DComb wet tropospheric correction for CryoSat-2 over open and coastal ocean

M. Joana Fernandes[1,2], Clara Lázaro[1,2], Alexandra L. Nunes[2,3], Nelson Pires[1,2]

[1] Universidade do Porto, Faculdade de Ciências, Porto, Portugal
[2] Centro Interdisciplinar de Investigação Marinha e Ambiental (CIIMAR), Porto, Portugal
[3] Instituto Politécnico do Porto, ISEP, Porto, Portugal

Outline

- **Methodology for the computation of the DComb wet tropospheric correction (WTC)**
    - Data sets used
    - Current implementation
- **DComb WTC for Jason-2**
- **DComb WTC for CryoSat-2**

Data Combination (DComb) WTC

- ❑ **Study performed in the scope of the CP4O project.**

- ❑ **Computed for CryoSat-2 by combining through objective analysis wet path delay observations from:**

  - scanning imaging microwave radiometers (SI-MWR) on board RS missions;

  - coastal inland and island GNSS stations.

⇨ **In the absence of observations, ECMWF Operational Model (ECMWF-Op) WTC is used.**

Data sets used

- **Water vapour products from SI-MWR sensors**

⇨ **Mean data availability for CS-2 period:**

- 11 satellites: 10 sun-synchronous; 1 non sun-synchronous;
- 6 different sensors; central pixel size: 10 – 50 km;
- Two types of products: swath and gridded.

⇨ **CS-2 coverage within 110 minutes:** 70%-100%.

⇨ **Each SI-MWR derived WTC was calibrated wrt AMR WTC.**

- **Tropospheric delays at GNSS stations**

⇨ **More than 400 GNSS stations (IGS, EUREF, SuomiNet, regional networks) available each day for the CS-2 mission period.**

Present DComb implementation

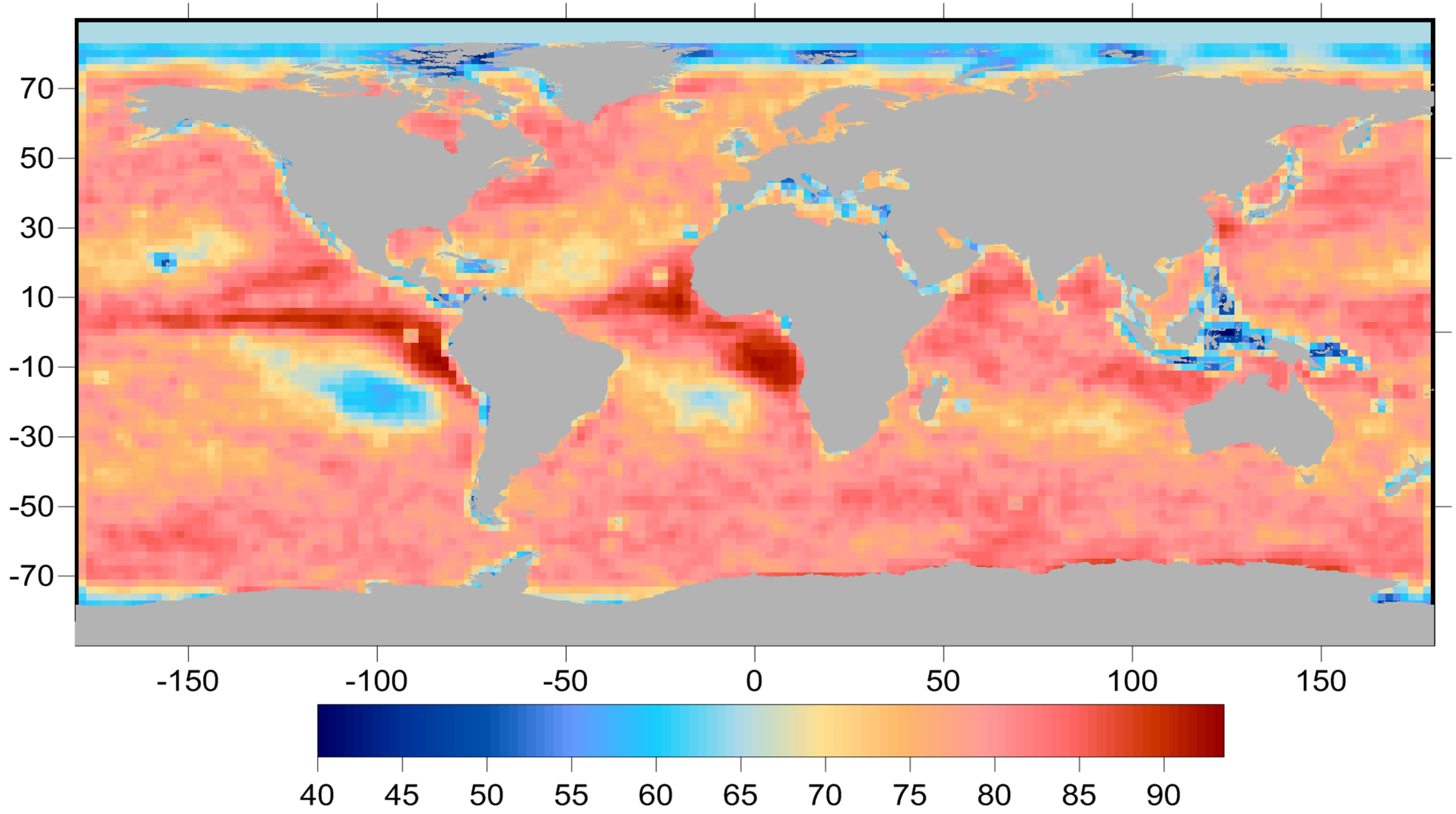
- **First Guess**: weighted average of all selected WTC values within the space and time search radii.

- **Signal variance** determined from 2 years of ECMWF-Op grids.

- **White noise associated to each data type**: GNSS: 0.5 cm; SI-MWR: from 0.81 to 1.22 cm, depending on sensor; ECMWF-Op: 1.5 cm.

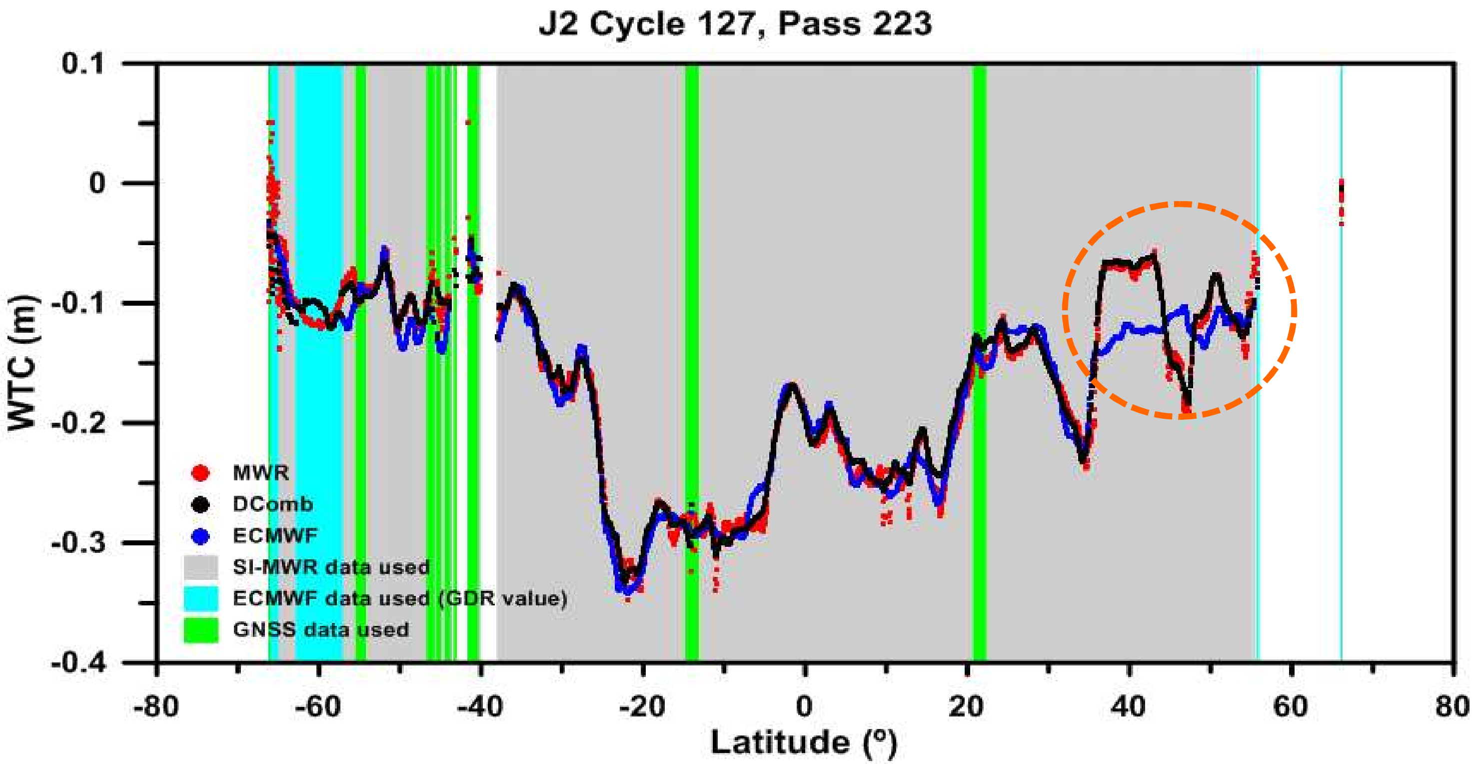
- **Correlation scales**: spatial scales determined from ECMWF-Op grids; temporal correlation scale: 100 min.

➩ **Spatial correlation scales** (in km) for the WTC as determined from a set of ECMWF-Op grids at 0.125˚ well distributed over the year 2013.

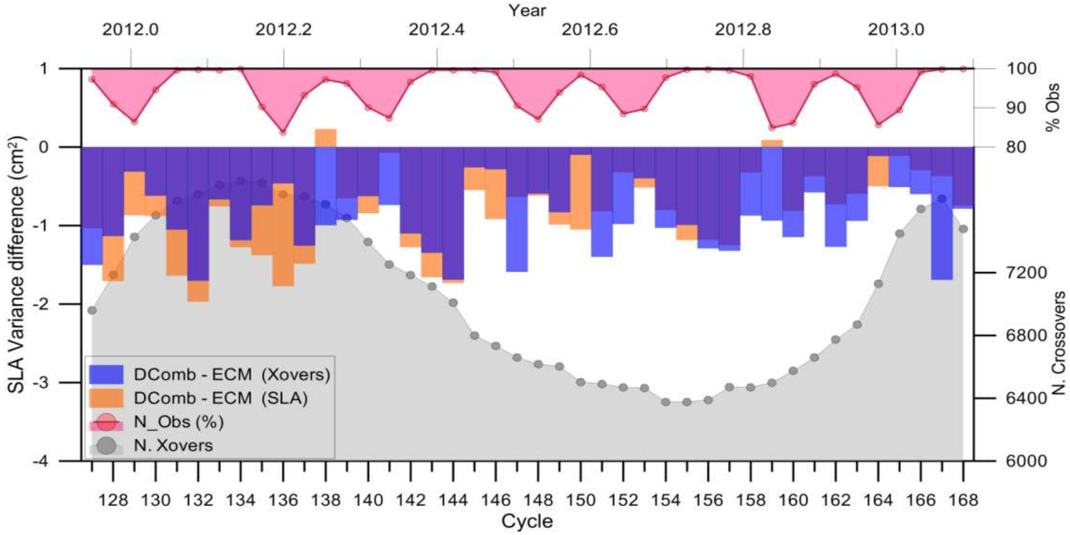


DComb WTC for J2

⇨ **Correction computed for cycles 127-168 (Jan 2012 – Jan 2013)**

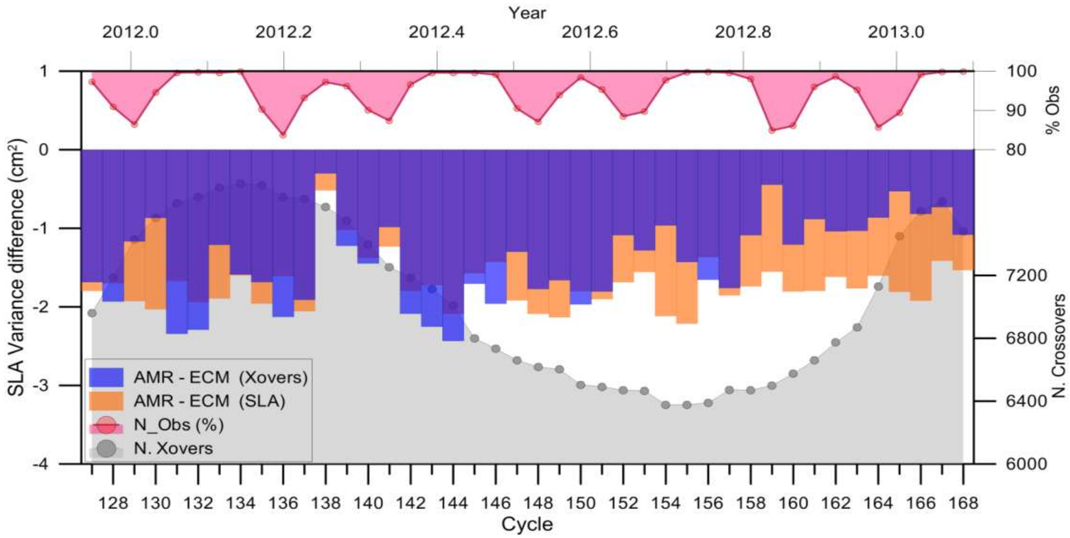


SLA Variance difference (J2): along-track and at xovers

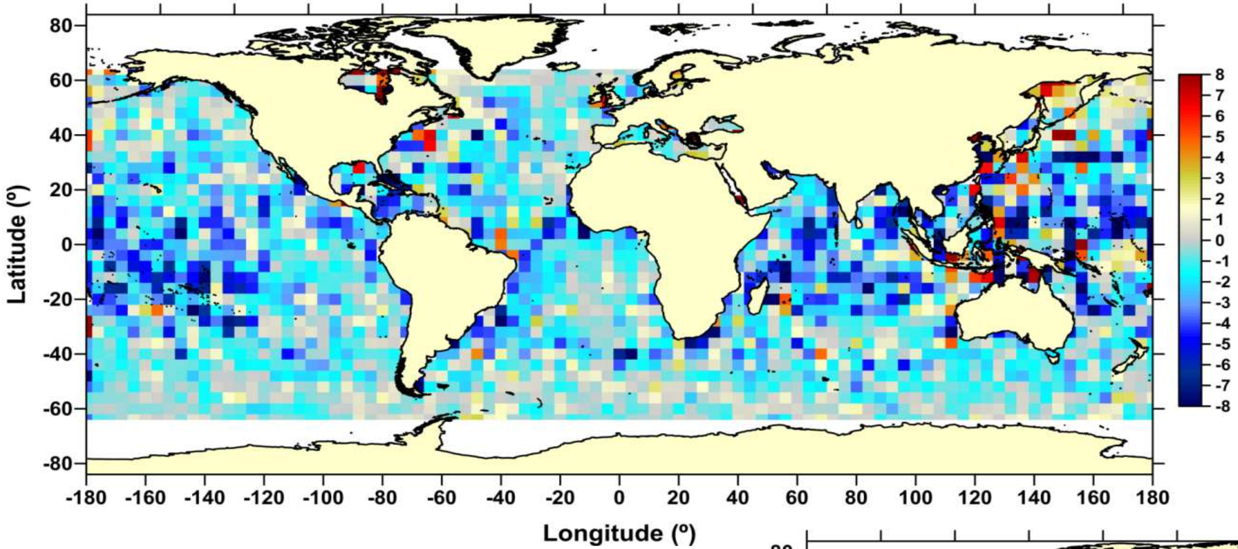


⇦ DComb – ECMWF-Op

AMR – ECMWF-Op ⇨

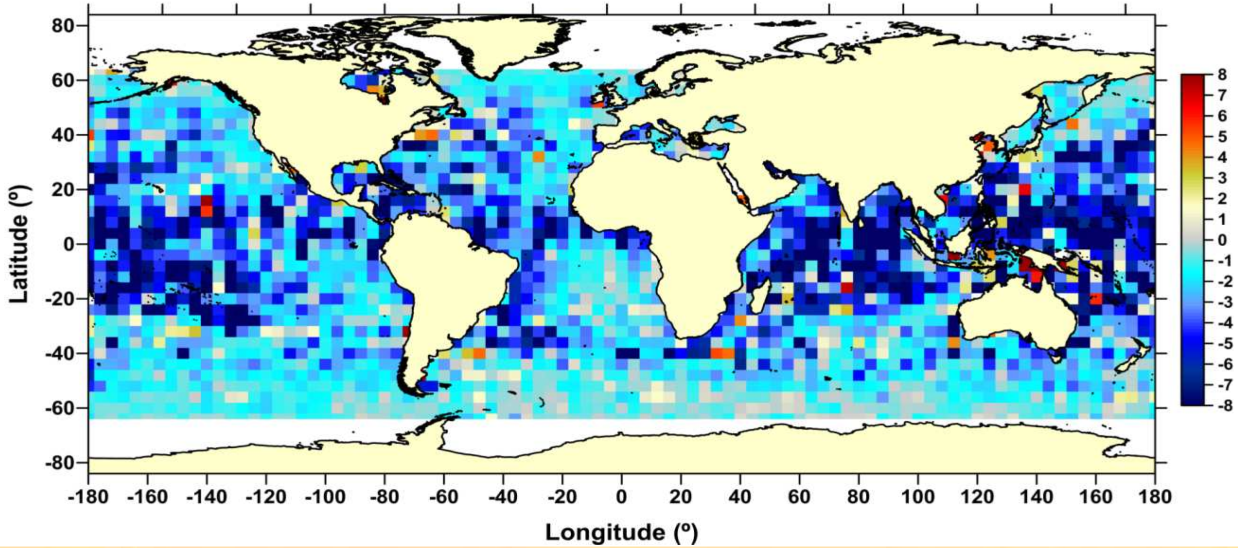


Difference in variance (cm²) of SLA differences at xovers (J2)



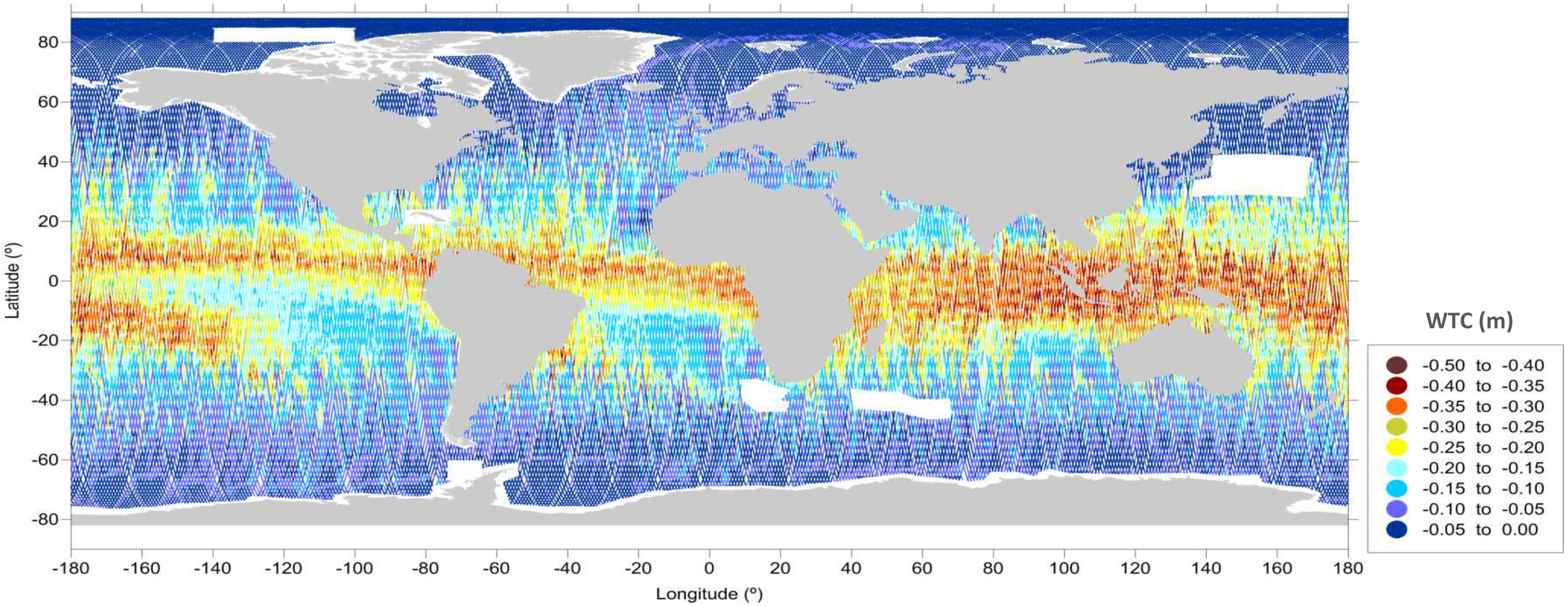
⇦ DComb – ECMWF-Op

AMR – ECMWF-Op ⇨

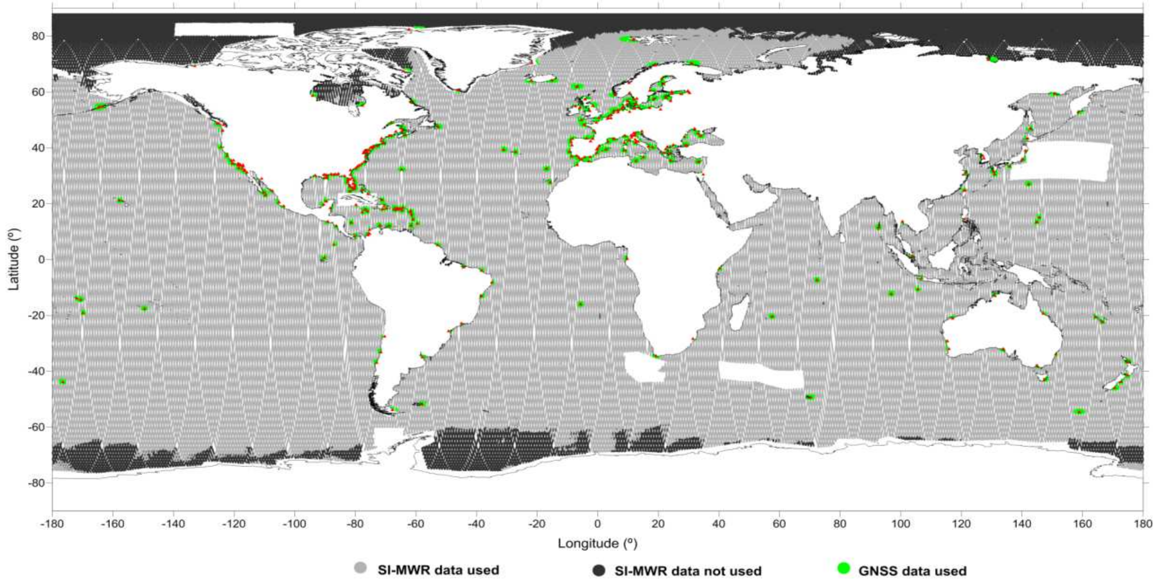


DComb WTC for CS-2

⇨ **Correction was computed for sub-cycles 05-48 (Jul 2010 – Dec 2013)**

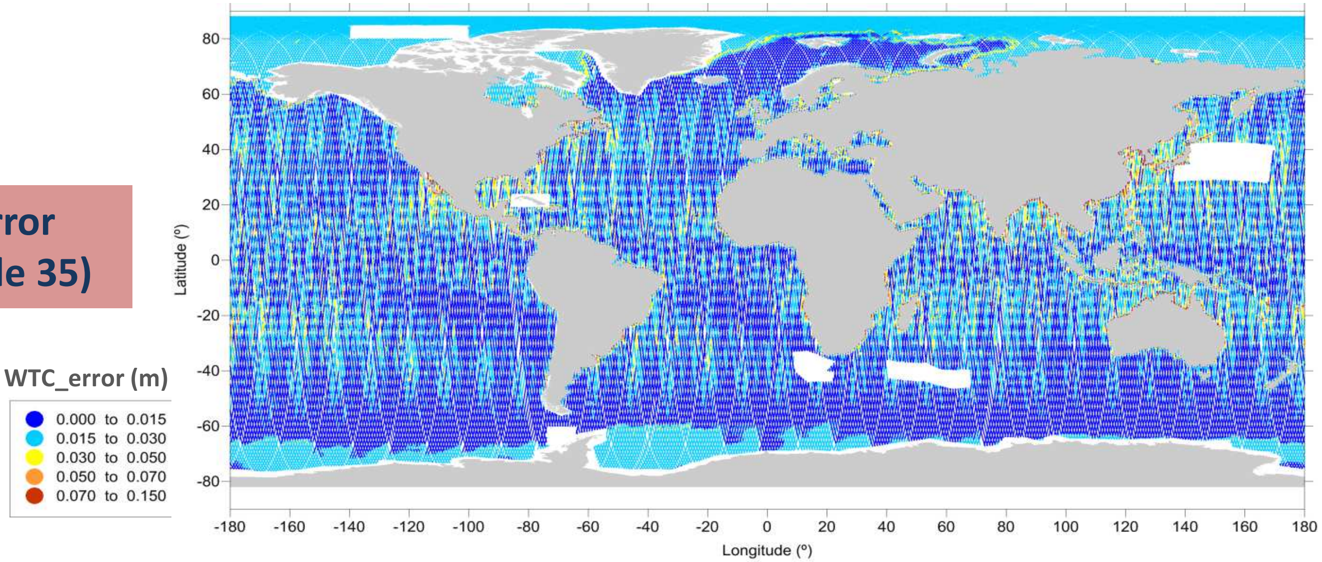


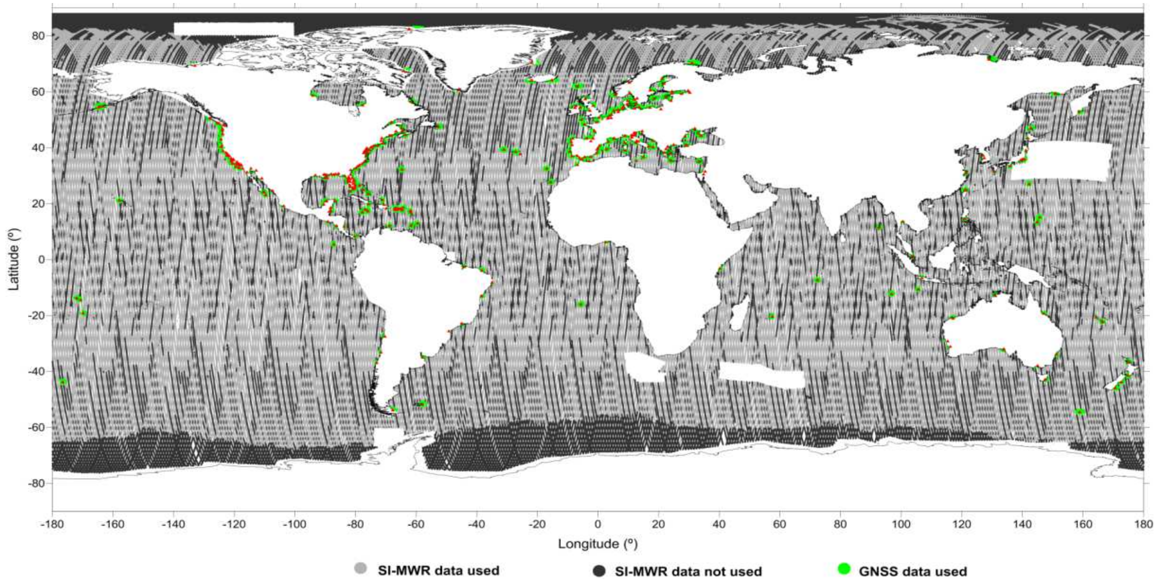
CS-2 DComb WTC (sub-cycle 35)



Data coverage
(CS-2 sub-cycle 35)

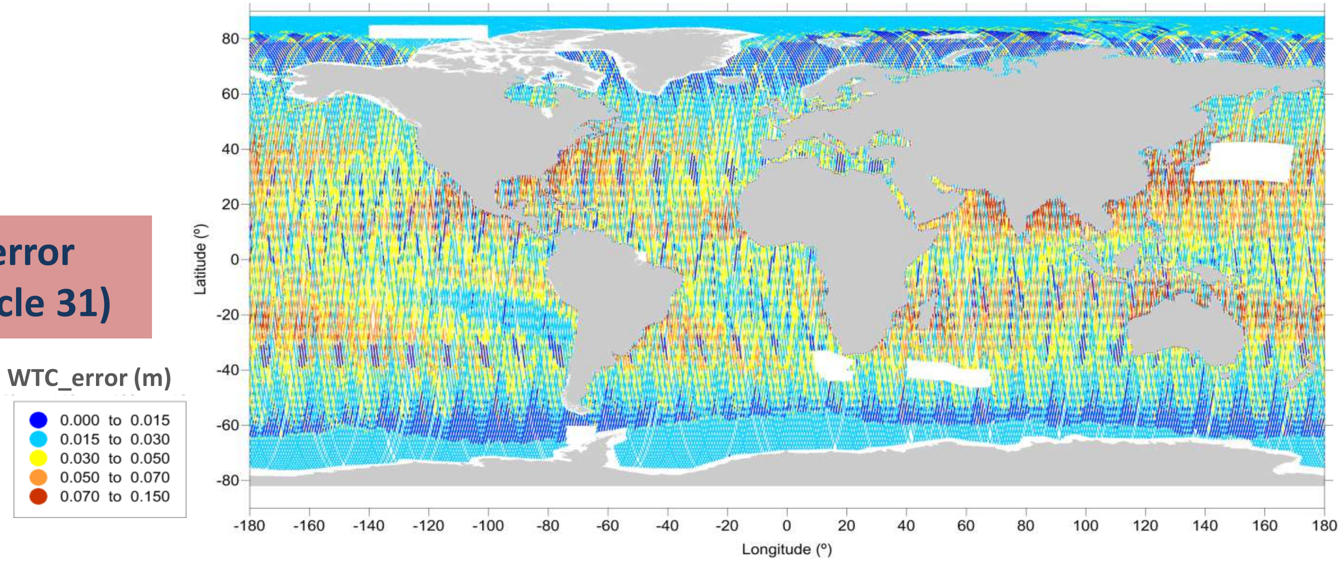
Mapping error
(CS-2 sub-cycle 35)

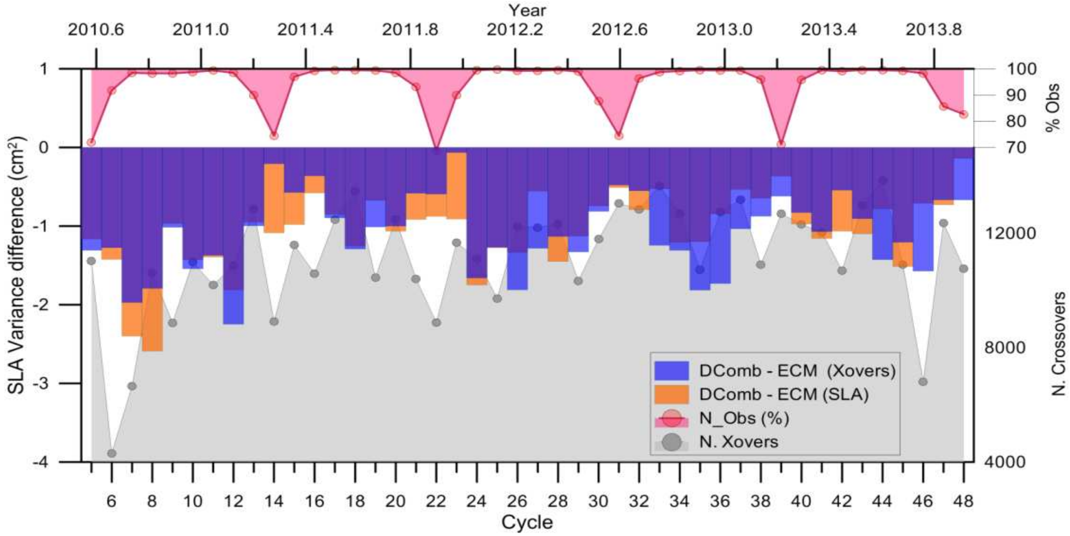




Data coverage (CS-2 sub-cycle 31)

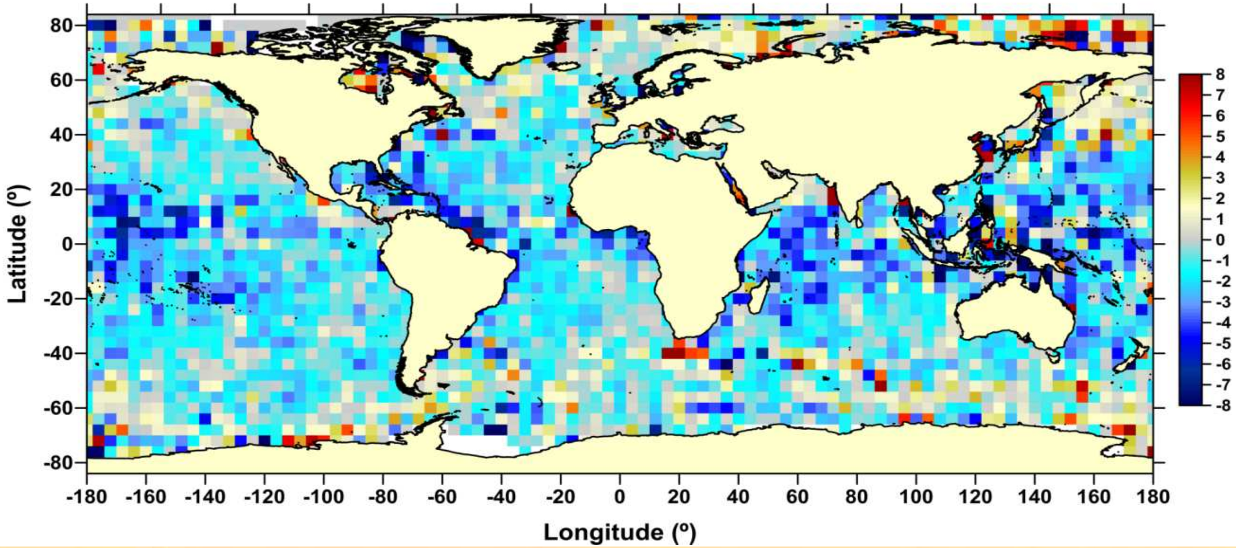
Mapping error (CS-2 sub-cycle 31)



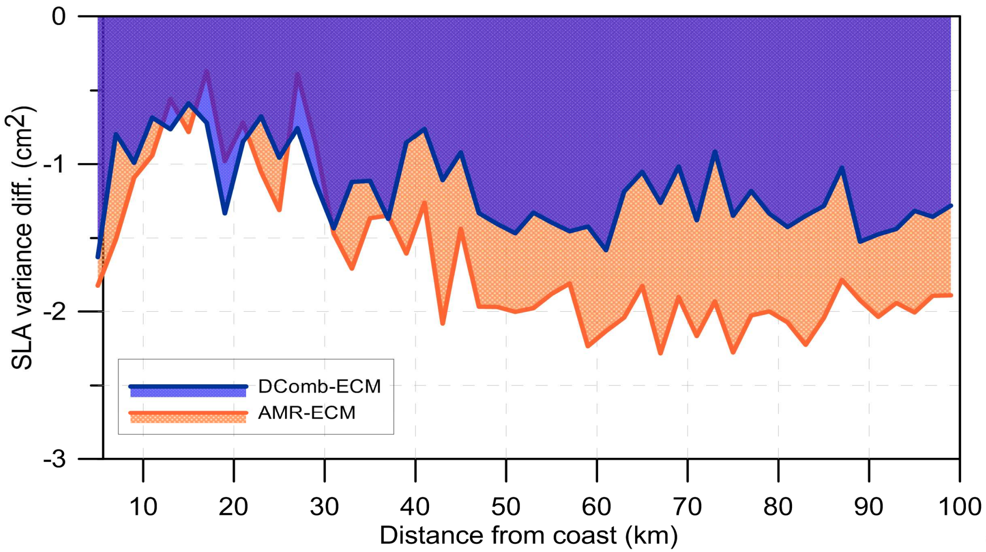


⇦ **SLA Variance difference (cm²) (CS-2, DComb – ECMWF-Op): along-track and at xovers**

Difference in variance (cm²) of SLA differences at xovers (CS-2, DComb – ECMWF-Op) ⇨

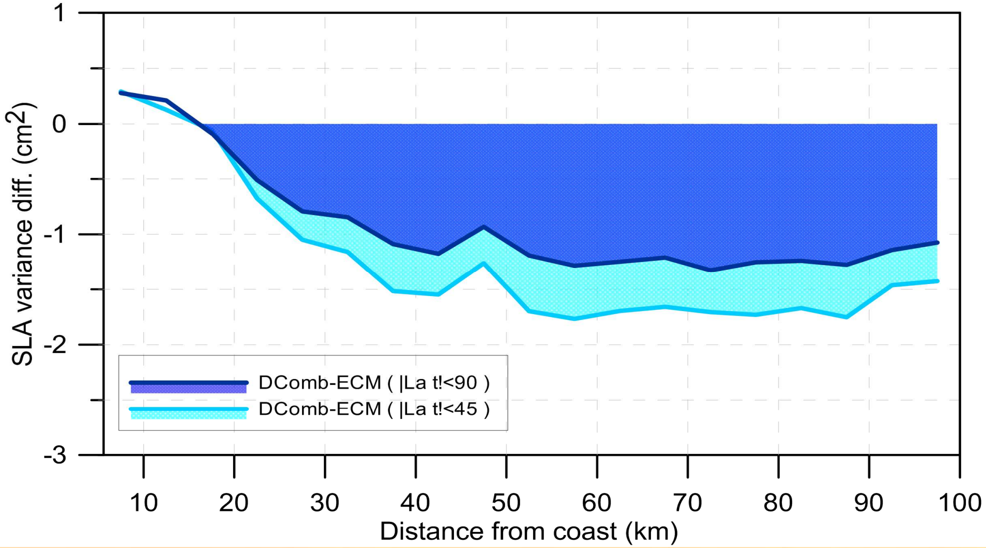


⇨ SLA Variance difference function of distance from coast



⇦ **J2 SLA variance difference (cm²)**
(DComb – ECMWF-Op and AMR – ECMWF-Op)

CS-2 SLA variance difference (cm²)
(DComb – ECMWF-Op) ⇨



Summary

- The DComb WTC correction is continuous and applicable to any mission
- Accuracy depends on data coverage
- SLA variance reduced by 1 to 4 cm^2 when DComb WTC is used instead of ECMWF-Op WTC
- Coastal regions: > 30 km away from the coastline, DComb WTC correction performs better than ECMWF-Op WTC