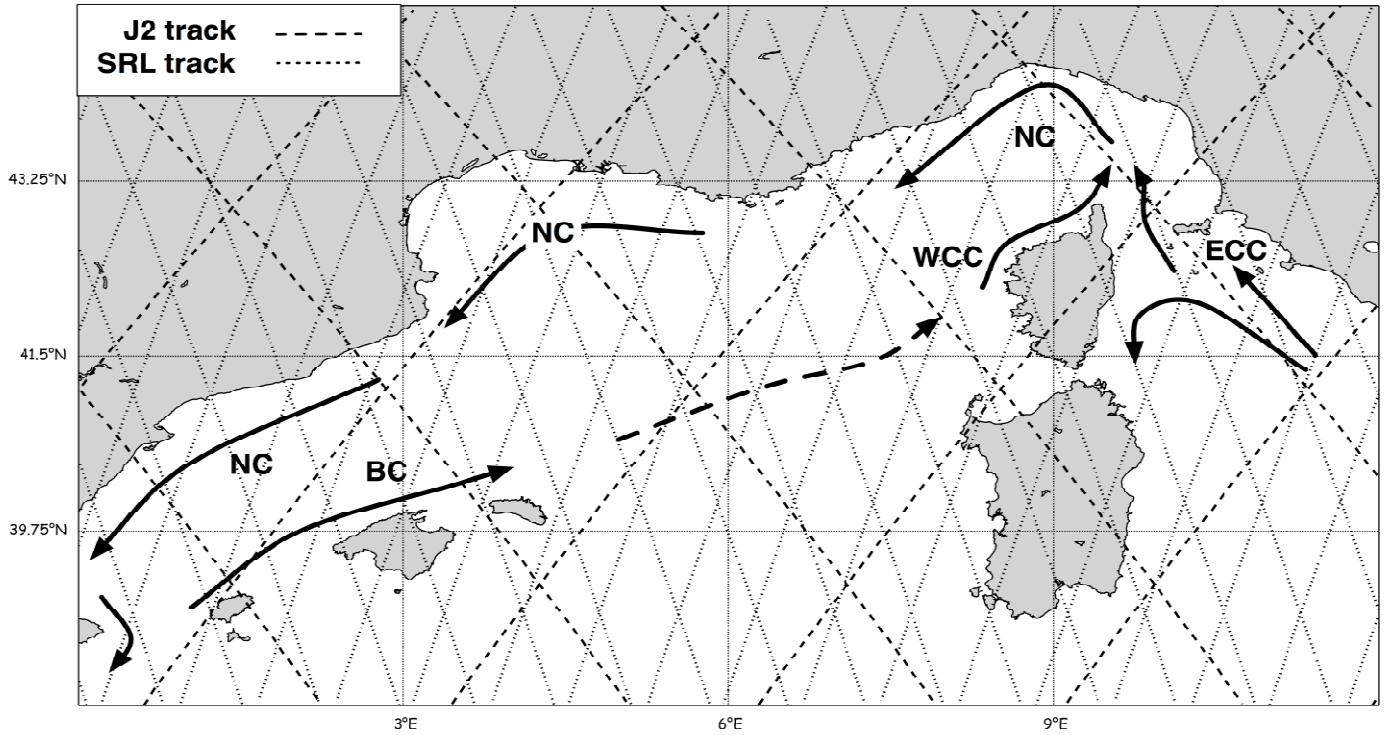
- Main feature of the circulation : the Northern Current (NC)
- Large variability (in both space and time)
- Associated to small length scales (0-50 km), under the lower resolution limit of standard altimeter products.
- Often close to the coast

→ Interesting area to analyze the performance of Ka-band altimetry

Data used

- SARAL GDR-T (Patch2): cycles 1 to 11 (14/03/2013 to 02/04/2014)
- Jason-2 GDR-D: cycles 173 to 209 (12/03/2013 to 15/03/2014)
- 1-Hz measurements only for this study
- SSHa data computed in the same way for Jason-2 and SARAL (same corrections used)

All SSHa observations located between 38-45° N and 0-12° E are considered



SSHa and editing conditions

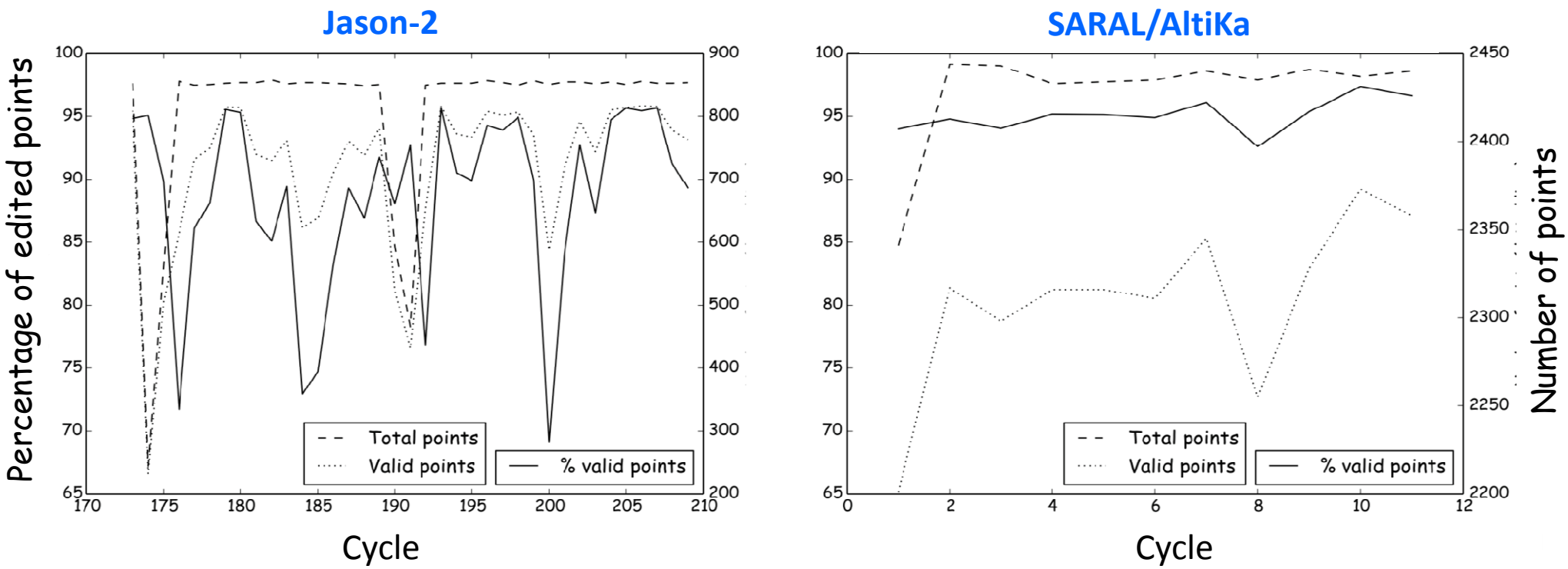
Thresholds for the parameters used for Jason-2 and SARAL data editing procedure

- ✓ **Reference :** Handbooks + CAL/VAL team recommendations
- ✓ **ssha recomputed** from GDR (Jason-2 ssha set to default if alt_echo_type=1)

Parameter	Validity conditions	
	Jason-2	**SARAL/AltiKa**
range_numval	50% of individual measurements, i.e: 10 ≤ x	50% of individual measurements, i.e: 20 ≤ x
range_rms	0 ≤ x ≤ 20 cm	
model_dry_tropo_corr	-250 cm ≤ x ≤ -190 cm	
rad_wet_tropo_corr	-50 cm ≤ x ≤ -0.1 cm	-50 cm ≤ x ≤ -2 cm
iono_corr_alt	-10 cm ≤ x ≤ 4 cm	
sea_state_bias	-500 cm ≤ x ≤ 0 cm	-500 cm ≤ x ≤ 0.25 cm
ocean_tide_sol1	|x| ≤ 500 cm	
solid_earth_tide	|x| ≤ 100 cm	
pole_tide	|x| ≤ 15 cm	
swh	0 ≤ x ≤ 1100 cm	
sig0	7 dB ≤ x ≤ 30 dB	3 dB ≤ x ≤ 30 dB
wind_speed_alt	0 ≤ x ≤ 30 m/s	
off_nadir_angle_wf	-0.2 deg^2 ≤ x ≤ 0.64 deg^2	-0.2 deg^2 ≤ x ≤ 0.15 deg^2
sig0_rms	x ≤ 1 dB	
sig0_numval	50% i.e: 10 ≤ x	50% i.e: 20 ≤ x
Ssha	|x| ≤ 200 cm	
surface_type	Ocean	

SSHa and editing: SARAL/AltiKa vs Jason-2

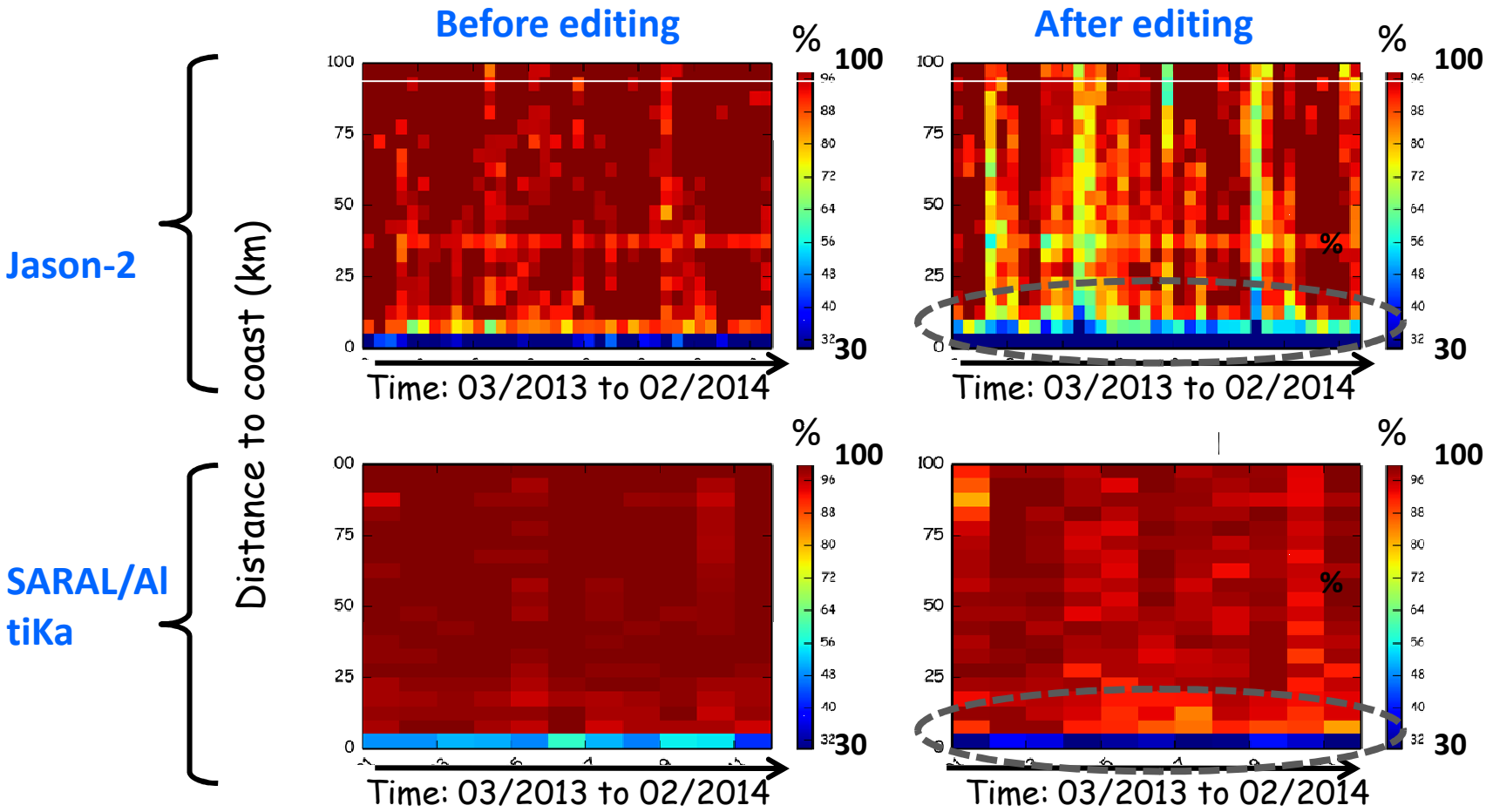
Number of 1-Hz measurements over ocean and % of SSHa edited



→ Data available after edition are much more stable in time for SARAL/AltiKa than in the case of Jason-2

SSHa and editing: SARAL/AltiKa vs Jason-2

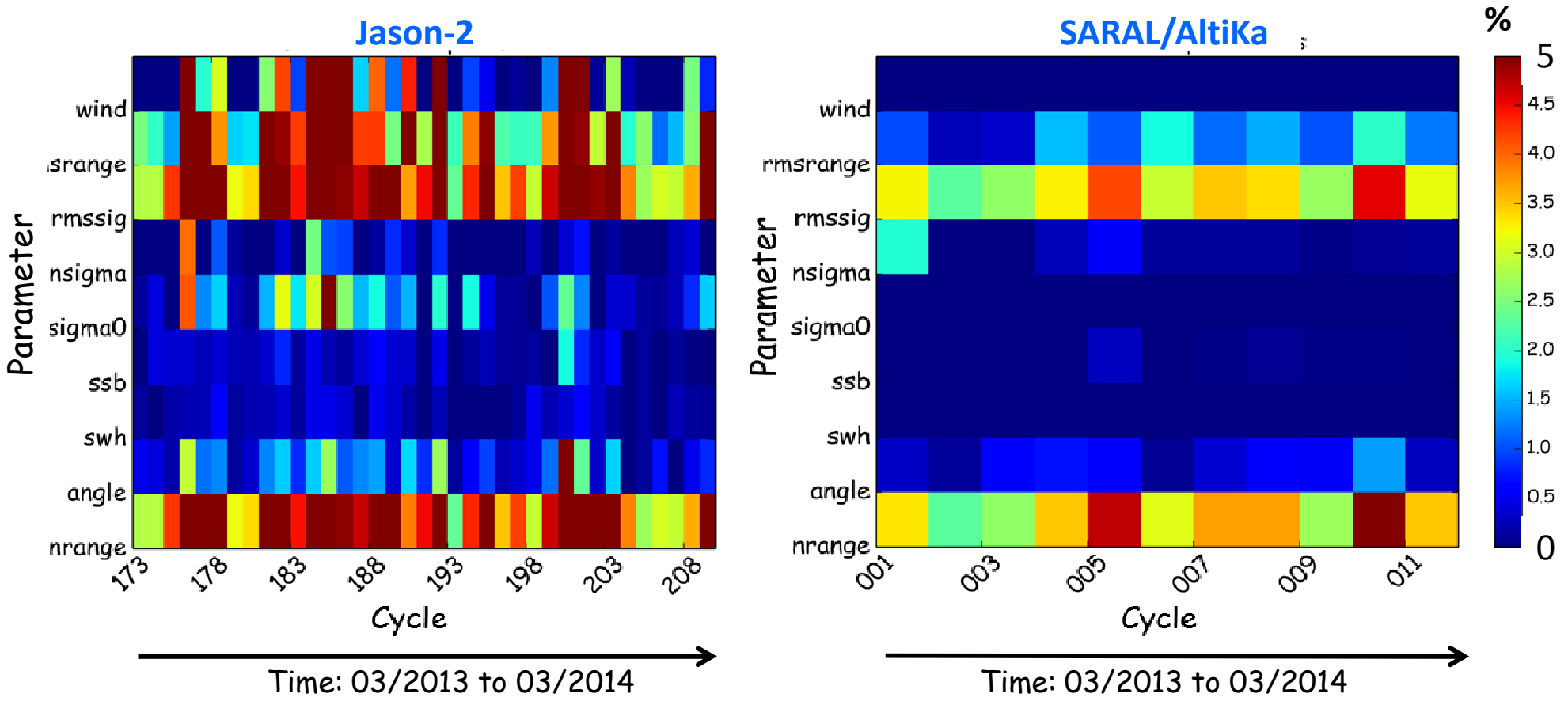
% of SSHa data (relative to the total number of 1-Hz observation points) vs distance from coast – regional average



→ **Significantly more pertinent SSH observations in the 0-15 km coastal band with SARAL/AltiKa measurements**

SSHa and editing: SARAL/AltiKa vs Jason-2

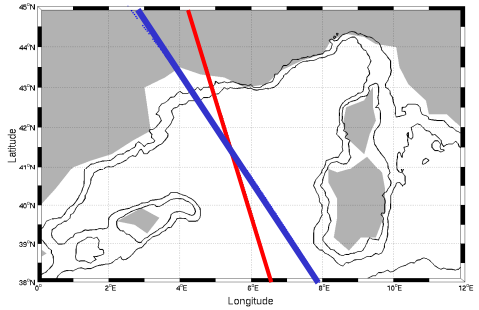
Origin of data loss (as a function of the editing condition)



→ **Much less parameters lead to data rejection in the case of SARAL mission, with much less data discarded**

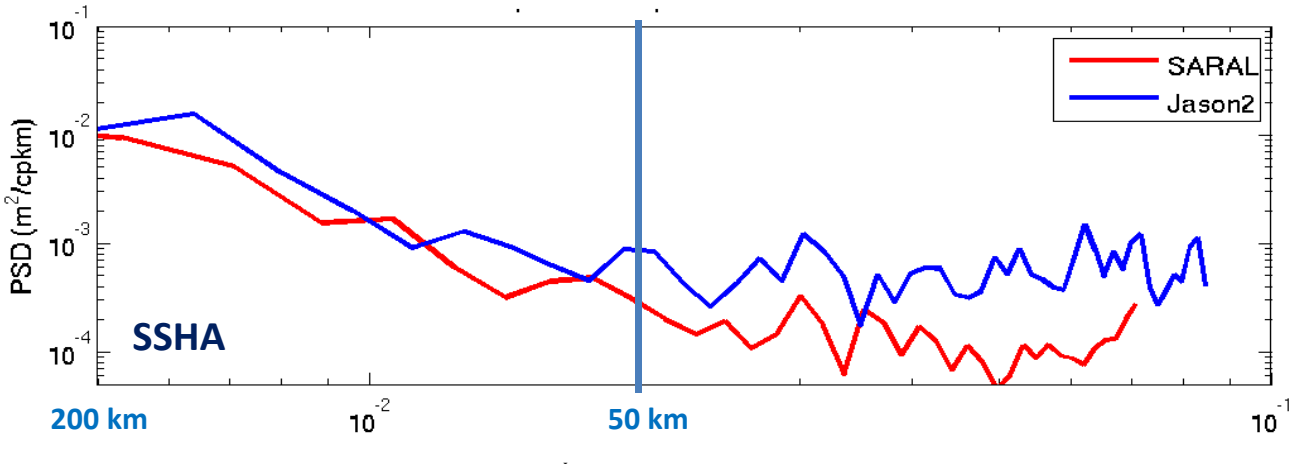
Can we better observe the coastal dynamics with SARAL/AltiKa data?

Spectral analysis : a regional view



- J2 : track 146
- SARAL/AltiKa: track 57

11 cycles considered for both Jason-2 and AltiKa



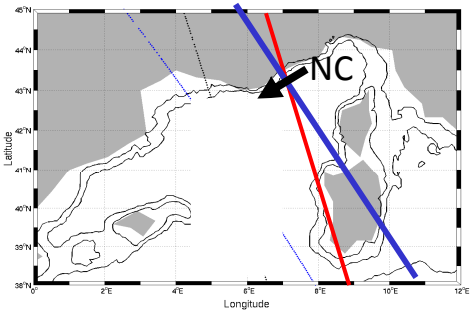
→ Significantly less noise in SARAL/Altika data for spatial scales < 50 km

→ Same as what is observed globally (and is expected with Ka-band altimetry)

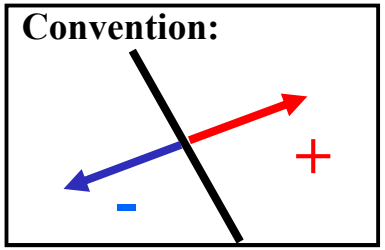
→ Better observation of ocean fine-scale dynamics

Can we better observe the coastal dynamics with SARAL/AltiKa data?

Velocities (m/s) derived from altimetry

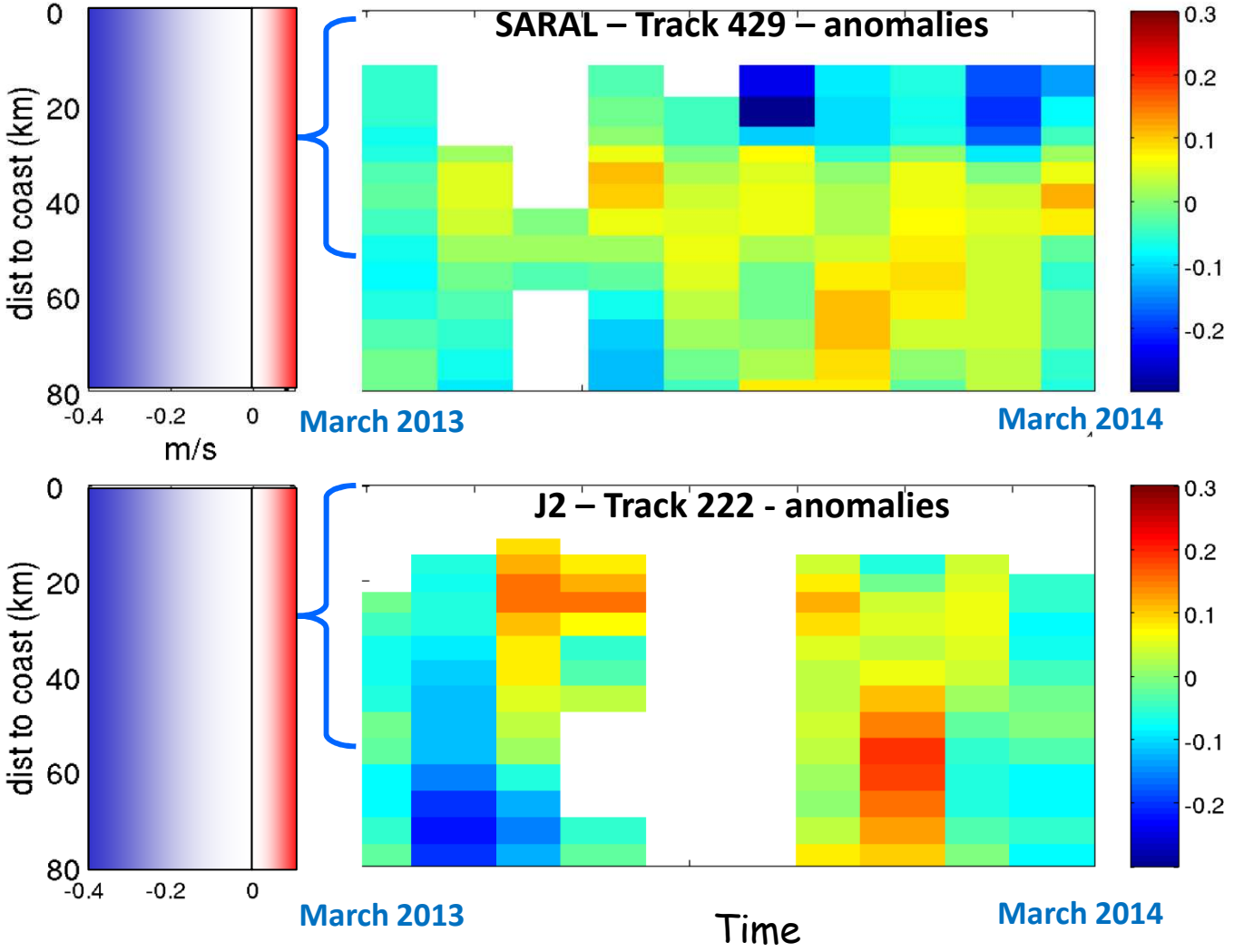


- J2 : track 222
- SARAL/AltiKa: track 429



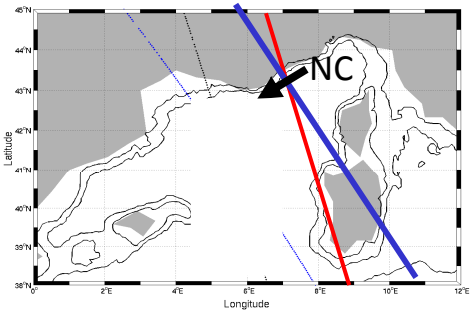
→ Information on coastal current variations seems more coherent with SARAL…

Mean derived from MDT



Can we better observe the coastal dynamics with SARAL/AltiKa data?

Velocities (m/s) derived from altimetry

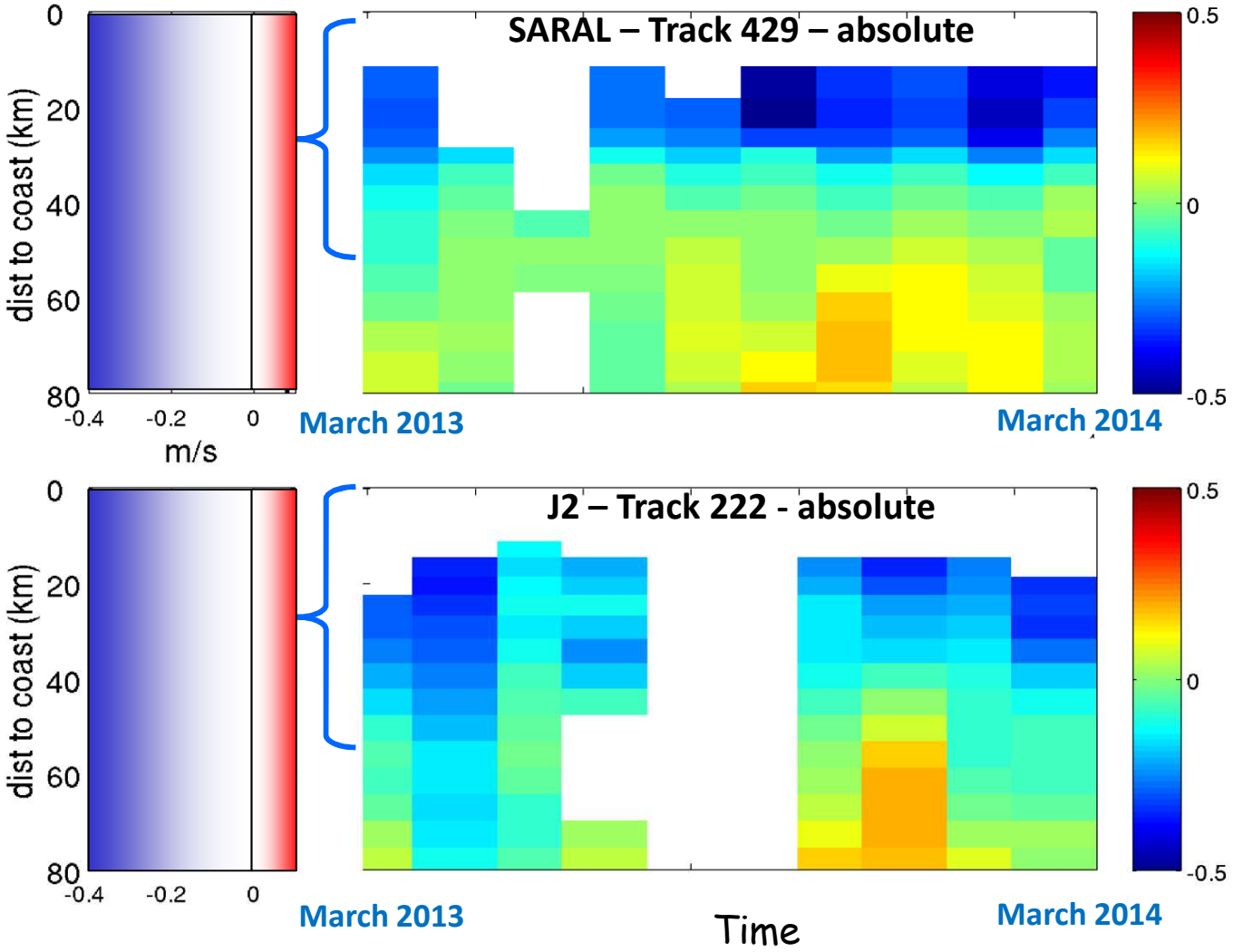


- J2 : track 222
- SARAL/AltiKa: track 429

→ NC offshore extension: smaller and more stable

→ Generally larger NC magnitude

Mean derived from MDT



Conclusions

- Better performance of SARAL/AltiKa near the coast:
  → significant increase in the number of sea level data available near coastlines

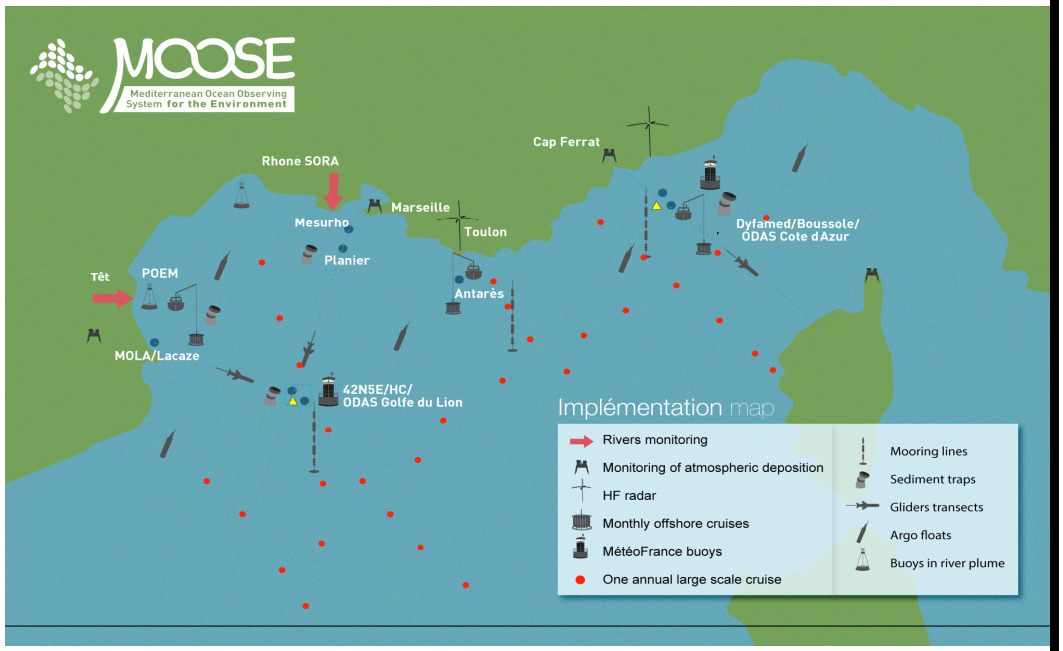
- Editing: much less erroneous 1Hz SSHa data with SARAL
  → the classical editing approach works quite well
  → but what about 40-Hz measurements?

- Along-track spatial resolution at least as good as Jason-2 one (slightly better because higher signal-to-noise ratio)
  → velocity values derived seem less noisy
  → coastal currents seem more realistic but …
  → difficulty to quantify the gain of Ka-band altimetry in terms of coastal circulation observed

→ Results really encouraging for coastal studies!

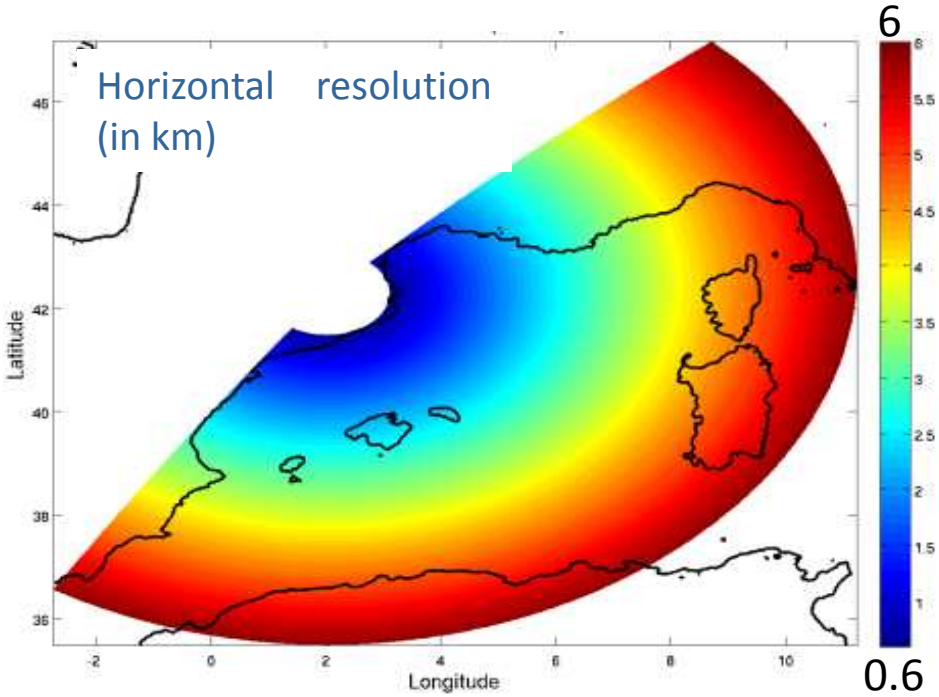
Perspectives

Moose - Mediterranean Ocean Observing System on Environment (>2010)



The implementation plan is a network based on a multisite system of continental-shelf and deep-sea fixed stations as well as Lagrangian platforms.

3D regional ocean circulation model (Symphonie, developed by the SIROCCO group).



→ **Will really help quantifity the contribution of new/future altimeters for coastal ocean studies!**