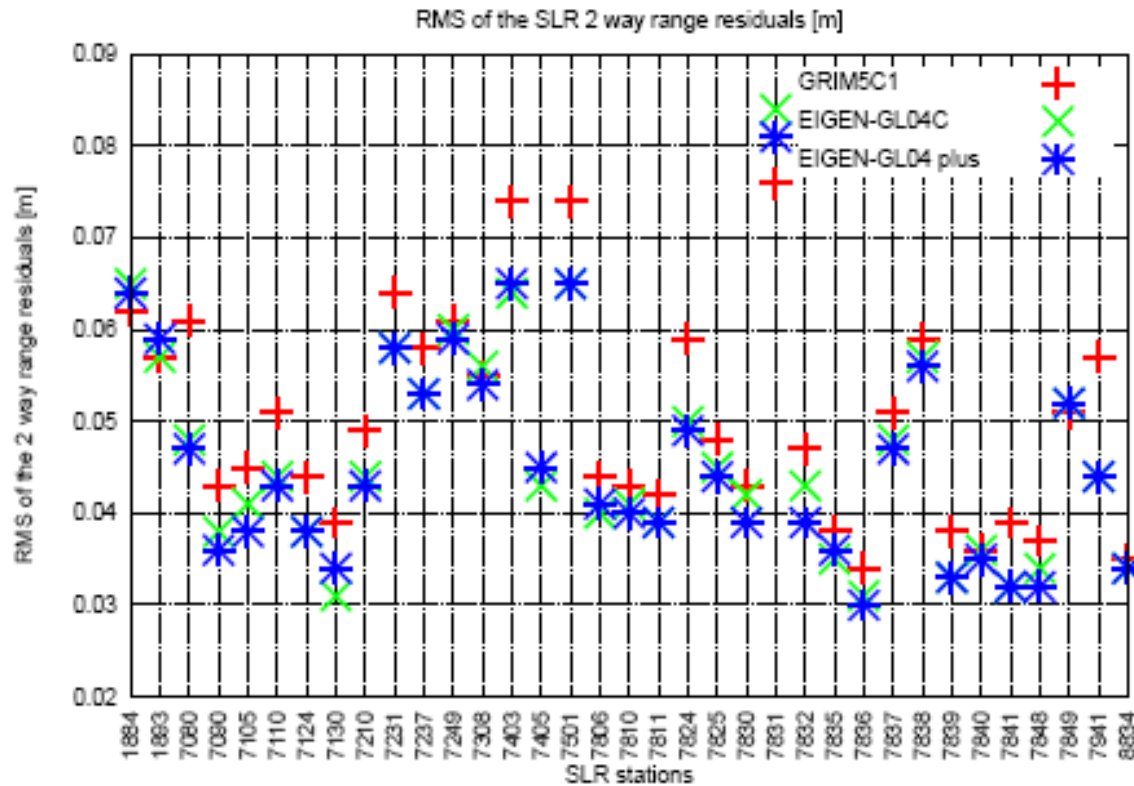


Modeling Tests and DORIS residual patterns

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ESA/ESOC

Evaluation of the AGRA model and annual/semi-annual gravity variation on the Envisat Orbit

- Together with the University of Darmstadt we evaluated the performance of the EIGEN-GRACE 04S model with annual and semi-annual variation (up to degree and order 50) and the Atmospheric gravity (derived from the NCEP pressure fields, 6 hourly fields up to degree and order 20) AGRA service at GSFC.
- We looked at the internal orbit consistency, SLR residuals and Altimeter crossovers.
- These two models are both part of the new CNES GDR-C standards for Jason-1 and Envisat



	GRIM5C1	EIGEN-GL04C	EIGEN-GL04 plus
Nr. of Observations	401305	401305	401289
Unweighted RMS [m]	0.0478	0.0433	0.0423
Unweighted Mean [m]	0.0024	0.0063	0.0059

Table 1: Statistics of the 2-way SLR residuals

Three different solutions were evaluated which differ only in the used gravity modeling. The solution labeled GRIM-5C1 is based on the ‘older’ GRIM-5C1 gravity model, the GL04C solution uses the EIGEN-GRACE 04C static gravity field and the GL04 plus uses the 04S model with (semi-) annual variation and the AGRA model. The later seems to perform the best. The small difference in used observation for the plus model has been corrected and resulted in the same RMS and mean SLR values.

	GRIM5C1	EIGEN-GL04C	EIGEN-GL04 plus
Removed [%]	9.2	9.7	8.3
RMS (radial) [m]	0.0018	0.0016	0.0016
RMS (along t.) [m]	0.0044	0.0040	0.0040
RMS (cross t.) [m]	0.0069	0.0050	0.0046
Mean (radial) [m]	0.0017	0.0015	0.0015
Mean (along t.) [m]	0.0040	0.0036	0.0037
Mean (cross t.) [m]	0.0059	0.0041	0.0038

Table 2: Internal orbit consistency

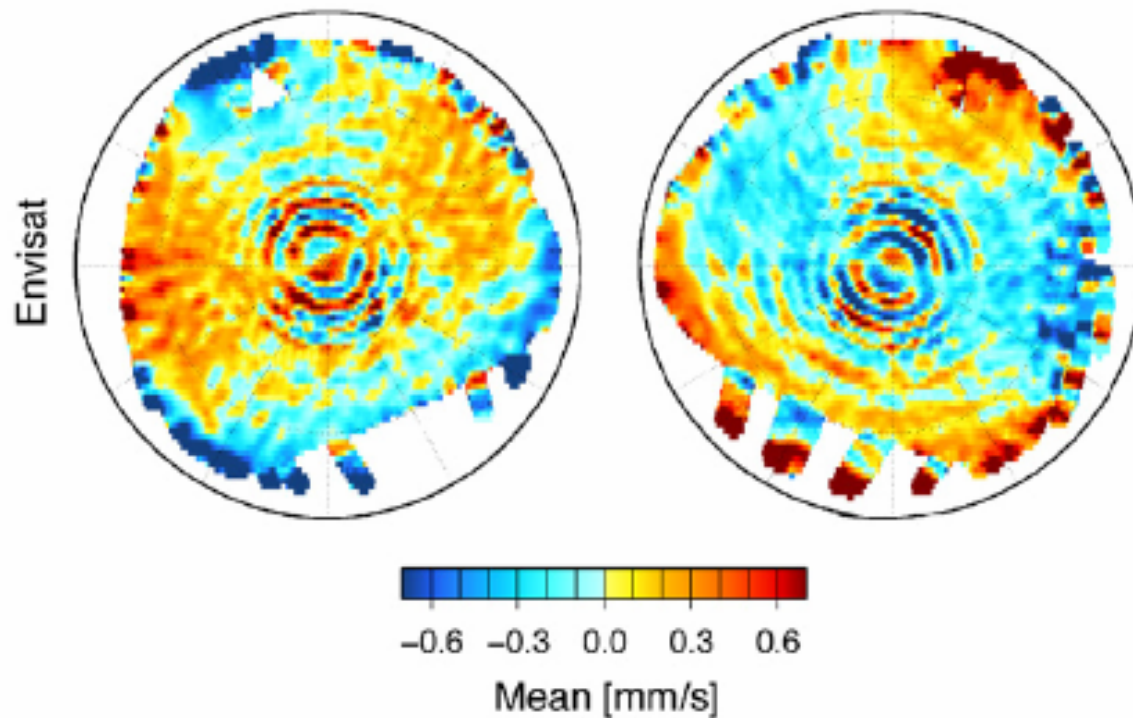
	GRIM5C1	EIGEN-4C	EIGEN-4C plus
Mean [m]	0.0094	0.0016	0.0017
RMS [m]	0.0691	0.0680	0.0679

Table 3: Single cross-over differences of the sea level anomaly [m]

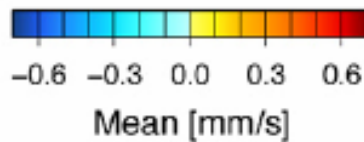
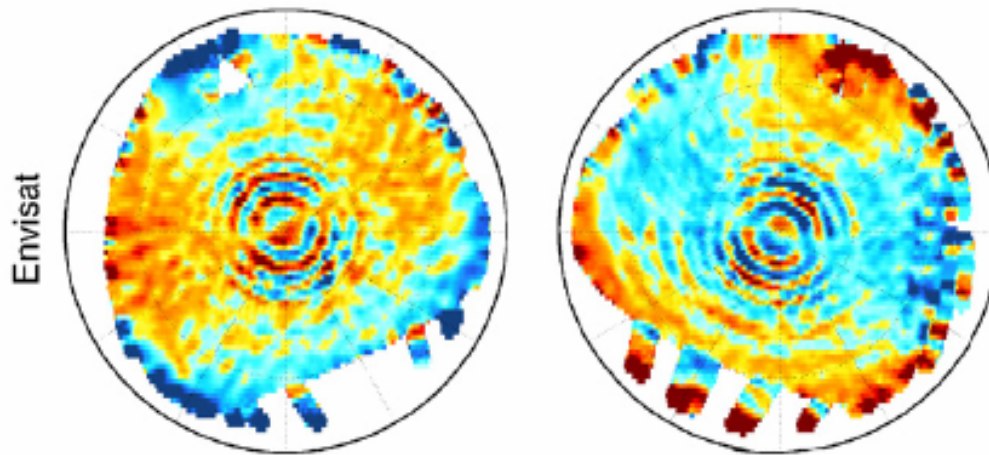
Again for both the Internal consistency and the single cross-over differences the EIGEN-GRACE 04S model with AGRA gives the best results. No editing was performed on the cross-over values. The internal consistency is based on the middle 24hrs in the two day overlap between two consecutive orbit arcs (each arc is 7 days)

DORIS residual analysis for Envisat

- At ESOC we have recently started looking at the DORIS residuals from our Envisat processing. We used the paper from Eelco Doornbos and Pascal Willis titled: 'Analysis of DORIS range-rate residuals for TOPEX/Poseidon, Jason, Envisat and SPOT' as an starting point.
- The following slide give an overview of some of our initial findings.
- All plots show the mean residual not the rms.



Plot taken from Eelco's and Pascal's paper showing the ascending (left) and descending (right) mean residuals for FAIB (Fairbanks, Alaska). As you can see from the plot the ascending and descending residuals have an opposite sign. Further the residuals seem to be symmetric around the 'flight direction' of Envisat over the beacon.

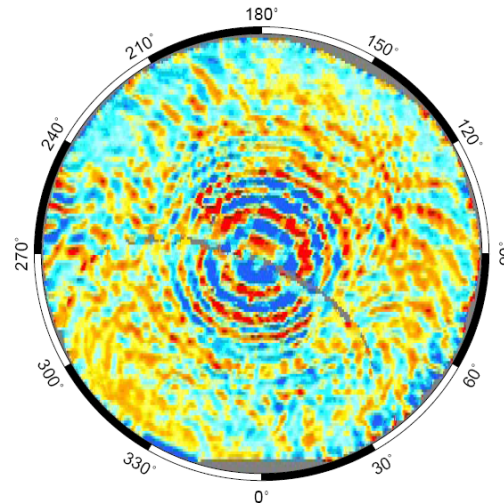
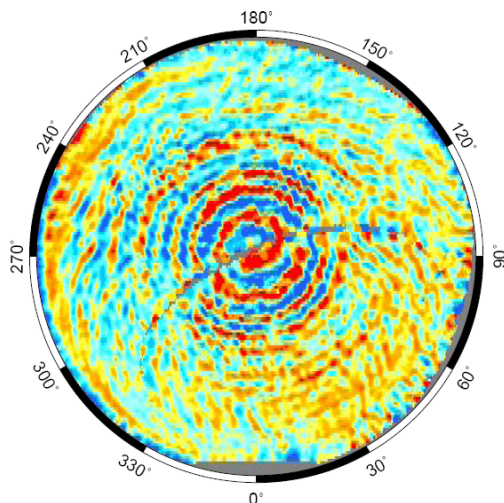


Top figures shows the same plots as the previous slide.

The bottom plot shows the residuals for Fairbanks from the ESOC processing of Envisat. All residuals from the period 2005 to 2007 were used. Earlier data (before October 2004) has much higher residuals due to shorter integration time (7 against 10 seconds).

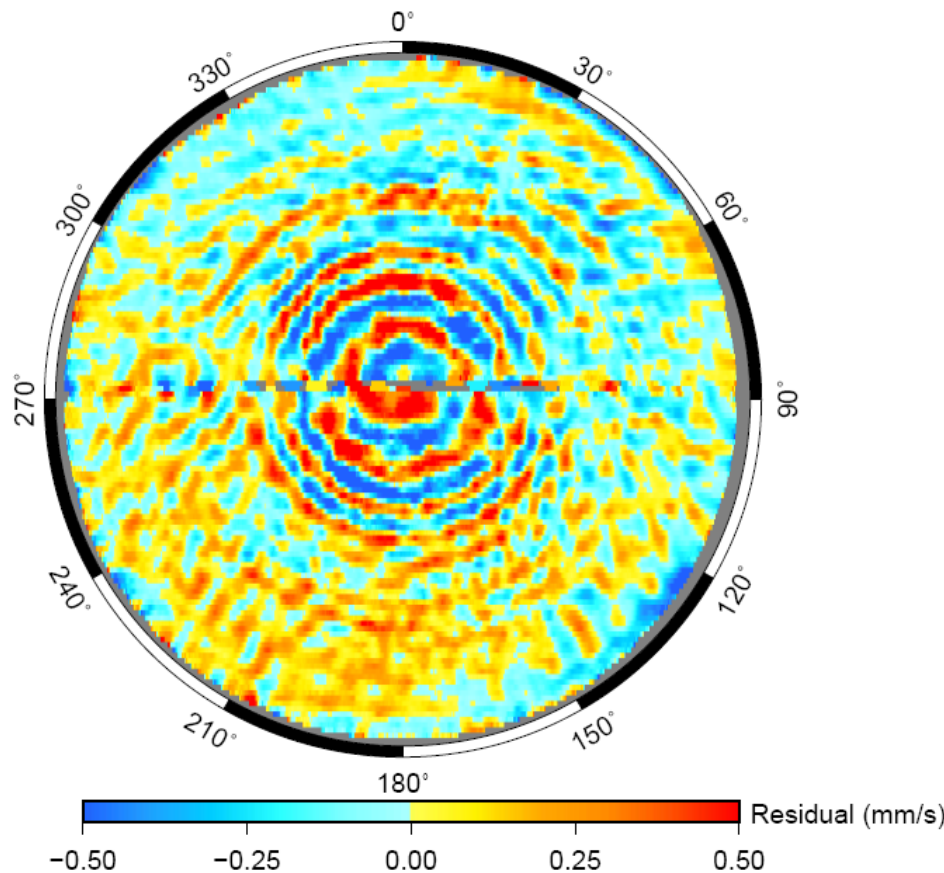
ENVISAT FAIB Residuals 2005-2007 (asc)

ENVISAT FAIB Residuals 2005-2007 (des)

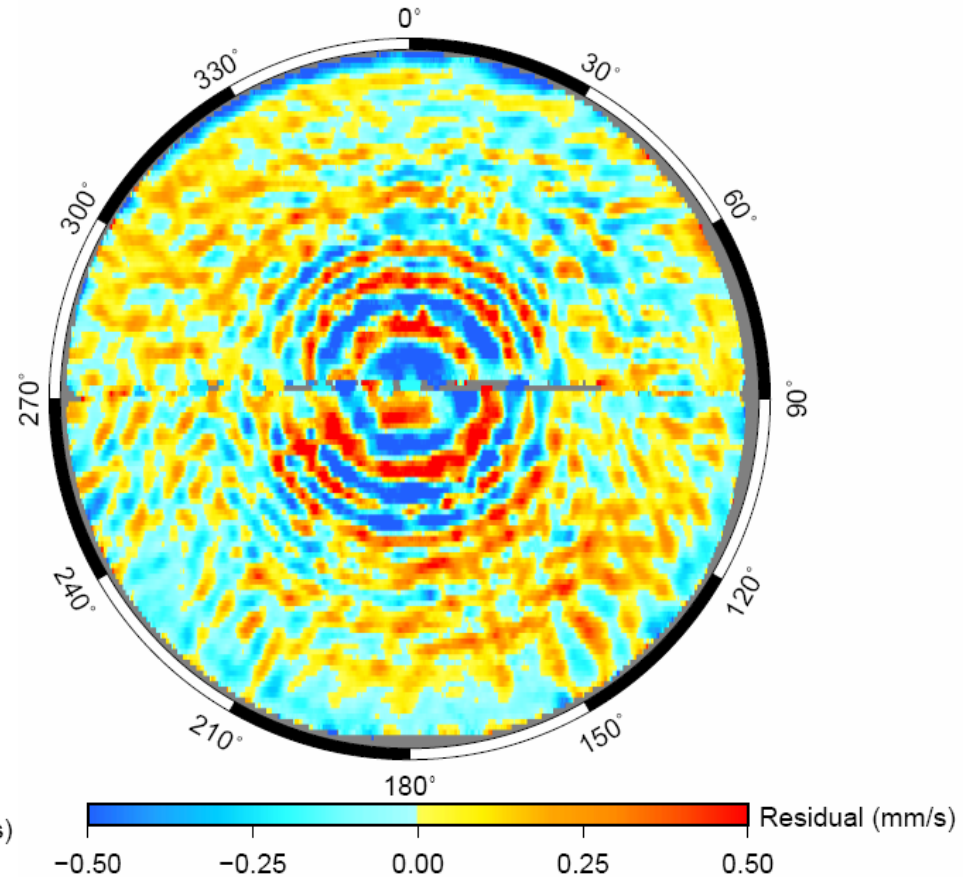


Notice the same symmetry. Much better would be to plot the residuals as seen from the Satellite thus eliminating this symmetry.

ENVISAT/FAIB DORIS Residuals 2005–2007 (asc)



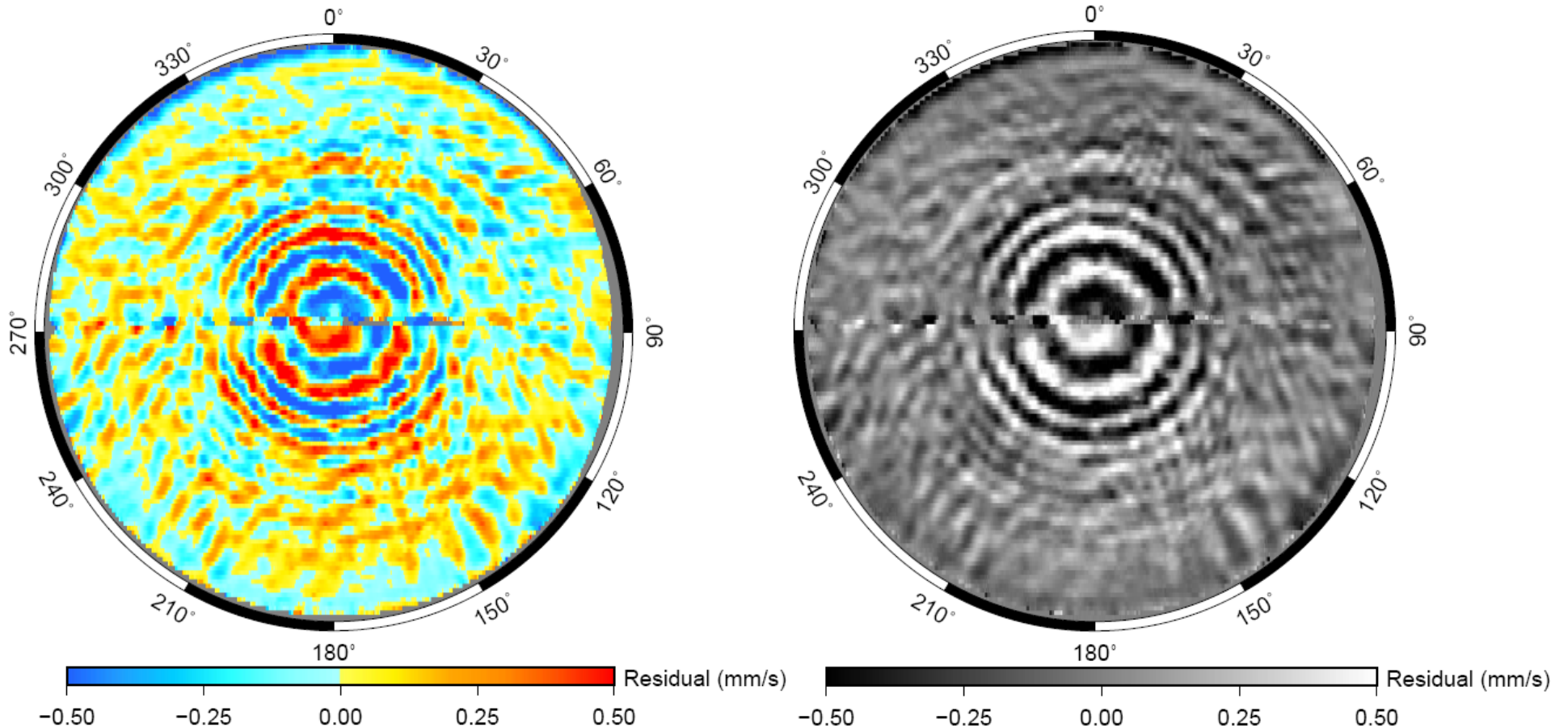
ENVISAT/FAIB DORIS Residuals 2005–2007 (des)



Same plot as previous slide but residuals are now plotted as seen from the Satellite (yaw and nadir angle) and can thus be combined. Also notice the absence of all measurements with zero Doppler rate. Still have to verify if this is our editing or the measurements are not present in the DORIS files.

ENVISAT/FAIB DORIS Residuals 2005–2007

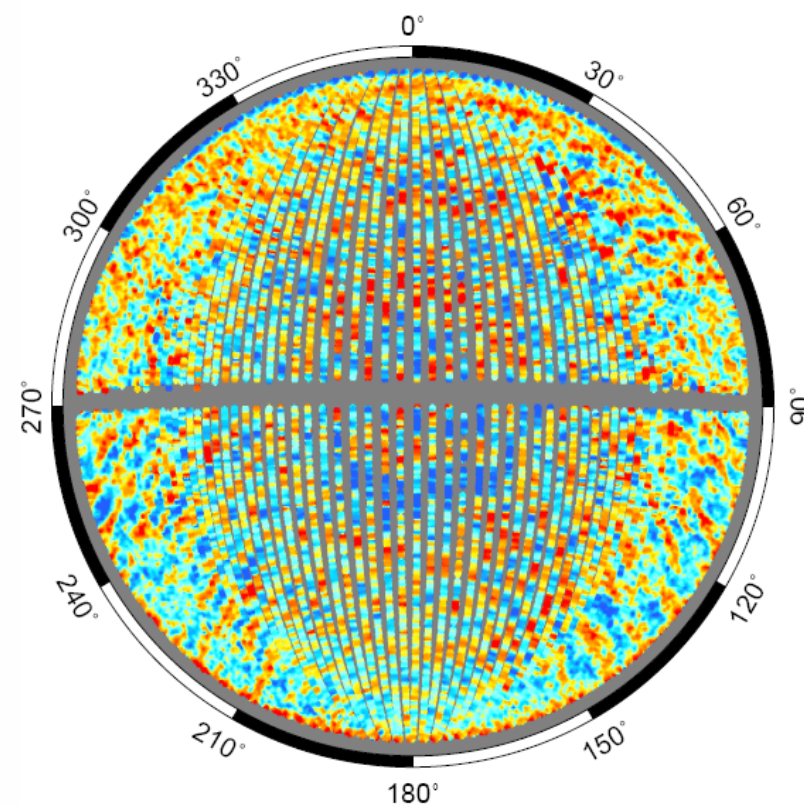
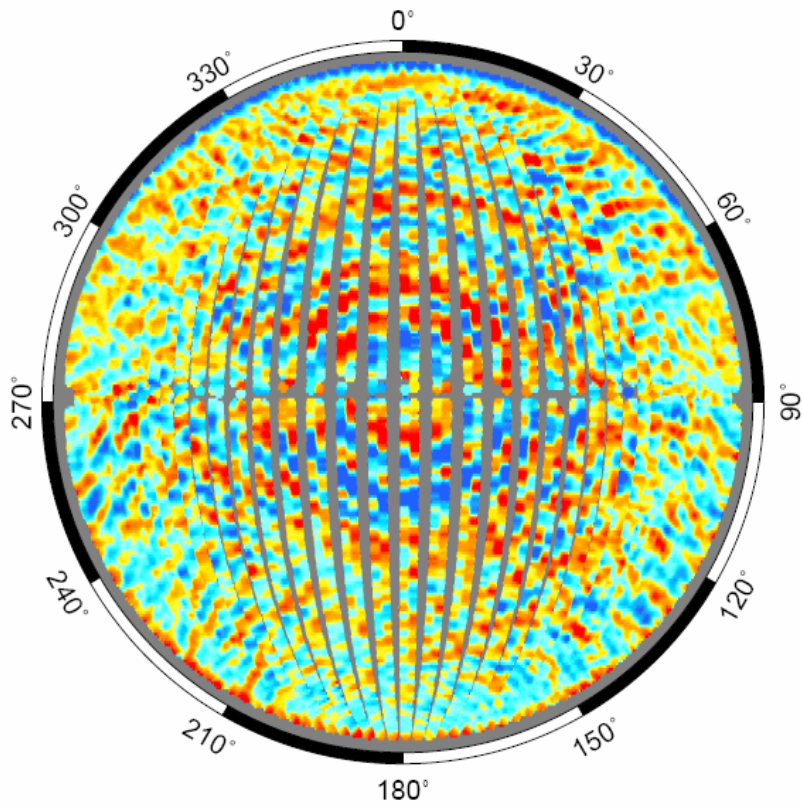
ENVISAT/FAIB DORIS Residuals 2005–2007



Envisat mean DORIS residuals for period from 2005-2007 as seen from Satellite shown in colour and b/w for Fairbanks beacon (FAIB).

ENVISAT/SCRB DORIS Residuals 2005–2007

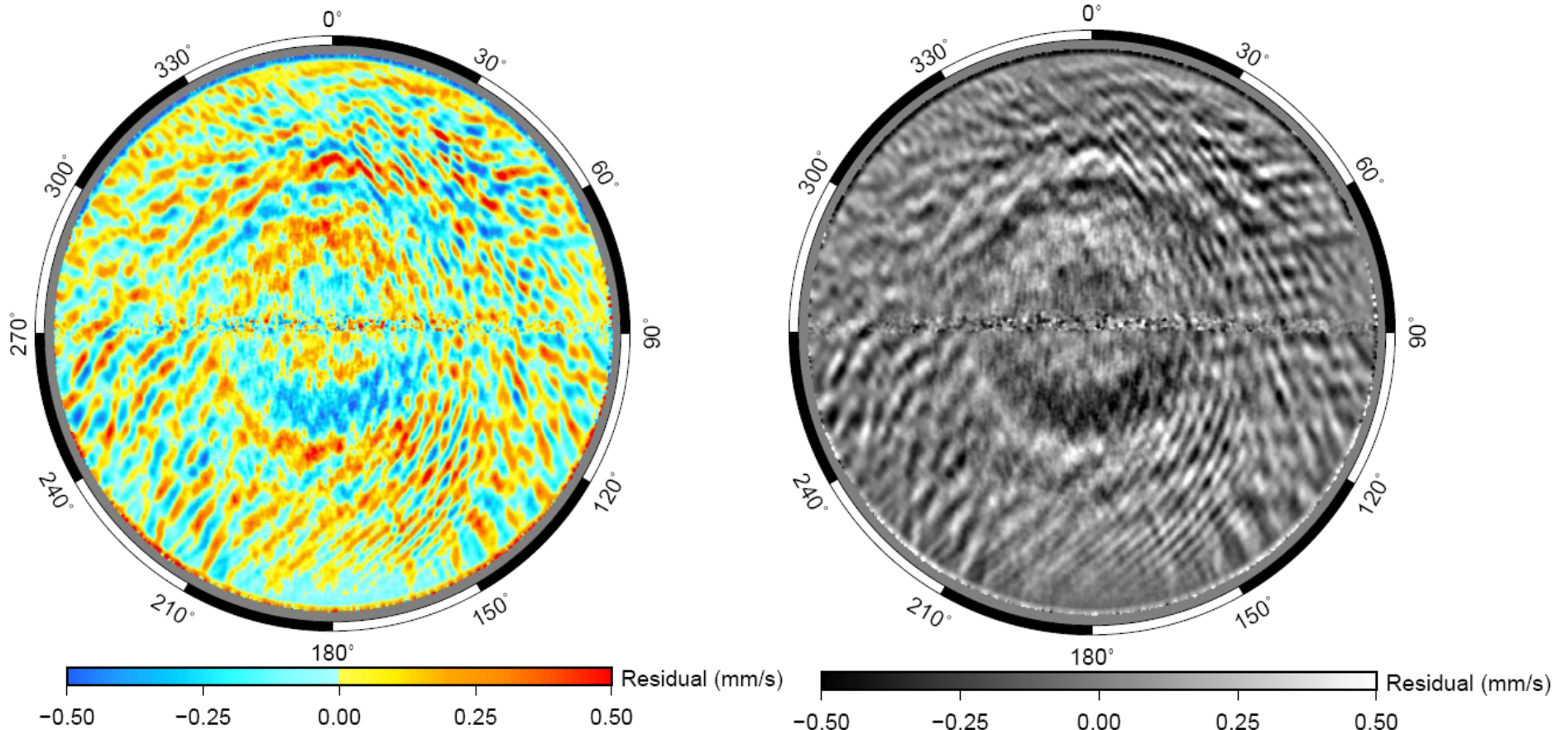
ENVISAT/KRVB DORIS Residuals 2005–2007



Envisat Doris residuals for two equatorial station Santa Cruz (SCRB) and Kourou (KRVB) same mean phase pattern is visible for SCRIB as for FAIB but is less present for Kourou . Due to ground track spacing and a repeat orbit the entire plots are not filled.

ENVISAT DORIS Residuals 2005–2007

ENVISAT DORIS Residuals 2005–2007



All Envisat Doris residuals as seen from the Satellite (the DORIS transmitting antenna). A residual pattern remains present. Unknown if this is caused by the DORIS antenna or the receiving beacons.