

## Abstract

A continuous monitoring of sea level is particularly necessary along the coastal zones as these areas are the most exposed to flooding and storm surges that dramatically affect local economy and society. The aim of this project is to study the annual sea level variability in the Bay of Bengal exploiting five years of CryoSat-2 data. The work is focused on the analysis of CryoSat's performances over coastal areas with using 20Hz SAR data from SARvatore online processing toolbox. This research is also an opportunity for comparing SIRAL's LRM and SAR modes, which have covered the same area for different time frames: LRM from 2010 to October 2012 and SAR from October 2012 to present. Finally, SARvatore is compared with independent datasets like the ESA CCI products, AVISO and RADS.

## Objectives

- CryoSat-2's coastal performances in time and space
- Time series continuity between SAR and LRM
- Comparison with other datasets

## CryoSat's coastal performance according to SARvatore

SARvatore is an online processing toolbox that delivers level 2 products from CryoSat-2 SAR mode with resolution 20Hz and 1Hz. Over Bangladesh, SAR mask is set after October 2012. In figure 1 the area of interest with SAR mask is shown. In order to study SARvatore performances with respect to distance to coast (d2c), 20Hz data are used, figure 2. The values range between -5 and 5 metres. Figure 3 shows that at distances closer than 4-6 km from the coast a higher standard deviation and median is registered. This is probably due to the fact that water points with d2c<4 km are mostly located along river patterns, figure 4. It points towards problems with the land-sea mask in GPOD. For this reason, data closer than 5 km from land are discarded in comparison with other datasets. This d2c dependence can be observed also in terms of time series. It can be noticed that peaks with higher amplitude occur for data with a d2c between 7.5 km and 10 km figure 5. However, for d2c<7.5 km lower fluctuations appear.

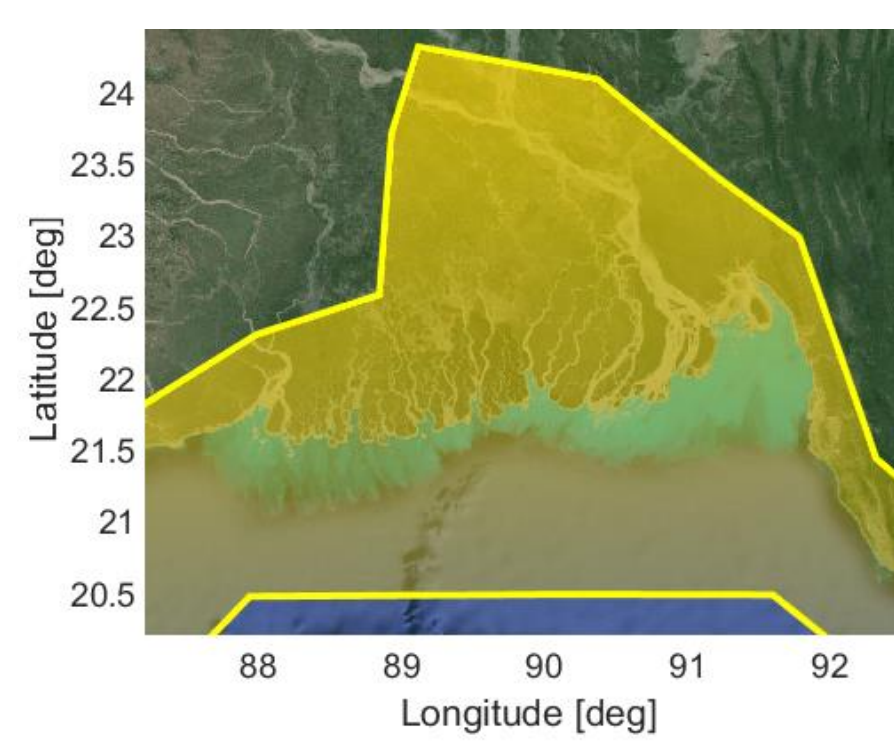


Figure 1: Area of interest with SAR mask applied after October 2012

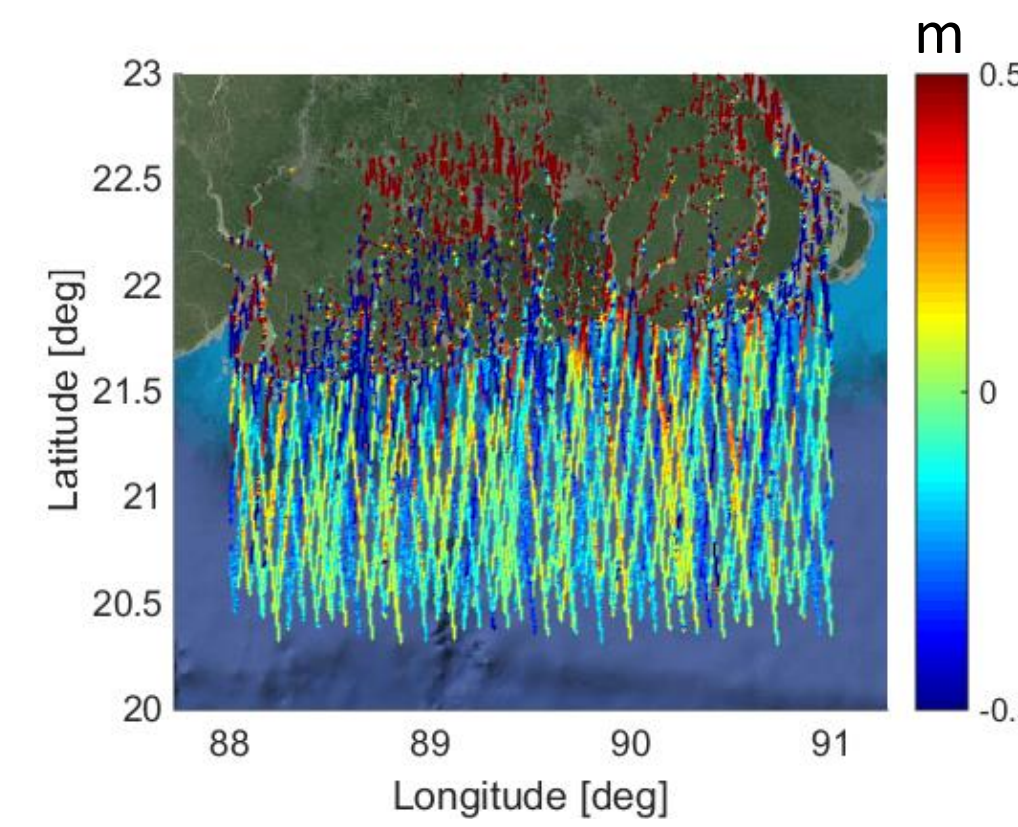


Figure 2: water data points from SARvatore dataset

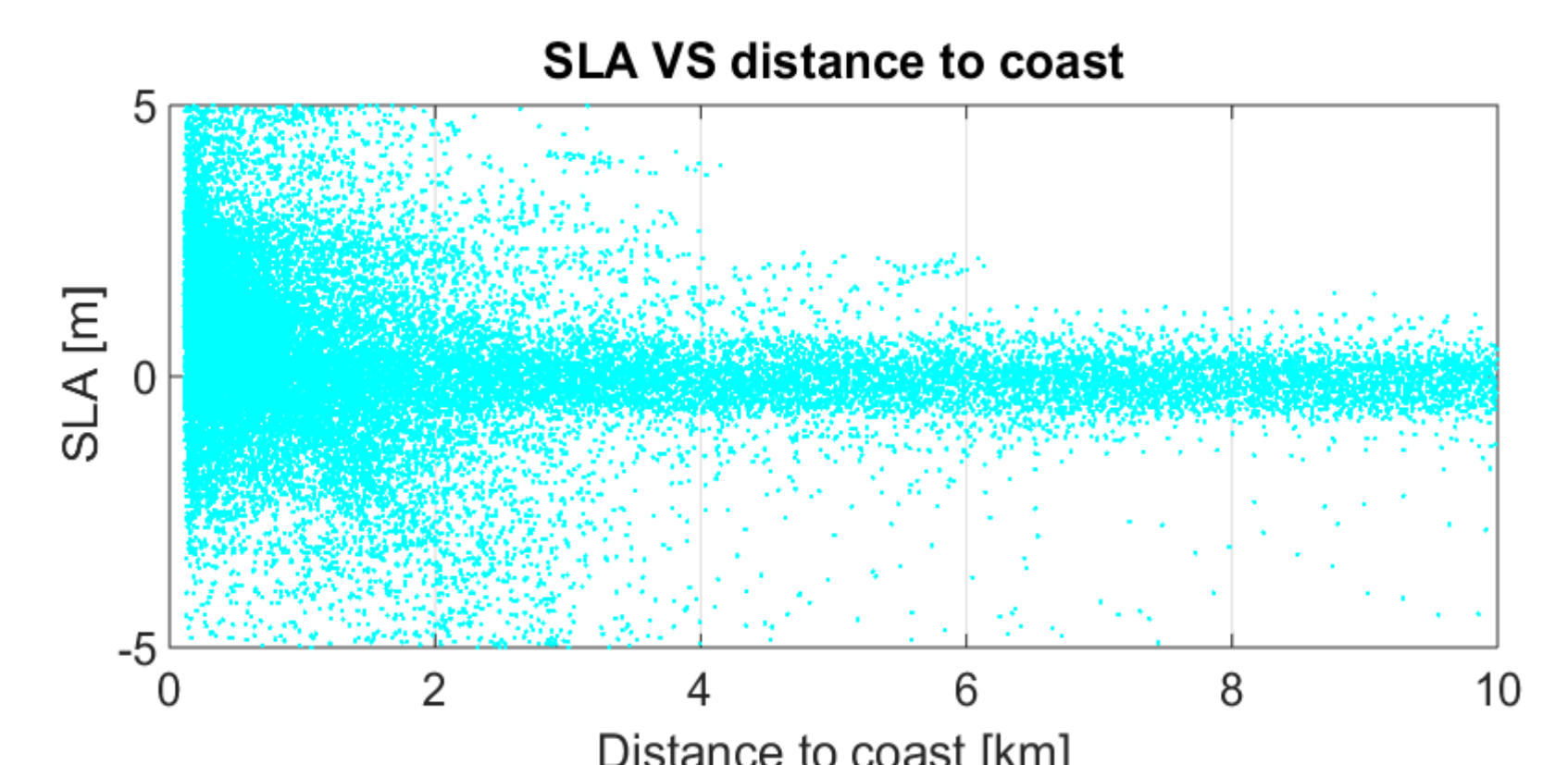


Figure 3: SARvatore SLA values with respect to distance to coast

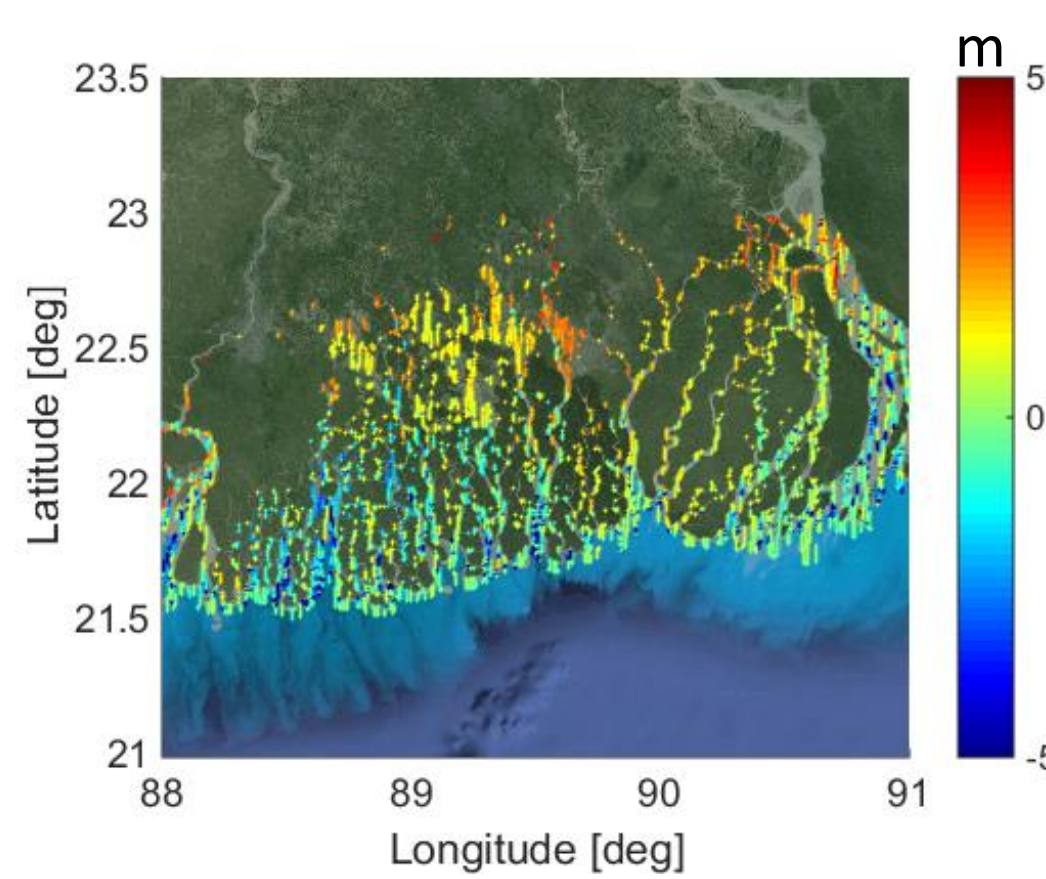


Figure 4: water data points with d2c<4km

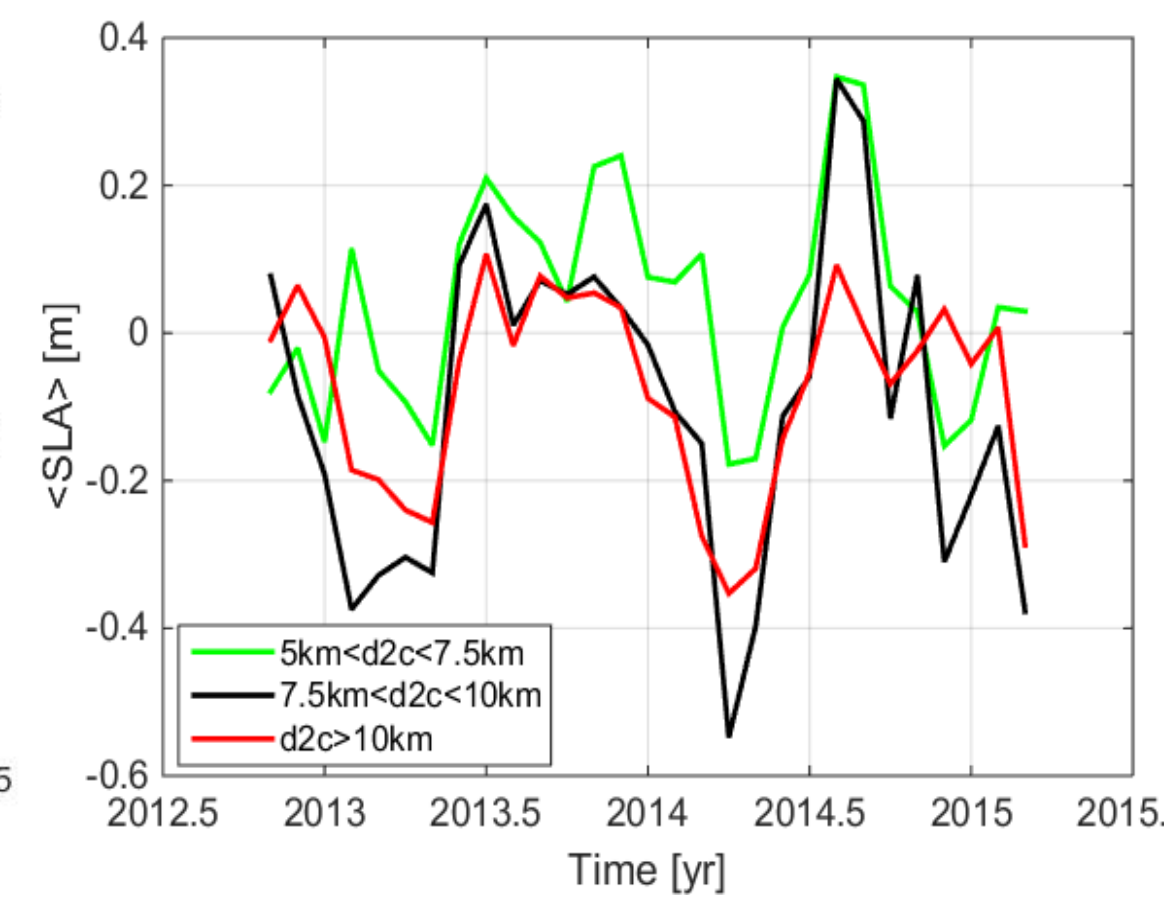


Figure 5 : SARvatore monthly time series for three different distance to coast

## Dataset comparison

The 1Hz resolution RADS and AVISO datasets are compared with SARvatore at 1Hz. RADS provides both LRM and PLRM modes: LRM data are from 2010 until September 2012 and PLRM coincide with the SAR mask time period. AVISO offers a continuous time series including both the modes from 2011 until 2015. Figure 6a, 6b, 6c, 6d show SARvatore, AVISO, RADS LRM, and RADS PLRM data respectively. AVISO only covers until 10km from the coast. Subsequently the mask bounded by 88° to 92° in longitude and 20.5° to 10 km from the coast in latitude was selected for the comparison.

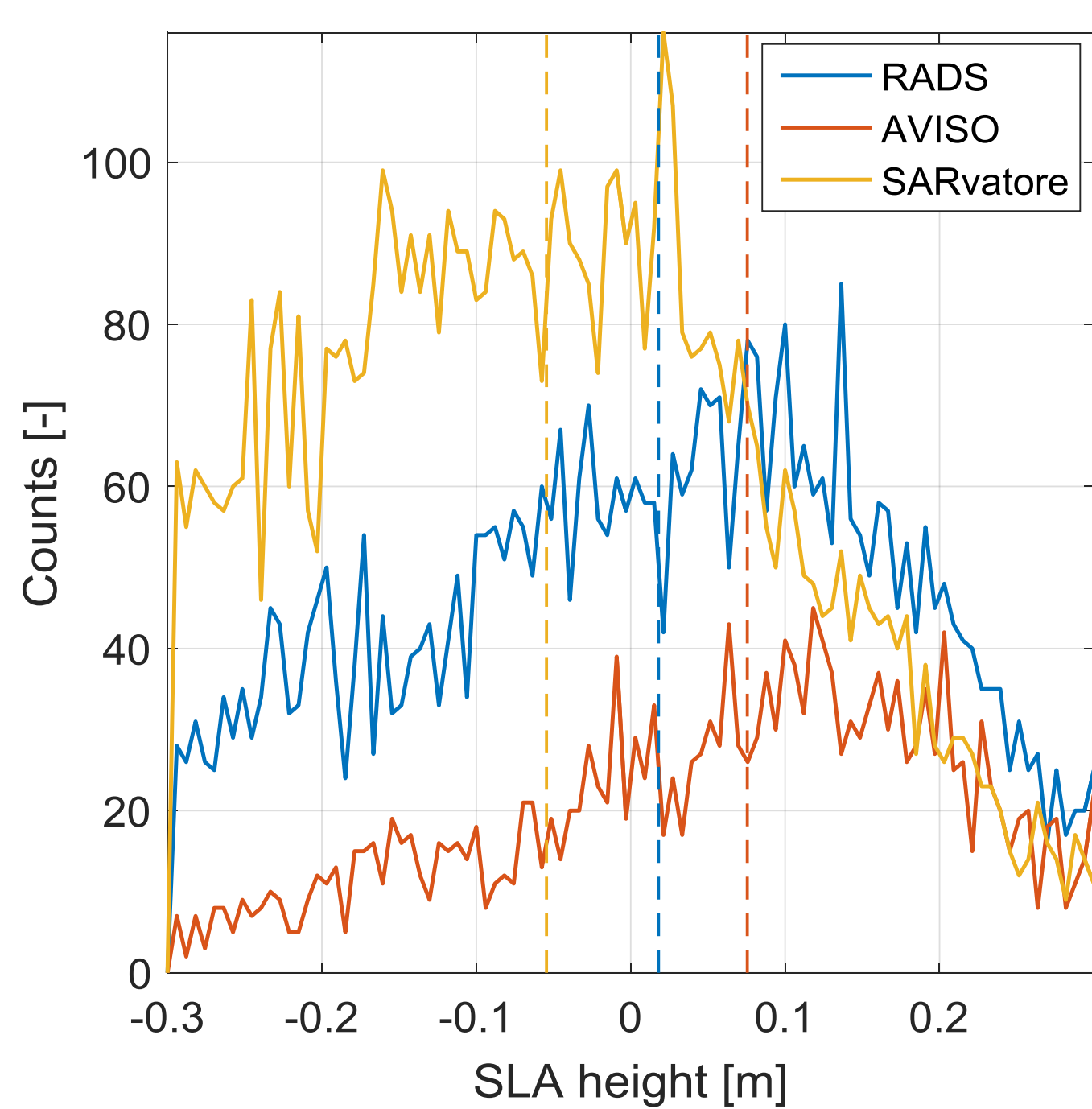


Figure 7: Distribution of values for AVISO, RADS and SARvatore datasets

Figure 7 shows the value distribution of the three datasets. For the same area, resolution and period, RADS and AVISO discard a higher amount of points with respect to SARvatore, resulting in positive median values against a negative one for SARvatore. In the time series comparison CCI monthly dataset is also included, following the same editing criteria. In figure 8 the monthly averaged values of SARvatore, AVISO, RADS, and CCI are shown. There is an interesting agreement among the single peaks and the periodic behaviour. CCI data, which are delivered as gridded products with ¼ degree resolution, fit well both RADS LRM and SAR values, showing a convincing continuity between the two operational modes.

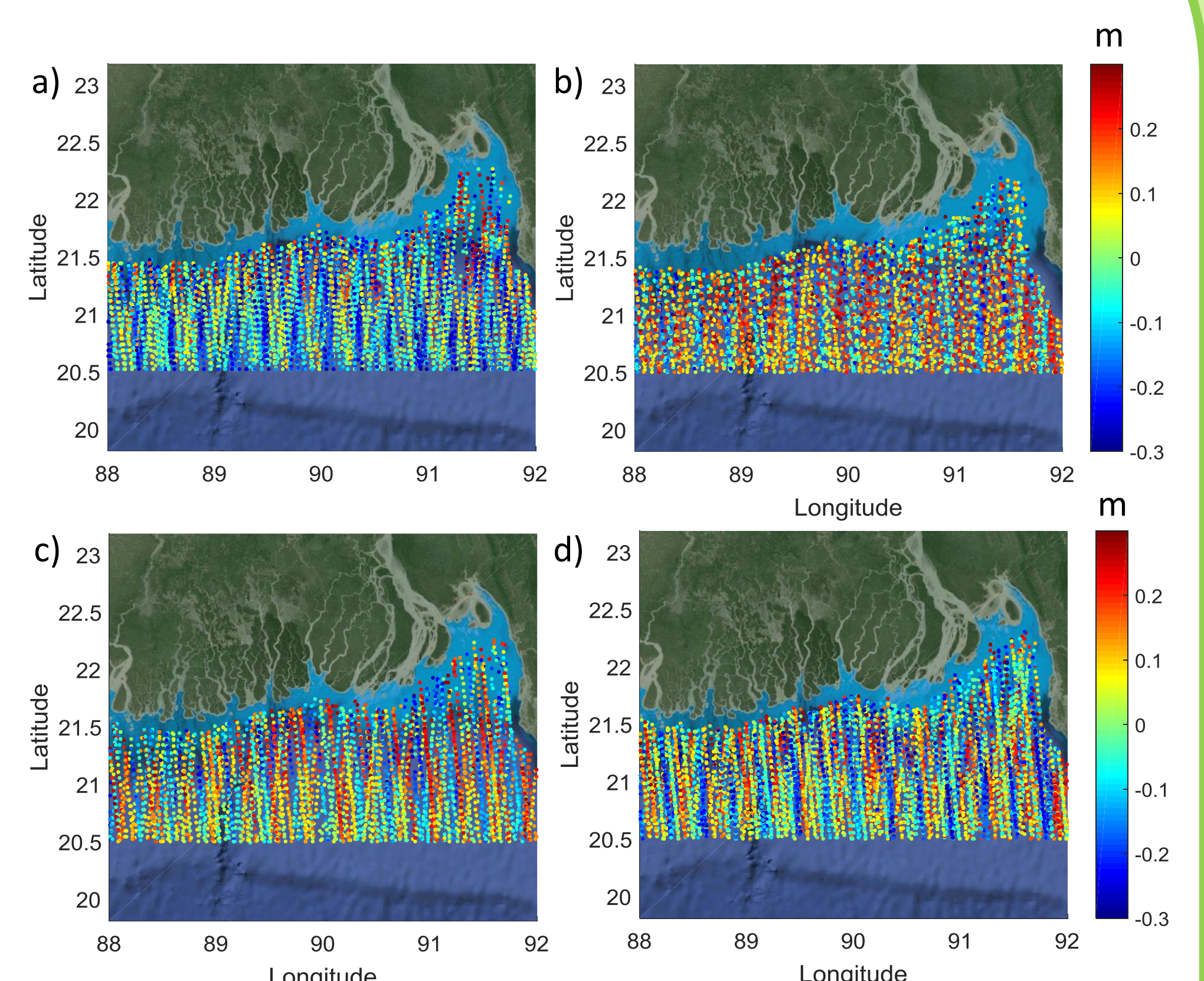


Figure 6: SARvatore (a), AVISO(b), RADS LRM (c), and RADS PLRM (d) datasets

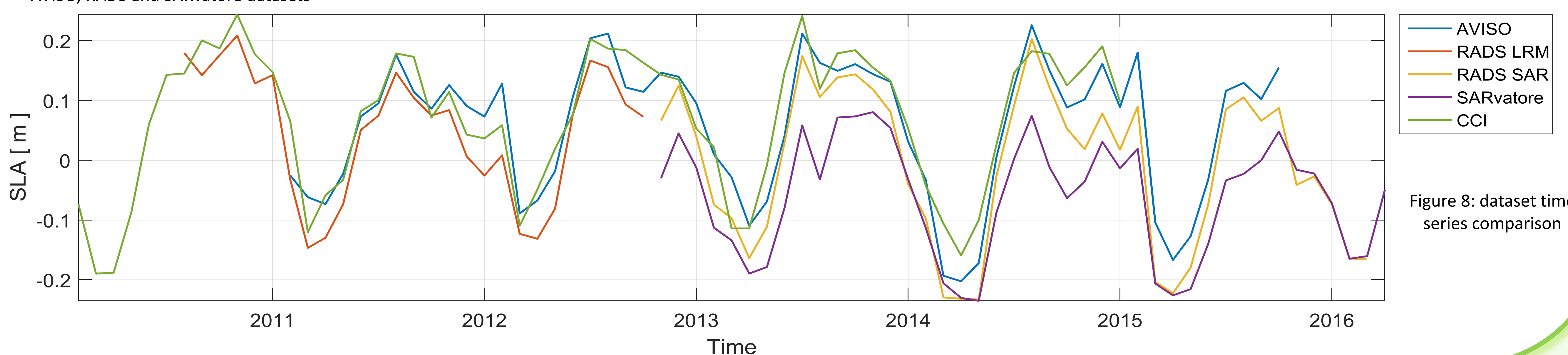


Figure 8: dataset time series comparison

## Summary

- High variance in water points closer than 4km from the coast for SARvatore dataset
- For the same period and area, more points are available in SARvatore products
- Correspondence among the datasets in single values and periodic behaviour
- Reasonable continuity between SAR and LRM modes

## Acknowledgements

- AVISO data are available on the Copernicus Marine Environment Monitoring Service: <http://marine.copernicus.eu/>
- RADS data are retrieved from: <http://rads.tudelft.nl/>
- CCI dataset is available on the CCI Open Data Portal: <http://cci.esa.int/>

