→ 8th COASTAL ALTIMETRY WORKSHOP

23–24 October 2014 | Lake Constance | Germany

COMPARISON OF REPROCESSED CRYOSAT-2 ALTIMETRY WITH IN-SITU DATA AROUND THE GULF OF CADIZ (SOUTH-WESTERN IBERIAN PENINSULA)

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(1) UCA Universidad de Cádiz

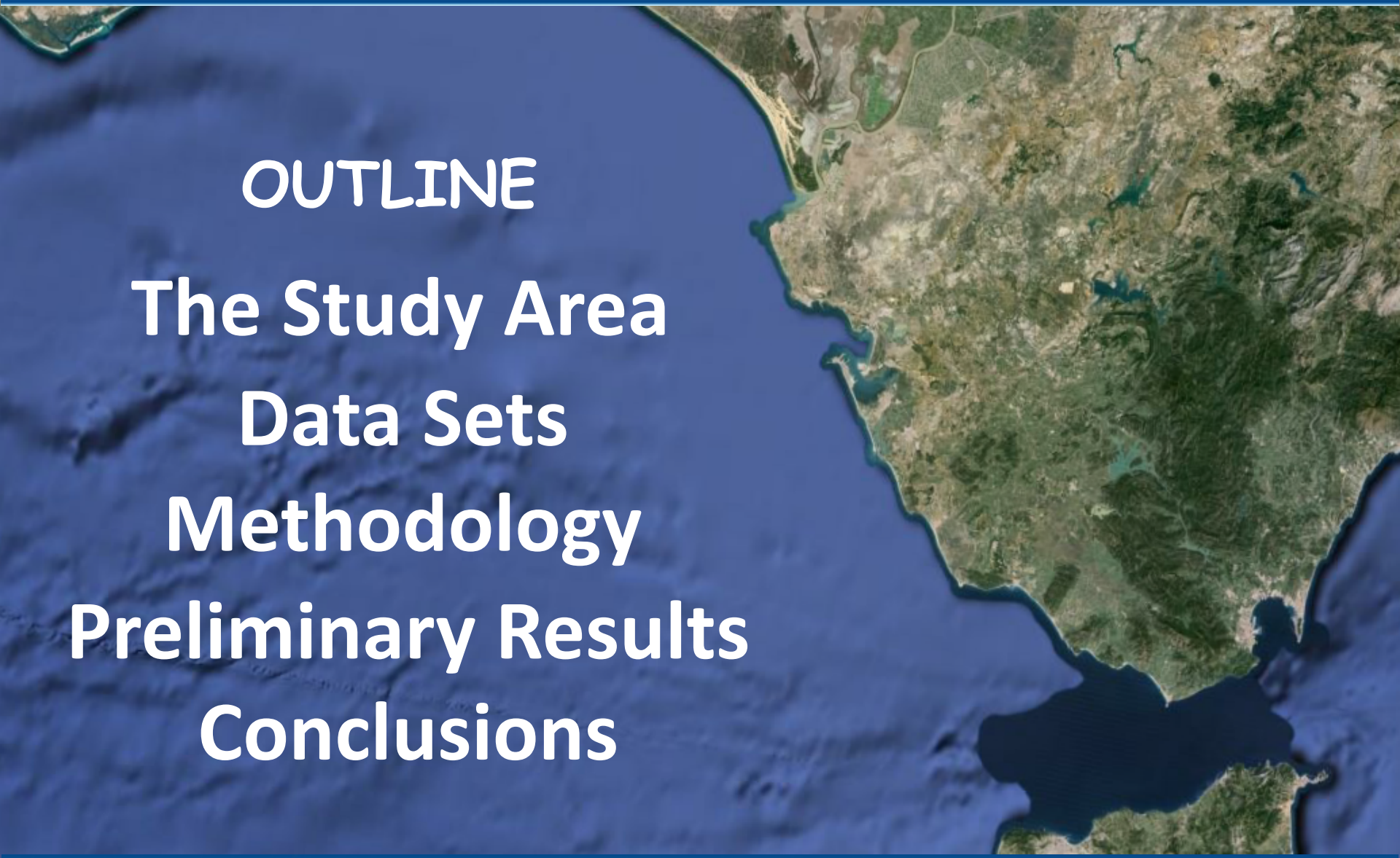
(2) Consiglio Nazionale delle Ricerche

(3) serco

(4) deimos SPACE

(5) esa

(6) National Oceanography Centre, NATURAL ENVIRONMENT RESEARCH COUNCIL



OUTLINE

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ACKNOWLEDGMENT

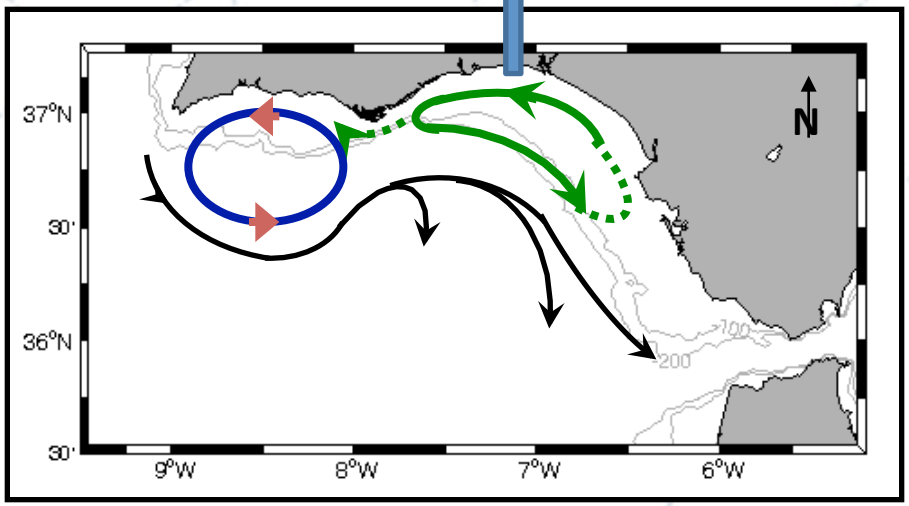
This work has been done under the frame of the ALCOVA Project (**Altimetría Costera: Validación con medidas in-situ. Aplicación a la dinámica de la costa suroccidental de la Península Ibérica)**, funded by Ministerio de Economía y Competitividad with FEDER funds.

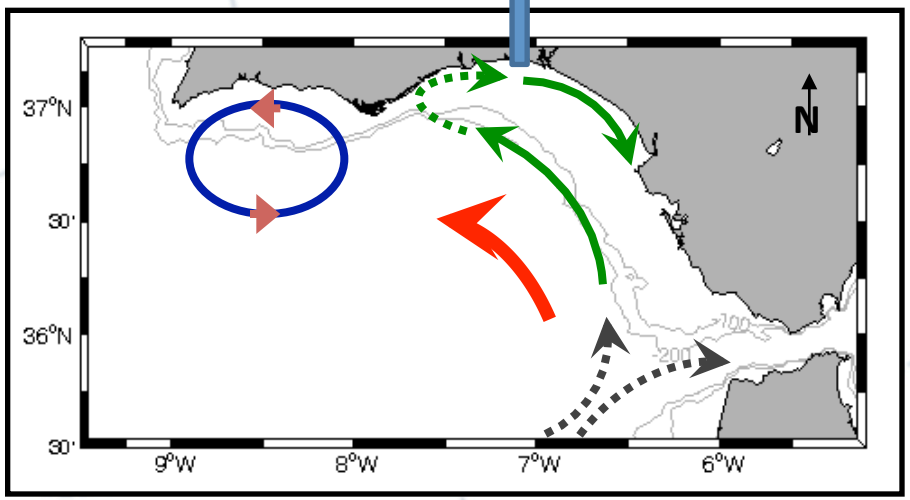
GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

FEDER
Fondo Europeo de Desarrollo Regional


The Study Area
EUROPE
AFRICA
GULF OF CADIZ
(Eastern Shelf)
STRAIT OF
GIBRALTAR

coastal warm counter surface current





Spring - Summer

García-Lafuente *et al.* (2006)

Autumn - Winter

Criado-Aldeanueva *et al.* (2009)

Data Sets

Tide Gauges Network

Puertos del Estado

HUELVA

BONANZA

ROTA

UCA Universidad de Cádiz

SANCTI-PETRI

CONIL

ALGECIRAS

TARIFA

CEUTA

	HUELVA	TARIFA
Latitude	6.83° W	5.60° W
Longitude	37.13° N	36.01° N
Time-interval	5-minutes	5-minutes
Sensor	Radar	Radar
Model	Miros	Miros
	REDMAR	REDMAR

Data Sets

CryoSat-2 in SAR mode

HUELVA

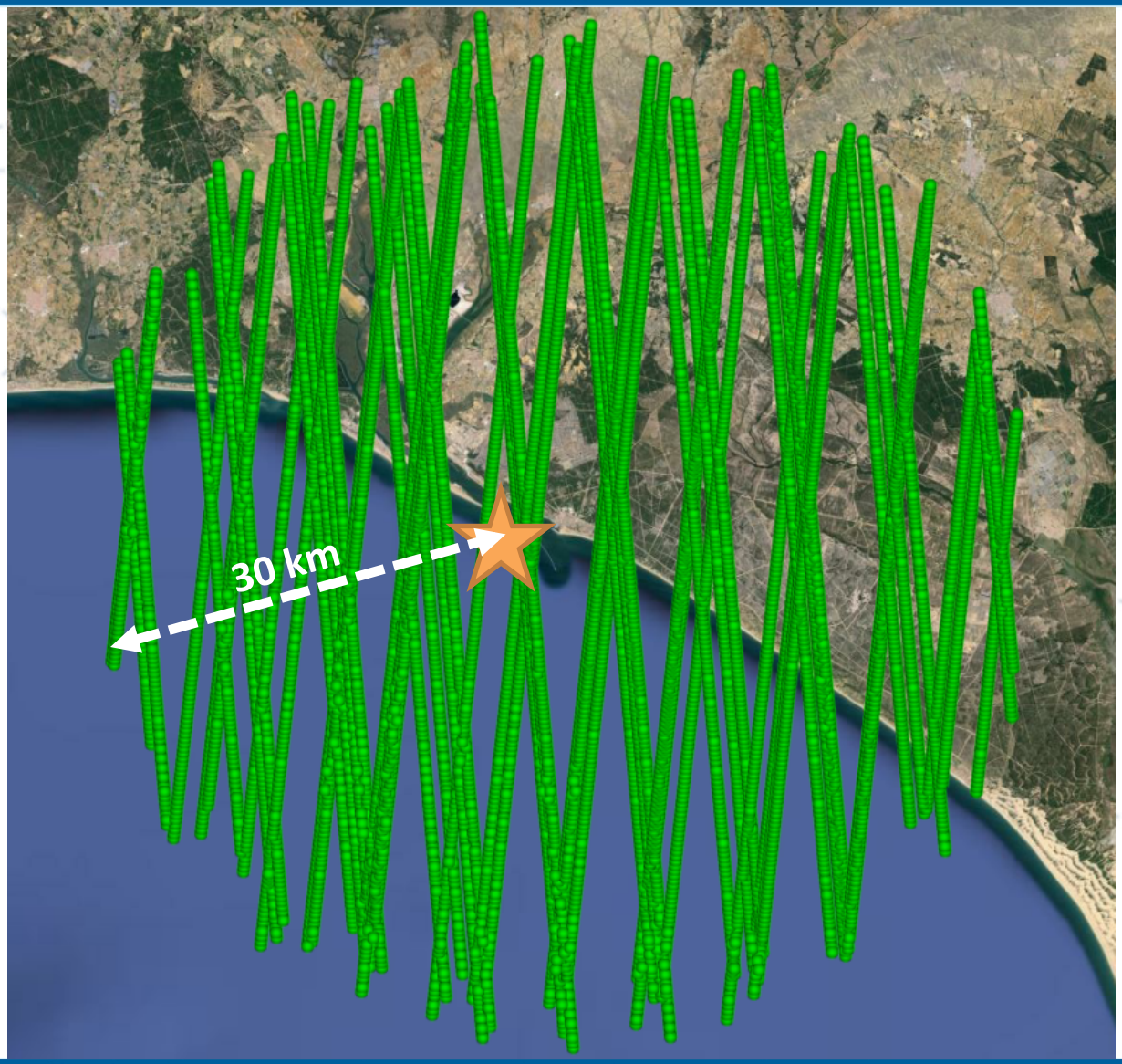
TARIFA

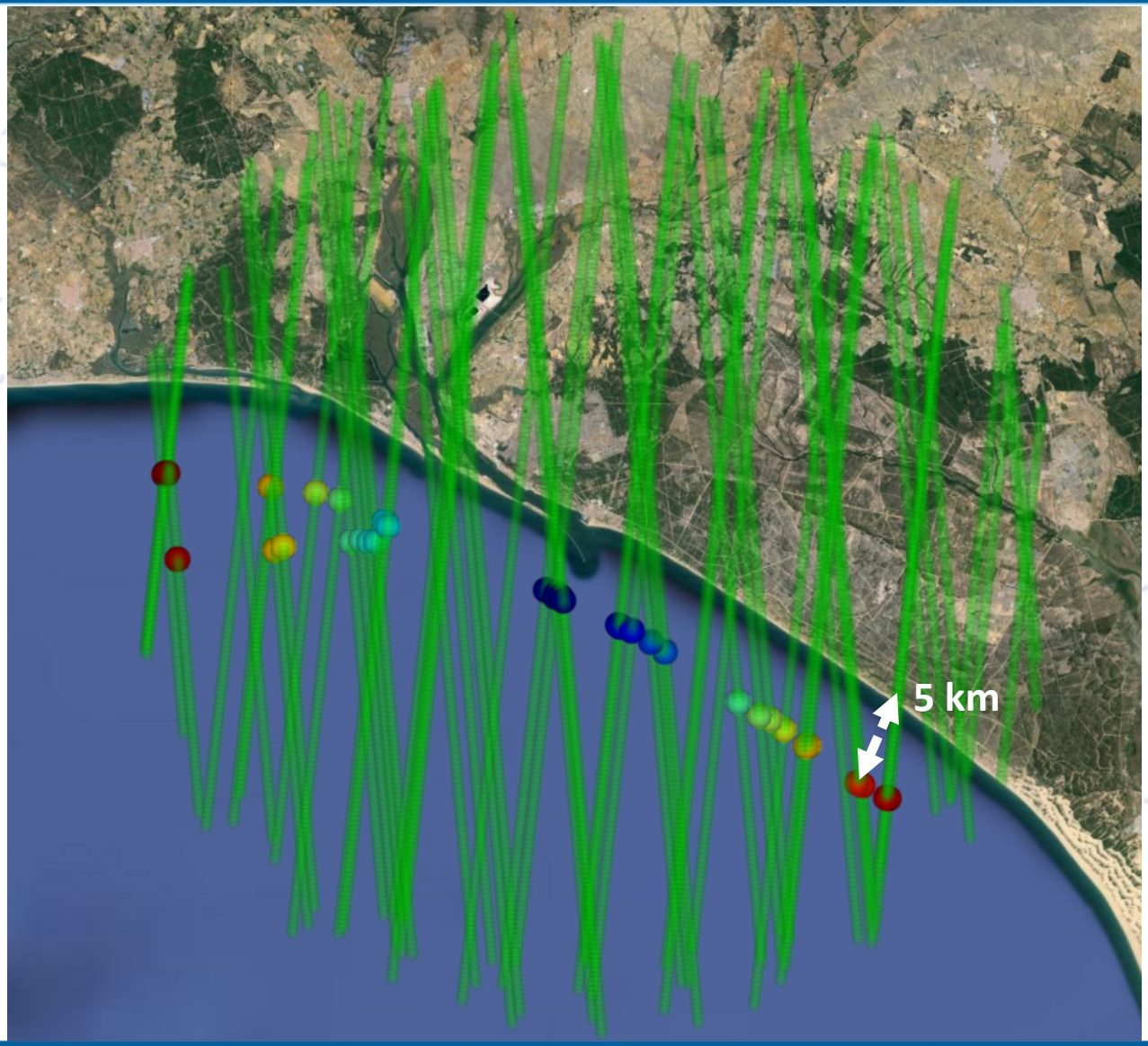
- Time period analyzed:
  August 2010 – February 2014.

- Two sources:

  DBL files from Kiruna station @ ftp://science-pds.cryosat.esa.int
  Range based on 'SAMOSA' retracker. 20 Hz posting rate.

  NetCDF files from ESRIN
  Range based on 'SARVATORE' retracker. 20 Hz posting rate.


30 km


5 km

Methodology

CryoSat-2

HUELVA

TARIFA

Time Series

SLA_Alt = Orbit - Range - Corrections - MSS

Range

Official product (DBL) & Sarvatore (Sarv)

Corrections

Ionospheric (GIM maps), Dry/Wet Troposheric (ECMWF model), Ocean Tide, Load Tide, Solid Earth Tide, Pole Tide and IBC. Regarding tidal elevation we used DTU10 global ocean tide model (Andersen 2010). NO SSB APPLIED.

MSS

The most updated version of the Danmarks Tekniske Universitet MSS: DTU13 (Andersen and Knudsen, 2009; Andersen, 2010).

Methodology

Tide Gauges

HUELVA

TARIFA

Time Series

SLA_TG = Water Level –Tides – IBC

Water Level: sea level recorded at 5-minutes interval. Data interpolated to the time of the radar measurements.
Tides: we used DTU10 global ocean tide model (Andersen 2010).
IBC: Inverse Barometer Correction.

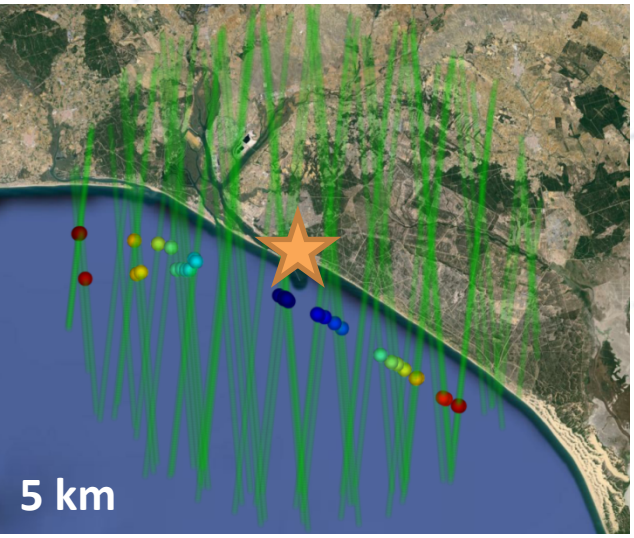
Results

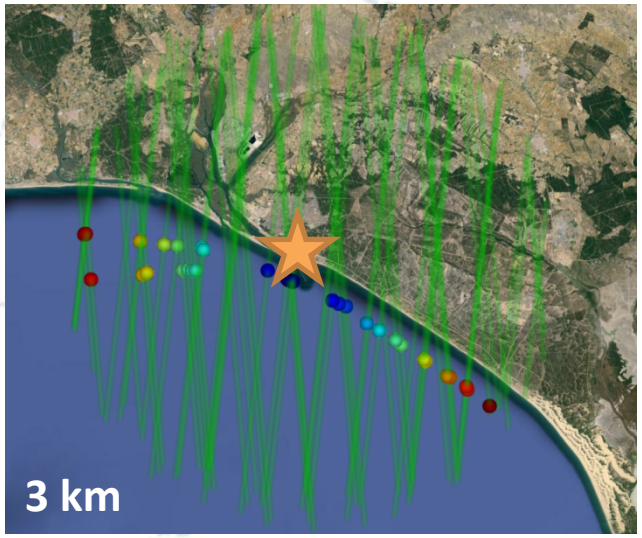
HUELVA

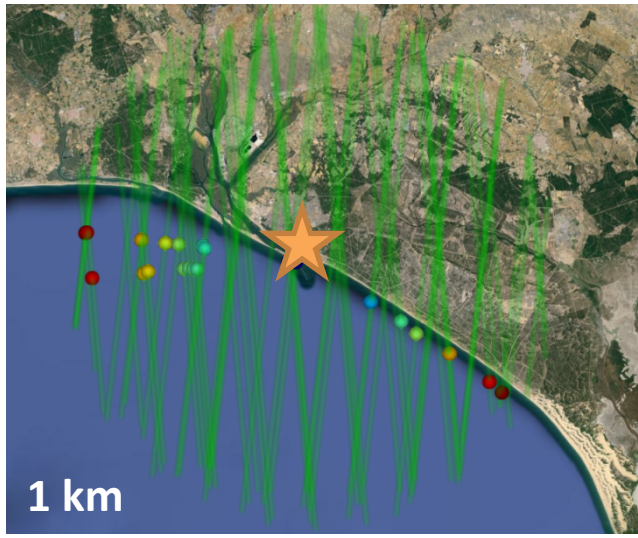
TARIFA

$$RMSD = \sqrt{\frac{\sum(X_1 - X_2)^2}{N}}$$

X_1 = SLA_Alt
X_2 = SLA_TG
N = number of valid meas.



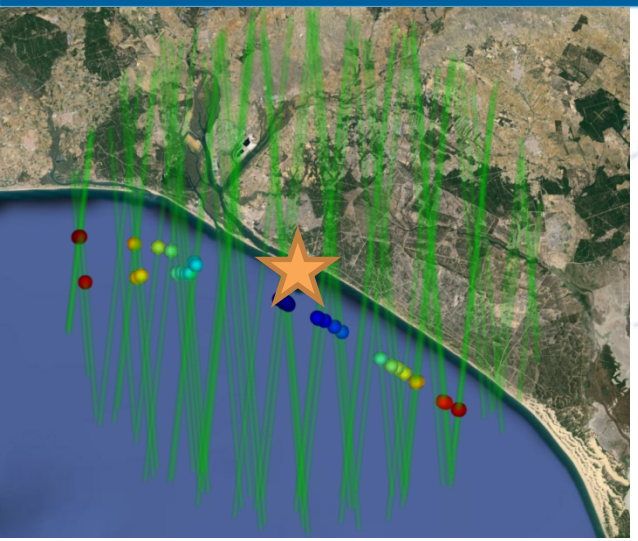




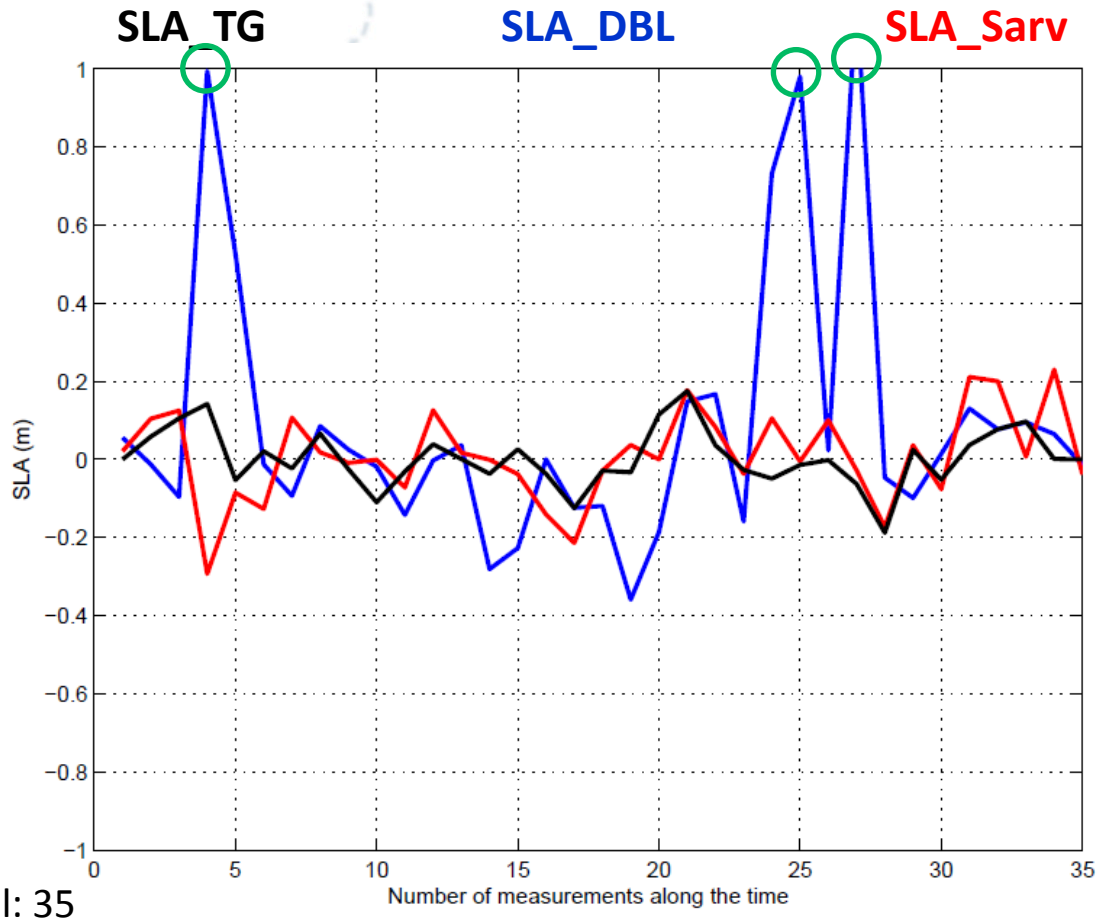
HUELVA

Green: Along-track positions between August 2010 and February 2014 used to create altimeter the time series.

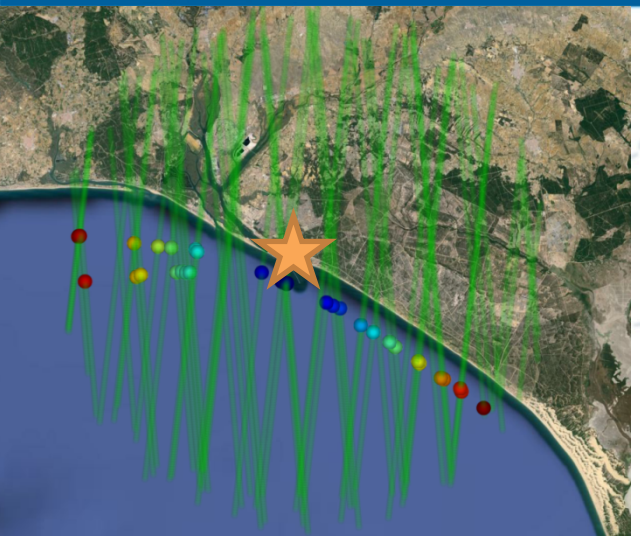
Dots: We selected distances to tide gauge lower than 30 km and distances to land not lower than 5 km – 3 km – 1 km.



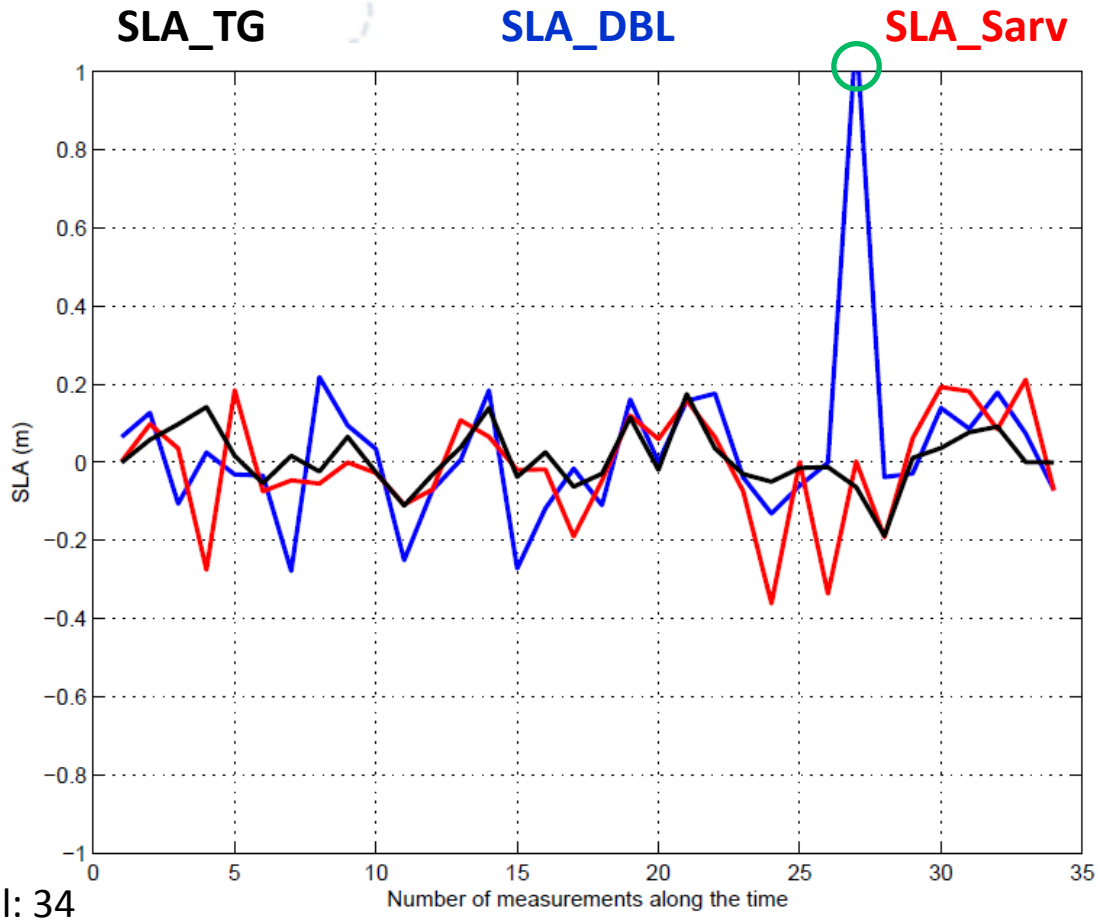
Radius: 30 km
Distance to land: 5 km



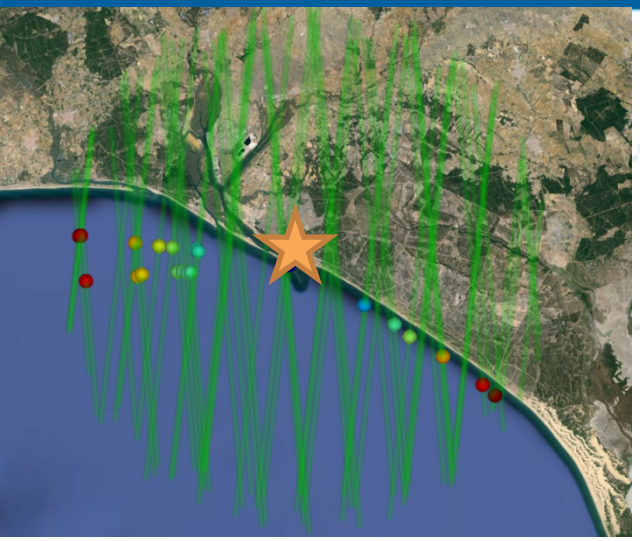
Nb of measurements: 49
Nb measurements after NAN removal: 41
Nb of measurements after outlier removal: 35
rmse_dbl: 0.37 m
rmse_sar: 0.11 m



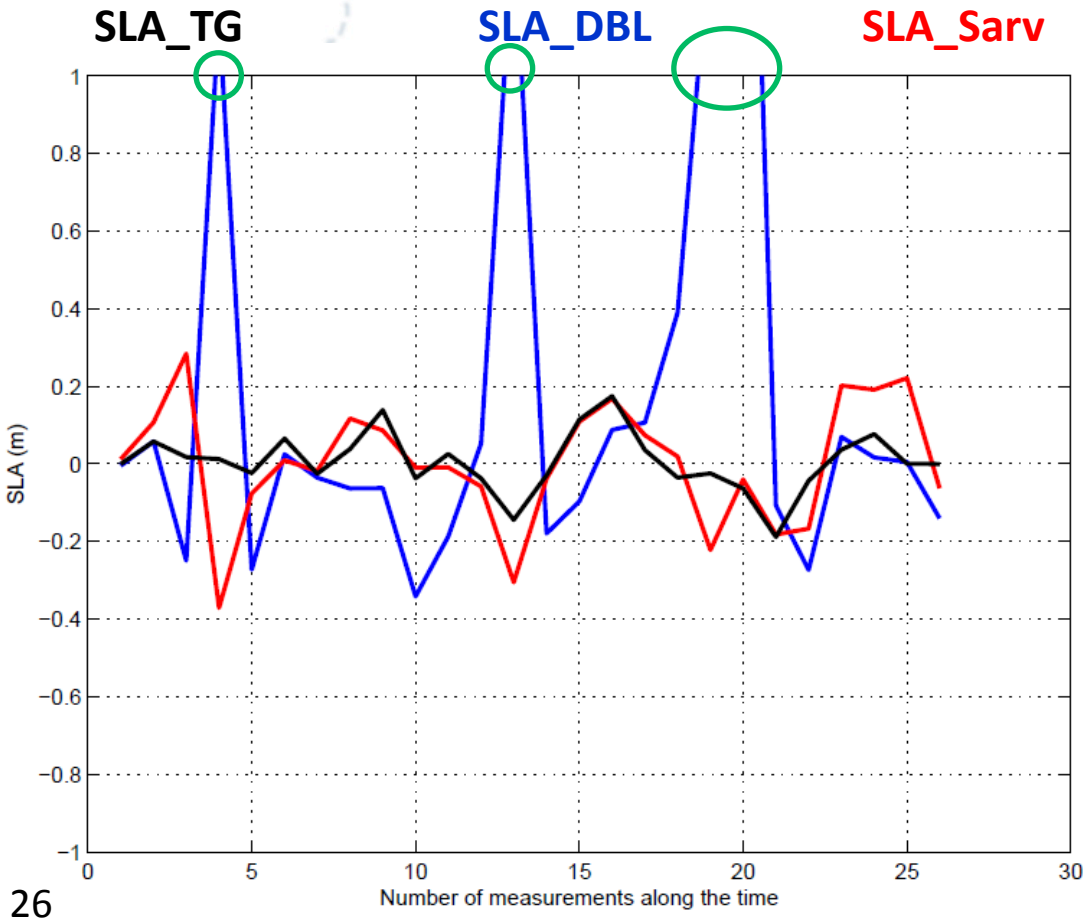
Radius: 30 km
Distance to land: 3 km



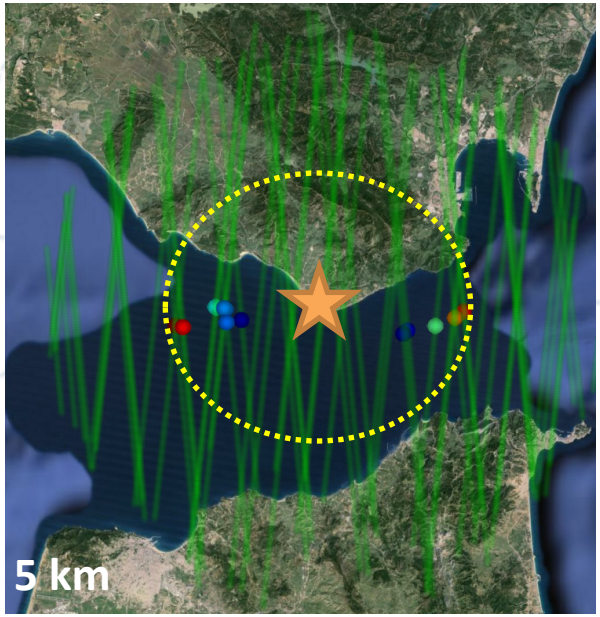
Nb of measurements: 51
Nb measurements after NAN removal: 42
Nb of measurements after outlier removal: 34
rmse_dbl: 0.23 m
rmse_sar: 0.13 m

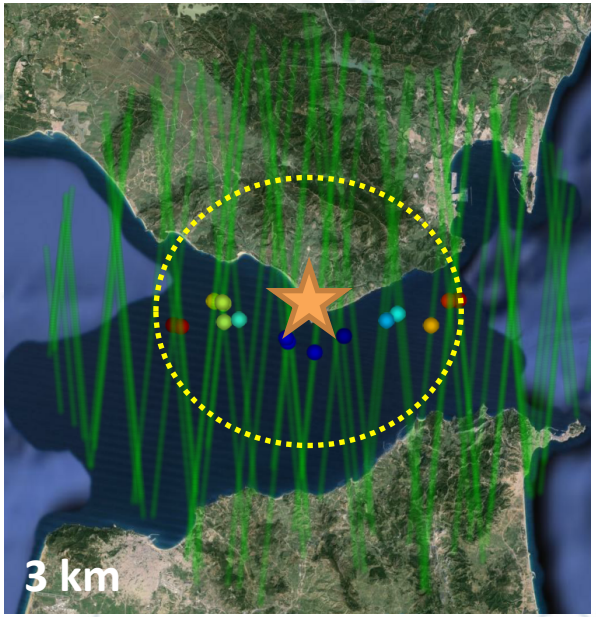


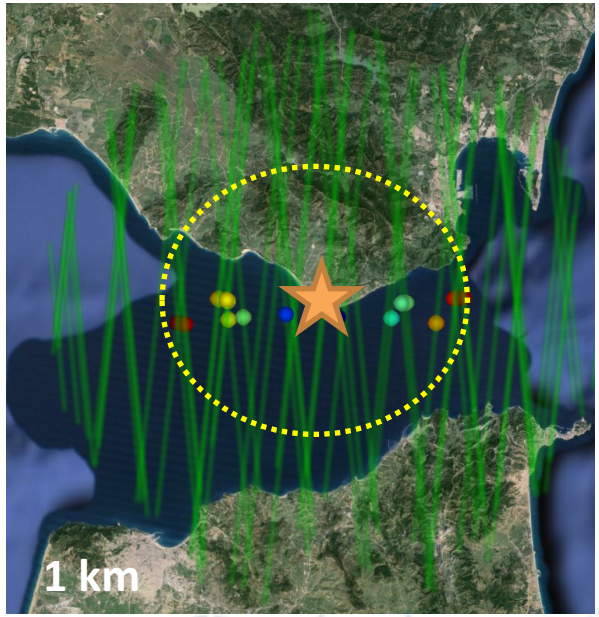
Radius: 30 km
Distance to land: 1 km



Nb of measurements: 54
Nb measurements after NAN removal: 41
Nb of measurements after outlier removal: 26
rmse_dbl: 0.70 m
rmse_sar: 0.13 m



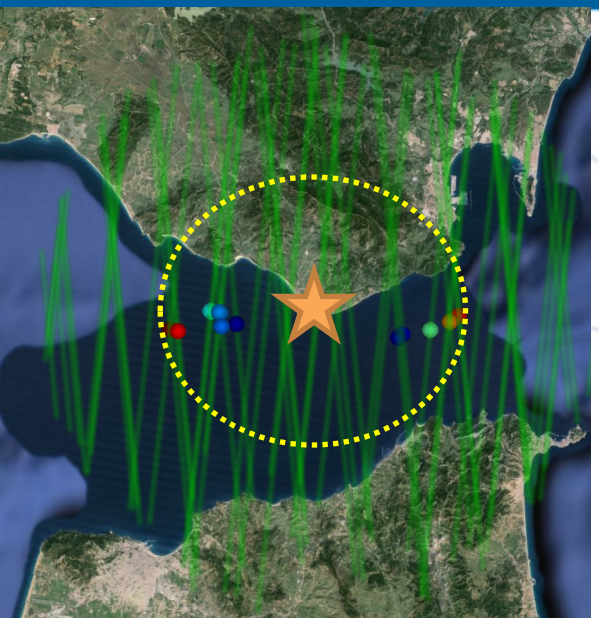




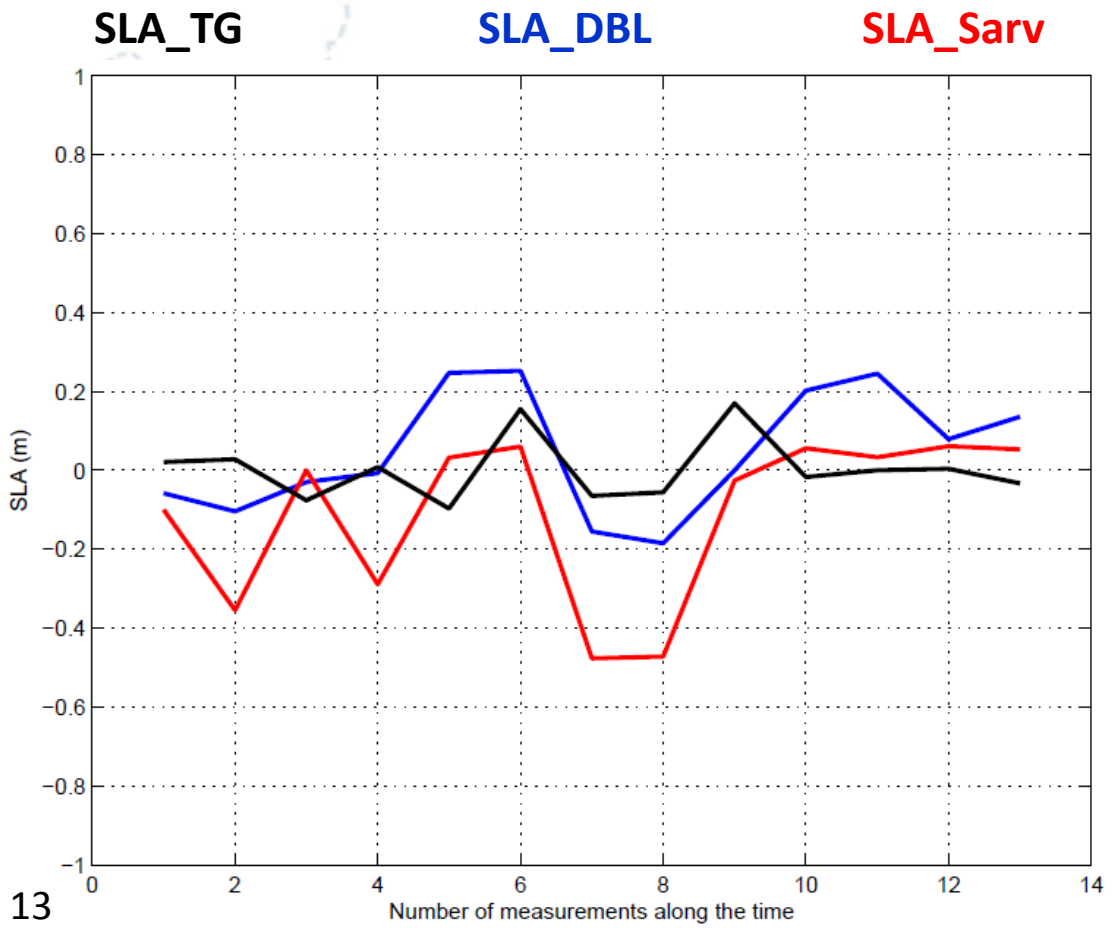
TARIFA

Green: Along-track positions between August 2010 and February 2014 used to create altimeter the time series.

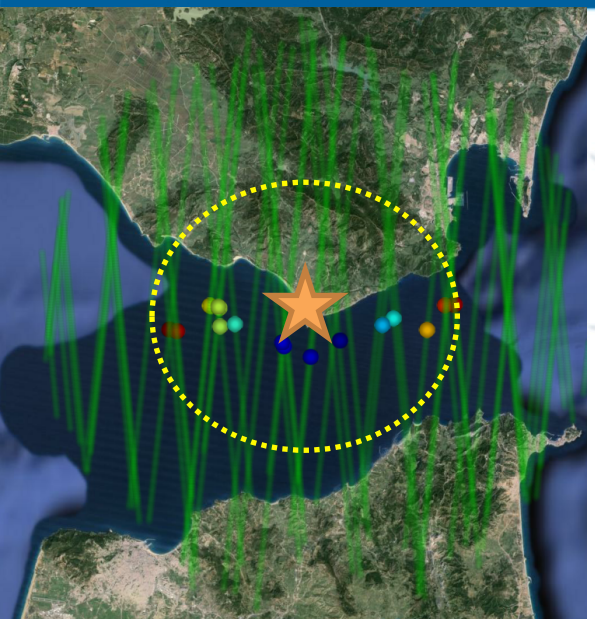
Dots: We selected distances to tide gauge lower than 17 km and distances to land not lower than 5 km – 3 km – 1 km.



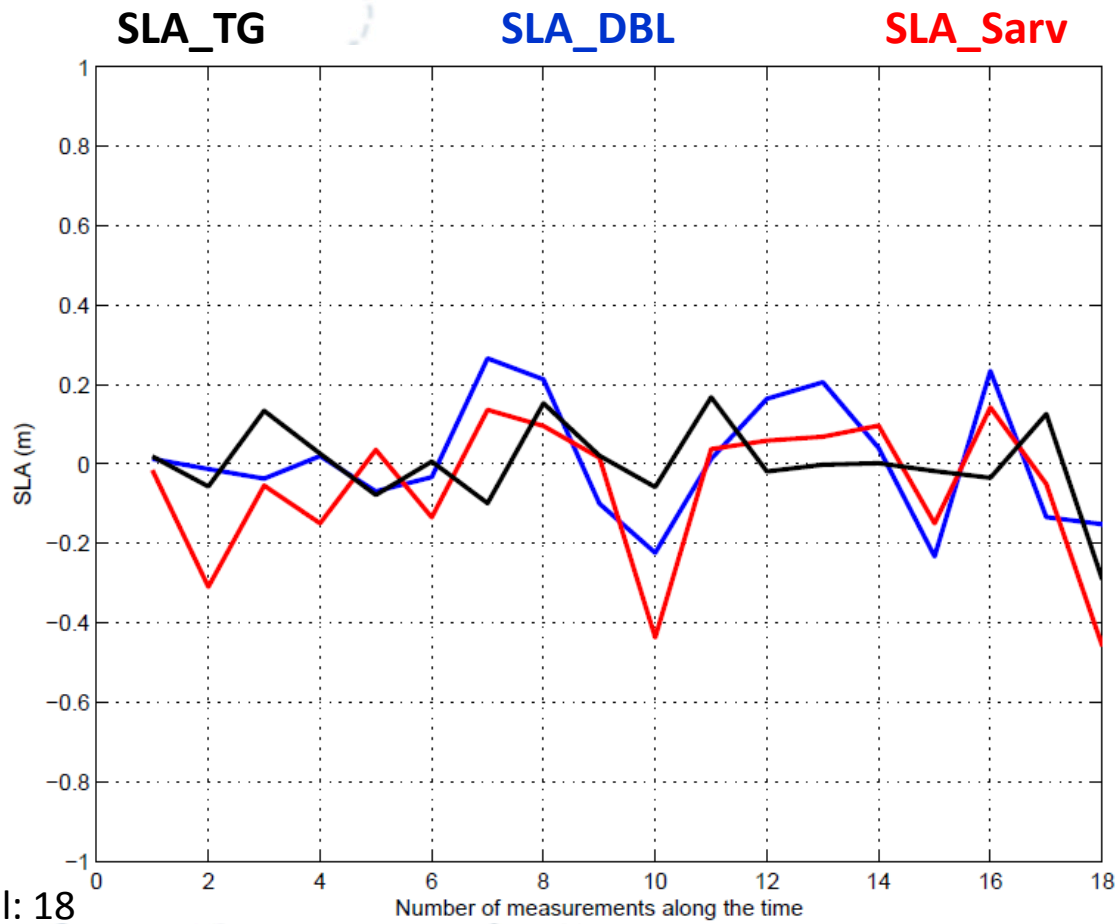
Radius: 17 km
Distance to land: 5 km



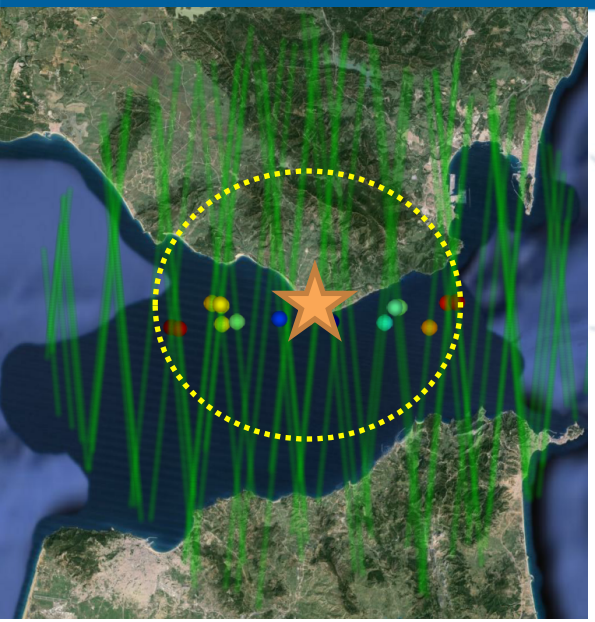
Nb of measurements: 29
Nb measurements after NAN removal: 26
Nb of measurements after outlier removal: 13
rmse_dbl: 0.16 m
rmse_sar: 0.23 m



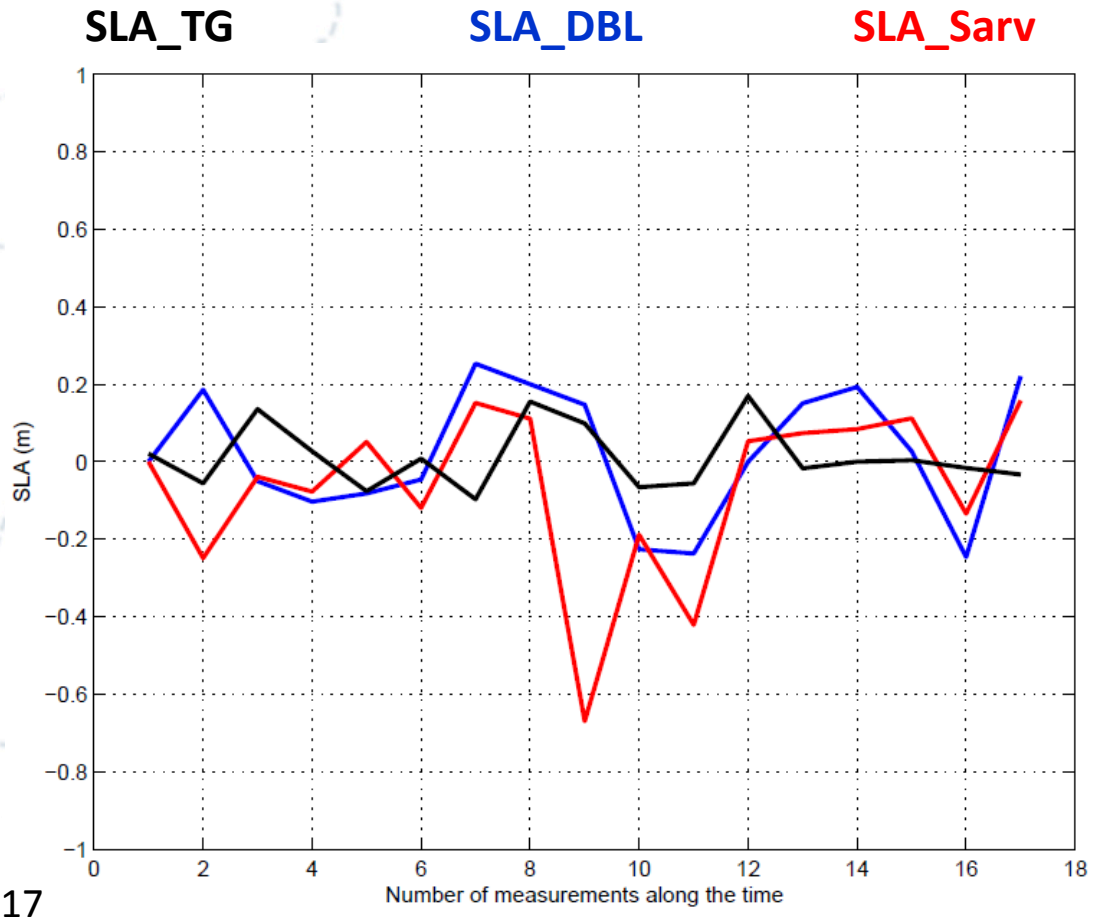
Radius: 17 km
Distance to land: 3 km



Nb of measurements: 30
Nb measurements after NAN removal: 27
Nb of measurements after outlier removal: 18
rmse_dbl: 0.17 m
rmse_sar: 0.17 m



Radius: 17 km
Distance to land: 1 km



Nb of measurements: 31
Nb measurements after NAN removal: 18
Nb of measurements after outlier removal: 17
rmse_dbl: 0.17 m
rmse_sar: 0.24 m

In summary…

	RMSE (m)					
	5 km		3 km		1 km	
	DBL	Sarvat.	DBL	Sarvat.	DBL	Sarvat.
Huelva	0.37	**0.11**	0.23	**0.13**	0.70	**0.13**
Tarifa	**0.16**	0.23	**0.17**	**0.17**	**0.17**	0.24

In conclusion…

Three and half years of CryoSat-2 SLA have been validated against two tide gauges located in the Gulf of Cadiz and Strait of Gibraltar (Iberian Peninsula).

The strategy of data selection in order to get time series is totally different to 'classical' altimeters.

Results (in terms of RMSE) in Huelva (Gulf of Cadiz) indicates a better performance of Sarvatore respect to DBL. The lower RMSE was obtained at 5 km to the land.

Results (RMSE) in Tarifa (Strait of Gibraltar) seems to indicate that DBL performs better than Sarvatore. Slightly lower RMSE are seen at 5 km to the coast.

This analysis will be completed using the whole network of available tide gauges along the Spanish coasts. The time period will be extended to August 2014.

We definitely need a solution for SSB.

THANKS FOR YOUR ATTENTION