Use of the Corsica site to compute altimeter biases for JASON-2/OSTM, JASON-1 and ENVISAT: Absolute and Regional CalVal methods

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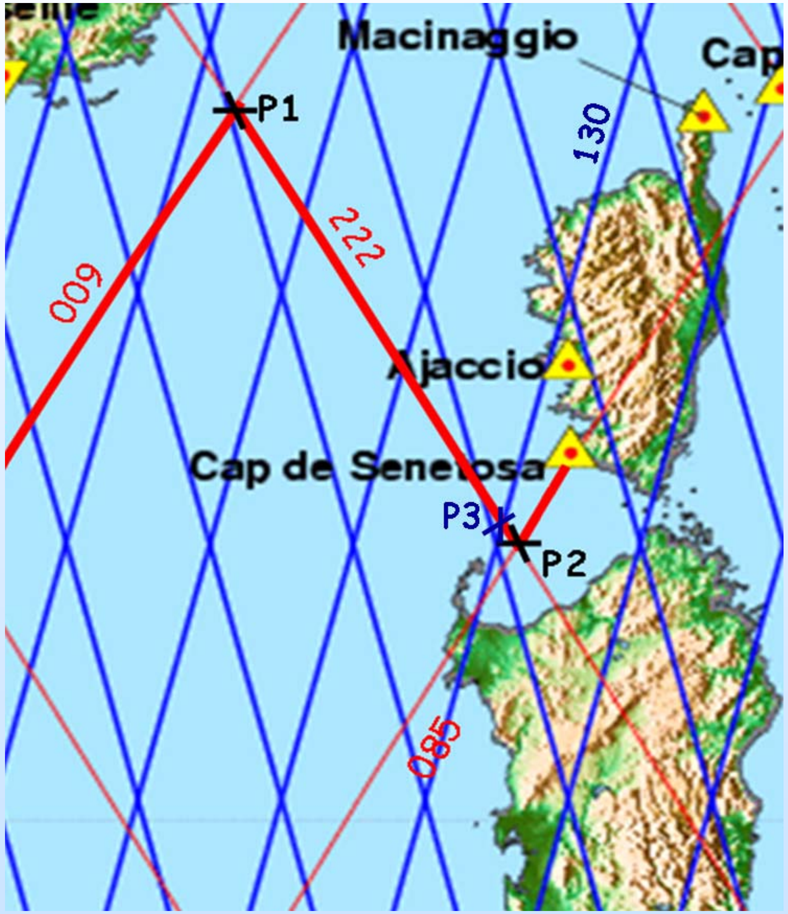
Agenda

- Status on the in situ absolute and regional CalVal methods
- Jason-2 bias: absolute and regional CalVal methods
- Jason-1 bias on the interleaved passes: regional method
- ENVISAT bias *(see poster in the same session)*
- Conclusions and perspectives

Status on the CalVal methods

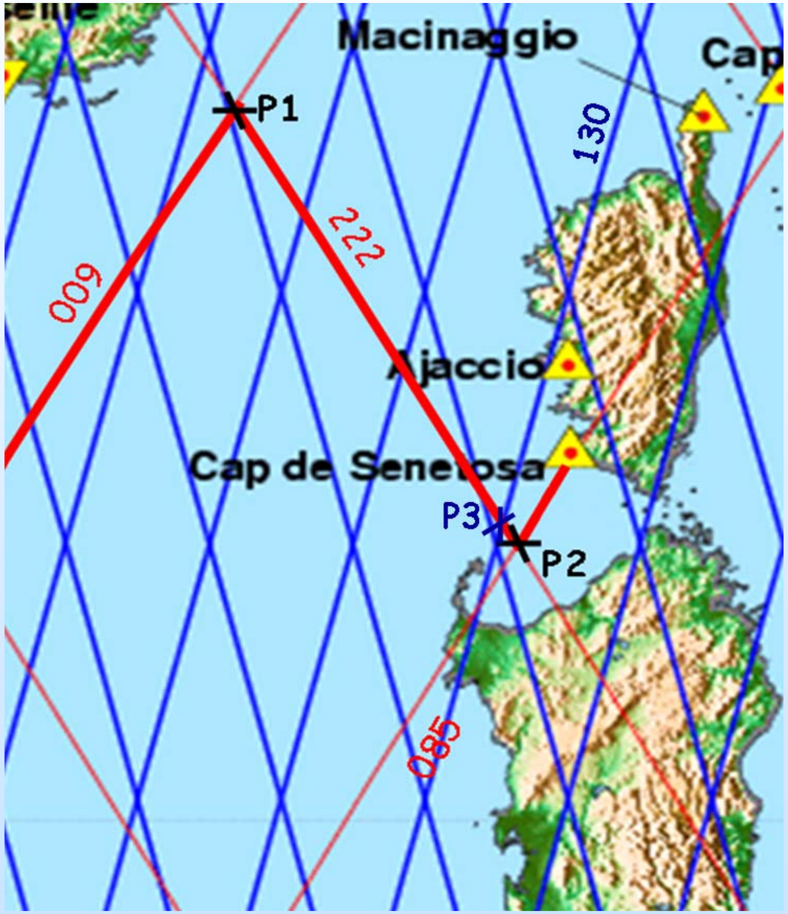
- **In situ calibration:**
  - **Regular long term control of the altimeter SSH measurements**
  - **Independent of other altimetry missions**

- **Absolute CalVal method:**
  - **For satellite passes flying directly over the calibration sites**
    - Jason-2 pass 085 in Senetosa
    - Envisat pass 130 in Ajaccio
  - **Comparable to the bias estimation in Harvest, Bass Strait, Gavdos…**



Status on the CalVal methods

- **Regional CalVal method:**
  - **Enables to compute the bias on offshore passes, at crossover points:**
    - considering passes of the same mission
    - or combining several missions
  - **Brings back the offshore SSH to the calibration site following a succession of accurate mean profiles**
    - → takes into account the spatial MSS gradient between the offshore crossover point and the calibration site
  - **The ocean dynamics (tides and atmospheric effects) differential signal between the offshore passes and the coasts may influence the bias estimation**



In situ data quality control

- **High quality tide gauge data is crucial to compute accurate biases**

- **In Senetosa, 4 tide gauges on site to:**
  - ensure the SSH measurements continuity
  - avoid gaps in the data if one of the instruments has a problem

M4 and M5 tide gauges in Senetosa

- **In situ measurements may be impacted by:**
  - **Failures and drifts of the pressure or temperature captors**
  - **Sea-shells and algae settling on the pressure captor**
  - **Vibrations and/or sinking of the instrument if not well fixed or positioned on its support: may change the zero reference**
  - **Other damages: flood, flat batteries, robbery attempts…**

In situ data quality control

- **High quality tide gauge data is crucial to compute accurate biases**

- **In Senetosa, 4 tide gauges on site to:**
  - ensure the SSH measurements continuity
  - avoid gaps in the data if one of the instruments has a problem

M4 and M5 tide gauges in Senetosa

- **In situ measurements may be impacted by:**
  - **Failures and drifts of the pressure or temperature captors**
  - **Sea-shells and algae settling on the pressure captor**

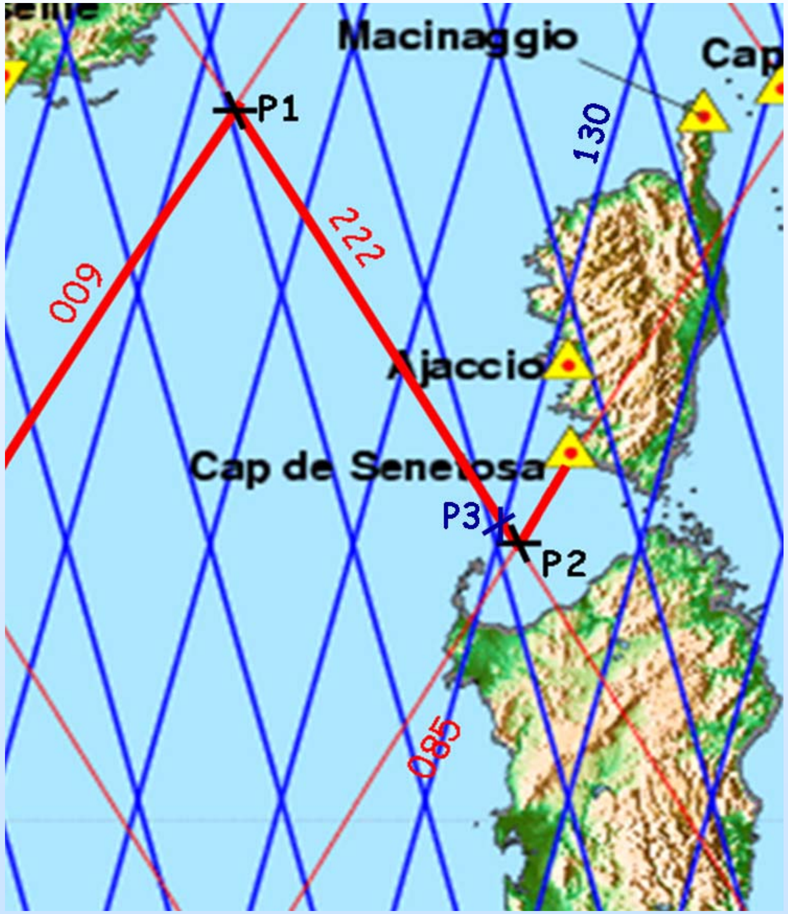
Important work on the in situ data quality control, as well as for the altimetry data

Jason-2 bias in Senetosa

- **Configuration:**
  - GDR-C products
  - 74 cycles
  - No tide nor dynamical atmospheric corrections

- **Computation of a "weighted bias" on each pass, considering the availability and quality of the in situ data:**

Weighted bias (cm)	Jason-2 - 64 cycles		Jason-2 – 74 cycles	
	Mean	Std	Mean	Std
Pass 085	18.2	3.3	18.8	3.4
Pass 222 (P2)	16.7	2.5	17.7	2.5
Pass 009 (P1)	14.8	3.3	16.0	3.3



Jason-2 bias in Senetosa

From 64 to 74 cycles: increase in the bias, due to changes in the MSS profiles implied by the new cycles (stabilization)

Decrease in the bias of about 3cm between the coast (pass 085) and the offshore altimetry data (pass 009)

→ ocean dynamics differential effects ?

→ stability of the MSS profile used to compute the bias ?

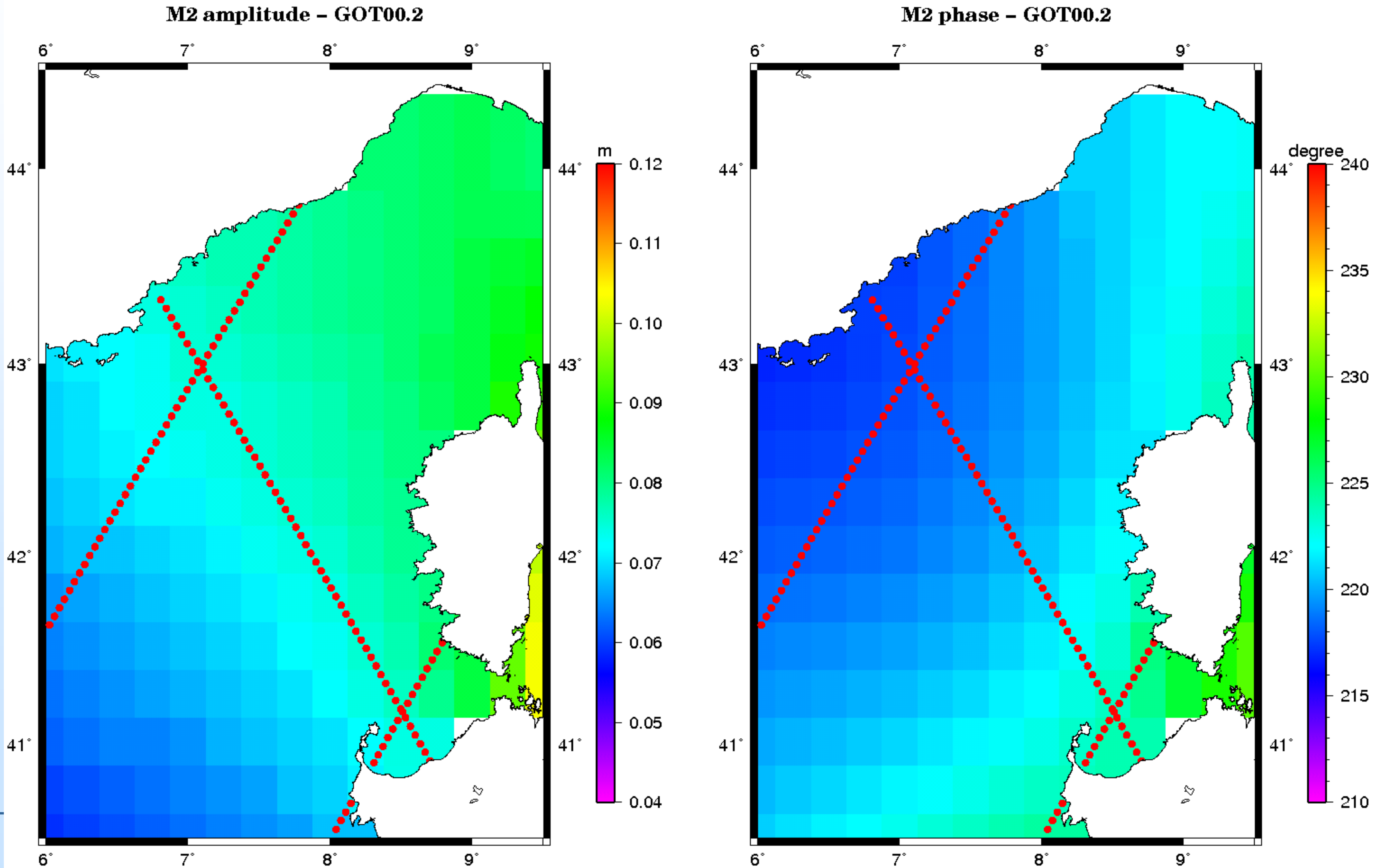
Weighted bias (cm)	Jason-2 - 64 cycles		Jason-2 – 74 cycles		
	Mean	Std	Mean	Std	
Pass 085	18.2	3.3	18.8	3.4	+0.6cm
Pass 222 (P2)	16.7	2.5	17.7	2.5	+1.0cm
Pass 009 (P1)	14.8	3.3	16.0	3.3	+1.2cm

Jason-2 bias in Senetosa

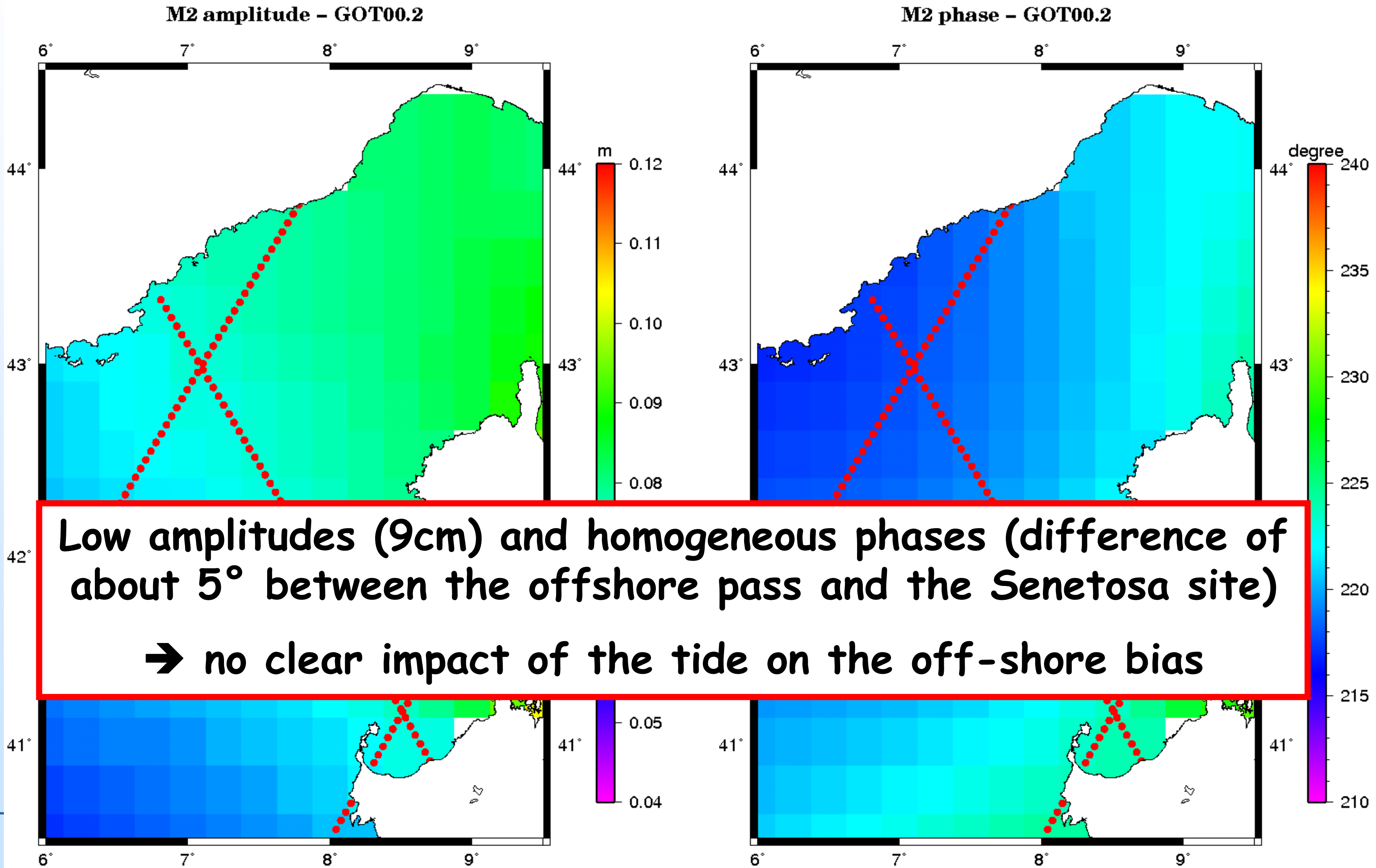
- **Considering the tide and the dynamical atmospheric corrections**
  - **Tide effect:**
    - Several **tide model** corrections available in the GDR-C products:
      - FES2004
      - GOT00.2
    - **Harmonic analysis** on the tide gauge data

Weighted bias (cm)	Jason-2 – 64 cycles no tide correction		Jason-2 – 64 cycles GOT00.2 tide correction		Jason-2 – 64 cycles FES2004 tide correction	
	Mean	Std	Mean	Std	Mean	Std
Pass 085	18.2	3.3	18.2	3.5	18.0	3.6
Pass 222	16.7	2.5	16.8	2.8	16.8	2.9
Pass 009	14.8	3.3	14.9	3.7	14.7	3.7

Jason-2 bias in Senetosa



Jason-2 bias in Senetosa



Low amplitudes (9cm) and homogeneous phases (difference of about 5° between the offshore pass and the Senetosa site)

➔ no clear impact of the tide on the off-shore bias

Jason-2 bias in Senetosa

- Considering the tide and the dynamical atmospheric corrections
  - **Dynamical atmospheric effect:**
    - **TUGO global simulation** for both altimetry and tide gauge data

Weighted bias (cm)	Jason-2 cycles 1 to 64 with no dynamical correction		Jason-2 cycles 1 to 64 with TUGO dynamical correction		
	Mean	Std	Mean	Std	
Pass 085	18.2	3.3	18.1	3.1	
Pass 222	16.7	2.5	16.5	2.5	
Pass 009	14.8	3.3	15.3	3.6	+5mm

Jason-2 bias in Senetosa

- Considering the tide and the dynamical atmospheric corrections
  - **Dynamical atmospheric effect:**
    - **TUGO global simulation** for both altimetry and tide gauge data

The dynamical atmospheric effects do not explain the gap between the offshore and coastal biases.

→ Would a regional correction better see the offshore dynamics ?

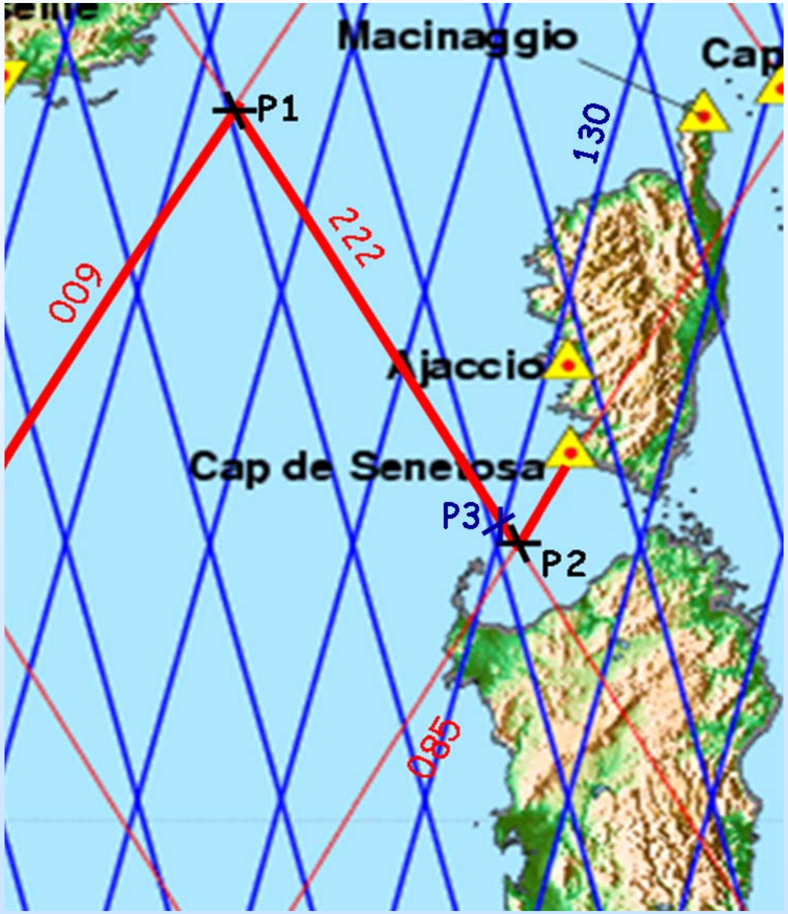
→ Are there temporal or spatial structures of the bias in the area ?

→ Is it visible on other mission biases ?

Jason-1 bias in Senetosa

- Computation of the biases on the **initial orbits** (same configuration as Jason-2):
  - GDR-C products
  - 259 cycles
  - No tide nor dynamical atmospheric corrections

Weighted bias (cm)	Mean	Std
Pass 085	9.1	3.3
Pass 222 (P2)	8.3	2.5
Pass 009 (P1)	8.3	3.5



Jason-1 bias in Senetosa

- Computation of the biases on the **initial orbits** (same configuration as Jason-2):

Same behavior as Jason-2: decrease in the bias between the coast and the offshore altimeter data even if it is weaker.

Not visible in the previous results computed with the GDR-A products *(Jan et al., 2004)*

➔ Jason-1 biases computed on a different and longer period

➔ Better retracking in the GDR-C products ?

➔ Better corrections (wet troposphere, SSB…) ?

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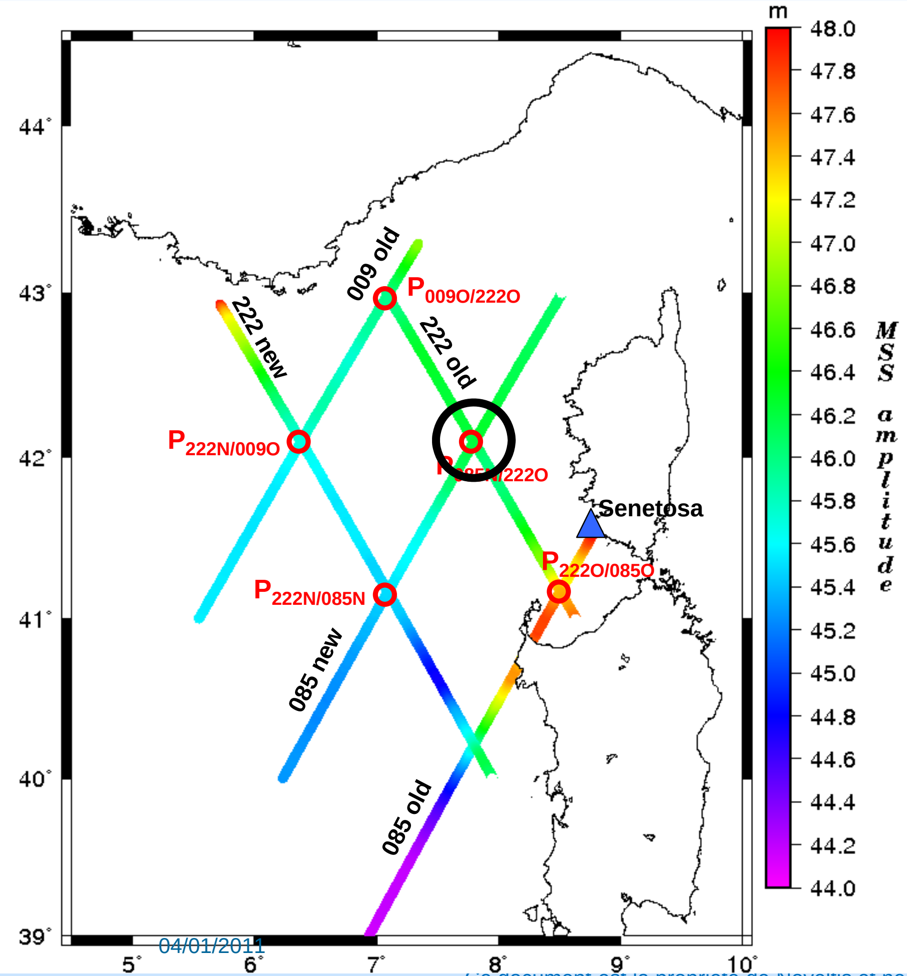
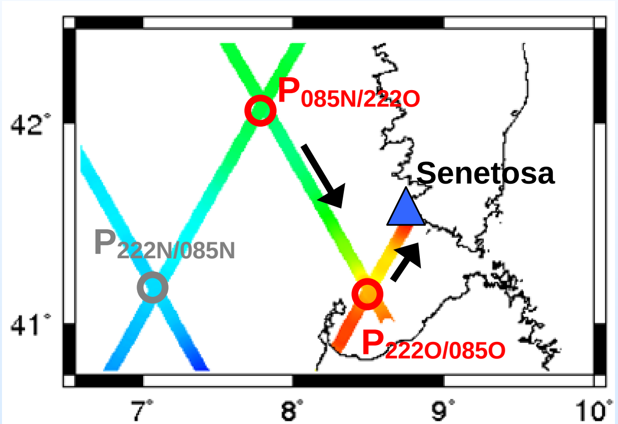
Jason-1 bias in Senetosa

- Computation of the biases on the **interleaved orbits:**
  - ✦ **GDR-C products**
  - ✦ **45 cycles**
  - ✦ **No tide nor dynamical atmospheric corrections**

Jason-1 bias in Senetosa

- **Computation of the biases on the interleaved orbits:**

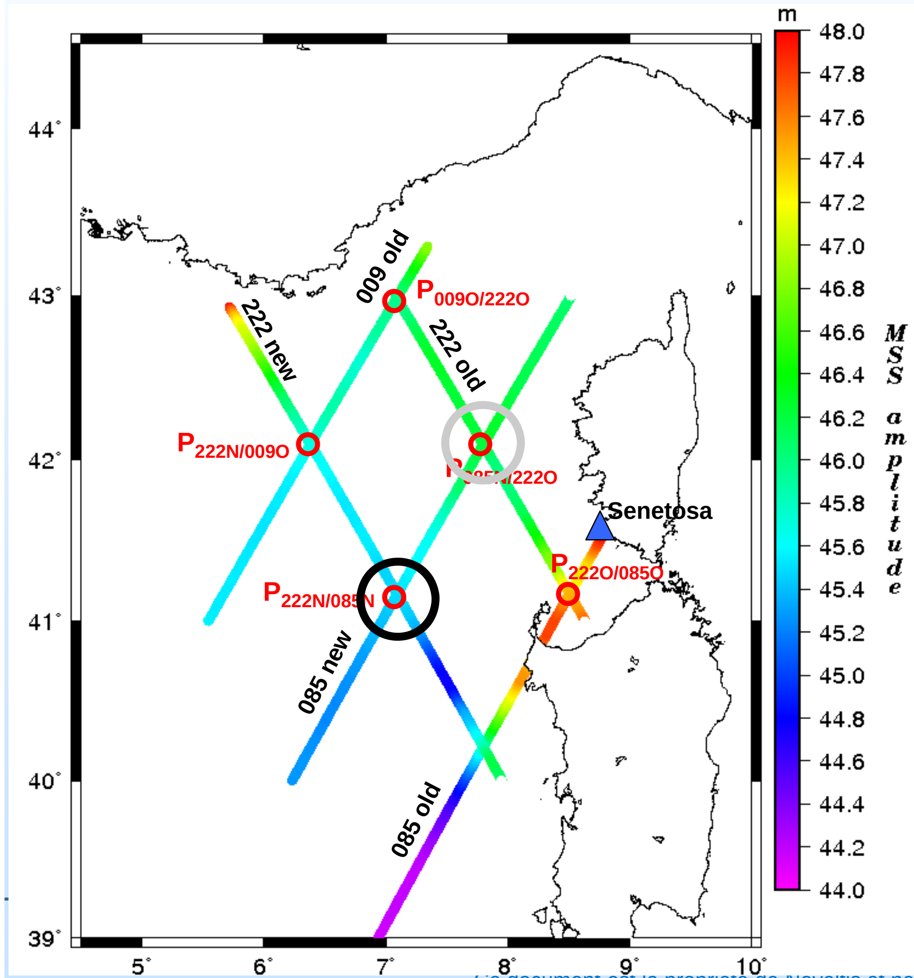


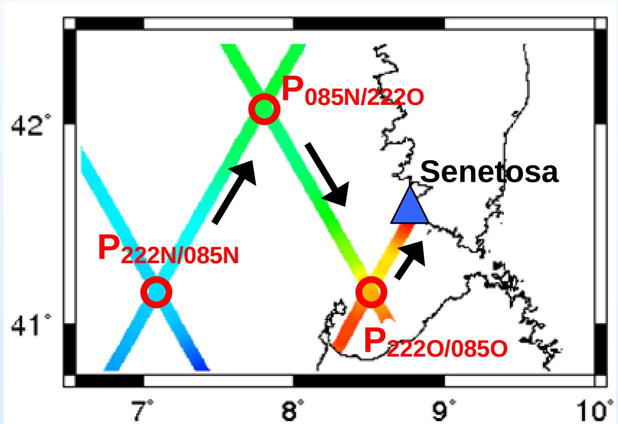


At the crossover point between new pass 085 / old pass 222

Jason-1 bias in Senetosa

- Computation of the biases on the **interleaved orbits:**

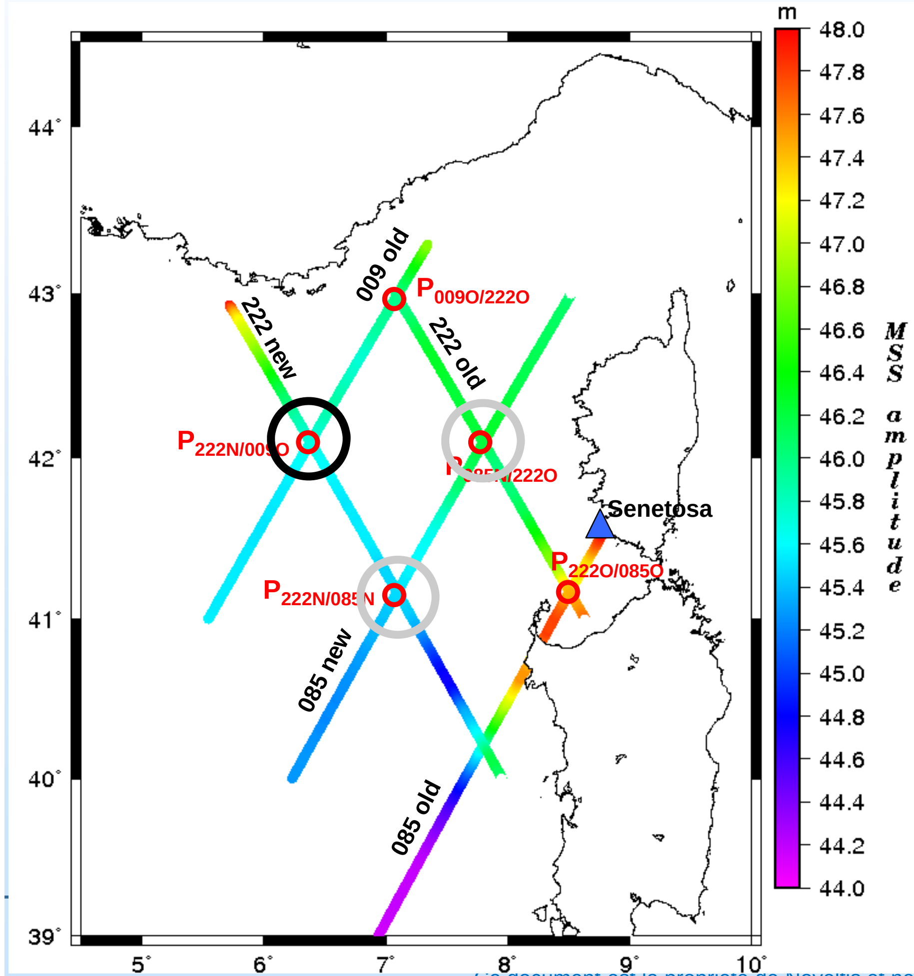


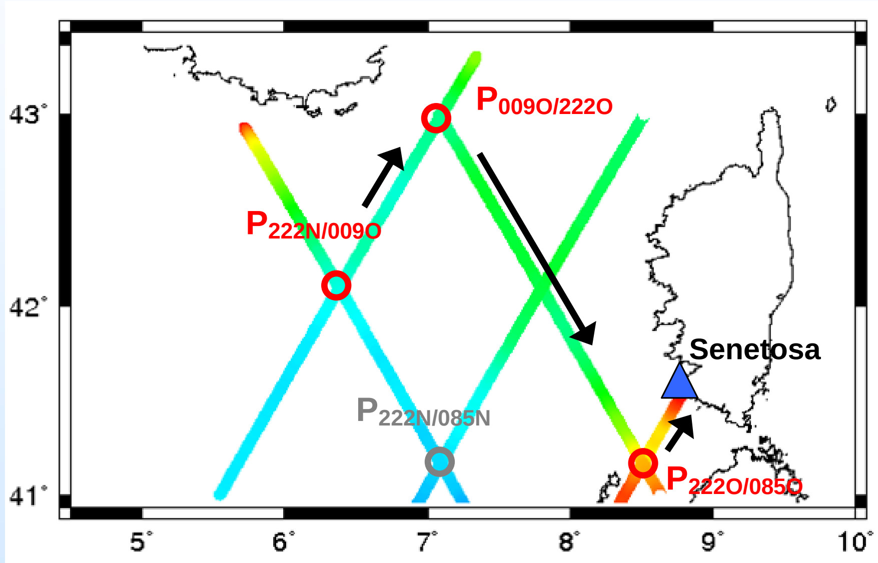


At the crossover point between new pass 222 / new pass 085

Jason-1 bias in Senetosa

- Computation of the biases on the **interleaved orbits:**

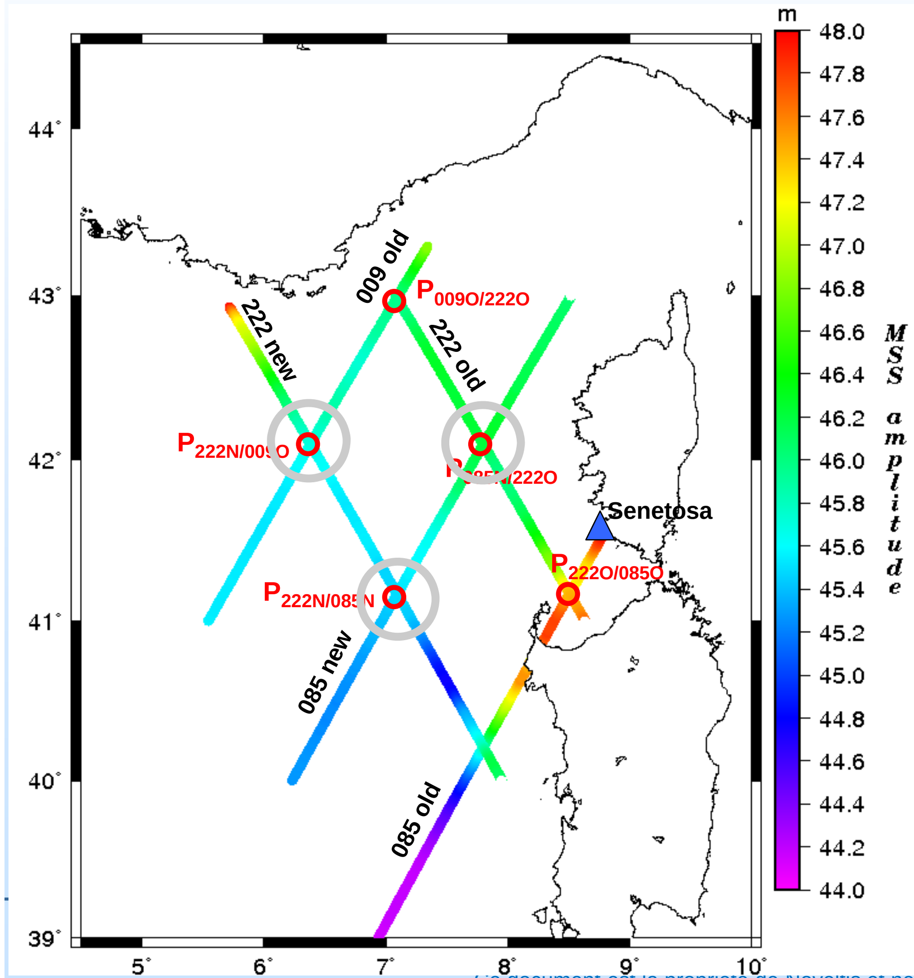




At the crossover point between new pass 222 / old pass 009

Jason-1 bias in Senetosa

- **Computation of the biases on the interleaved orbits:**



Use of a succession of accurate mean profiles to take into account the spatial MSS gradient between the offshore crossover point and the calibration site.

Which mean profiles to follow ?

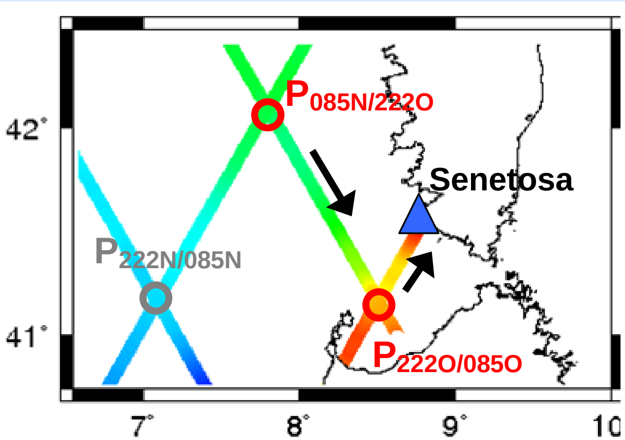
→Jason-1 mean profiles (259 cycles but different period)

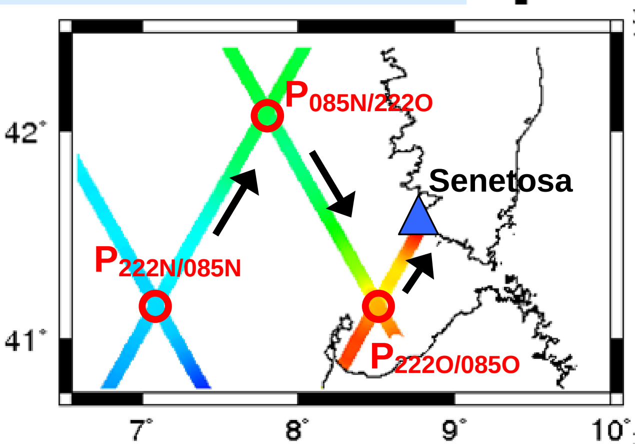
→Jason-2 mean profiles (only 74 cycles but same period)

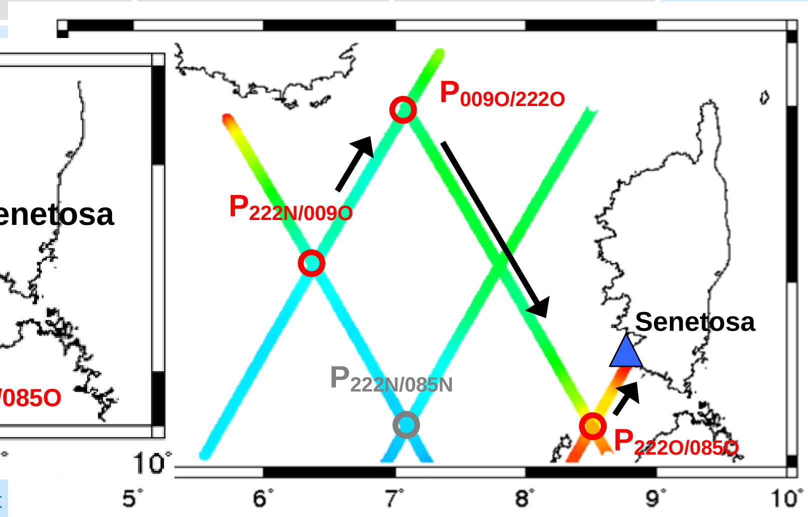
Jason-1 bias in Senetosa

- **Computation of the biases on the interleaved orbits:**

Weighted bias (cm)	Following the Jason-1 mean profiles		Following the Jason-2 mean profiles	
	Mean	Std	Mean	Std
Pass 085 (at the crossover point with old pass 222)	8.1	2.7	8.4	2.7
Pass 222 (at the crossover point with new pass 085)	9.1	3.6	9.4	3.6
Pass 222 (at the crossover point with old pass 009)	7.6	3.0	7.2	3.0

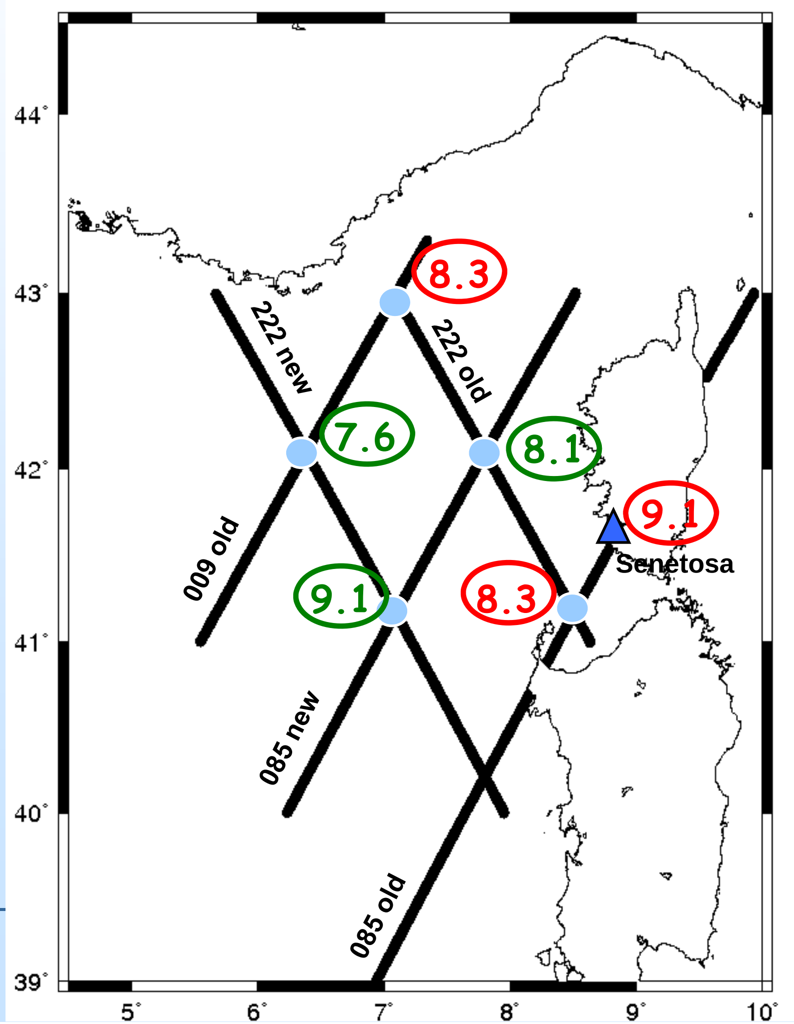






Jason-1 bias in Senetosa

- Computation of the biases on the original and interleaved orbits:



Homogenous bias along the old pass 222

Next step: computation of the bias along the passes

Conclusions

- Decrease in the bias between the coast and the offshore passes for both Jason-2 and Jason-1 (on the original and interleaved orbits) → Not seen in the Jason-1 GDR-A products
- Weak impact of the tide and dynamical atmospheric corrections on the bias in this region (few mm)
- Regional spatial structure in the bias ?

  → Would be interesting to use the same regional method on other in situ Calval sites in order to understand these results

THANK YOU !

Posters:

- ➢ Use of the Corsica site to compute altimeter biases for JASON-2/OSTM, JASON-1 and ENVISAT: Absolute and Regional CalVal methods
- ➢ Absolute and offshore in situ calibrations of Jason-2 in Senetosa: Sensitivity analysis of the altimeter bias to the Mean Sea Surface