DORIS DIODE on-board Jason-3 and Sentinel-3 : real-time pole coordinates and USO frequencies

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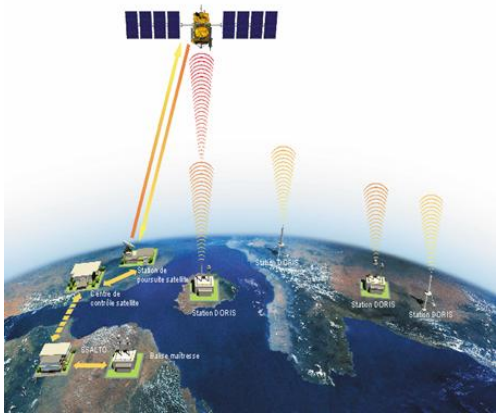
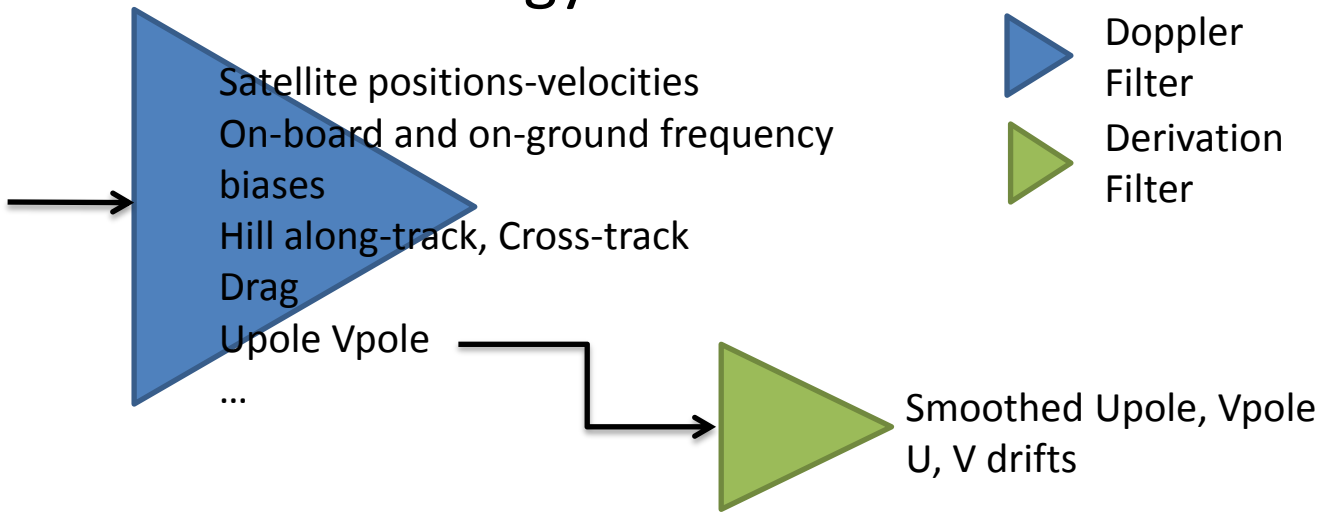
DORIS Auxiliary Data

- New TM format containing on board estimates
  - Pole coordinates and drifts
  - Beacons and satellites USO frequencies and drifts
- Will be available for Jason3 and Sentinel3
  - Available in Near Real Time (typically 3h)
- Goals
  - Deliver real-time pole estimates with a good accuracy
  - Deliver a real-time monitoring of the beacons network frequencies
- Ground activation for Cryosat2, HY2, Jason2, Saral



Pole coordinates and drifts

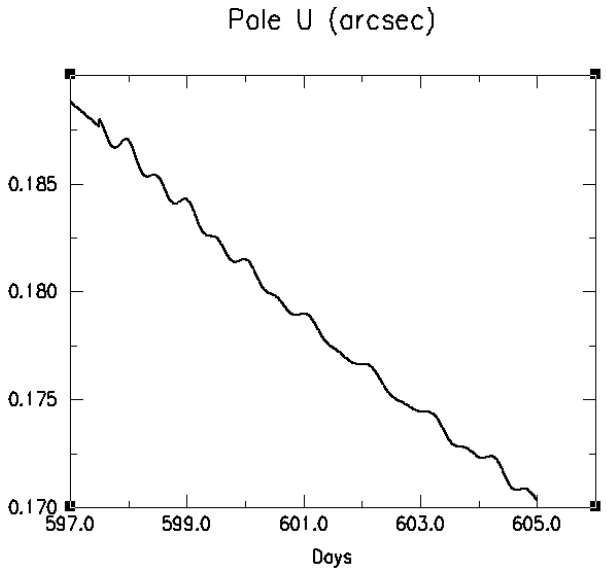
- DIODE estimation strategy

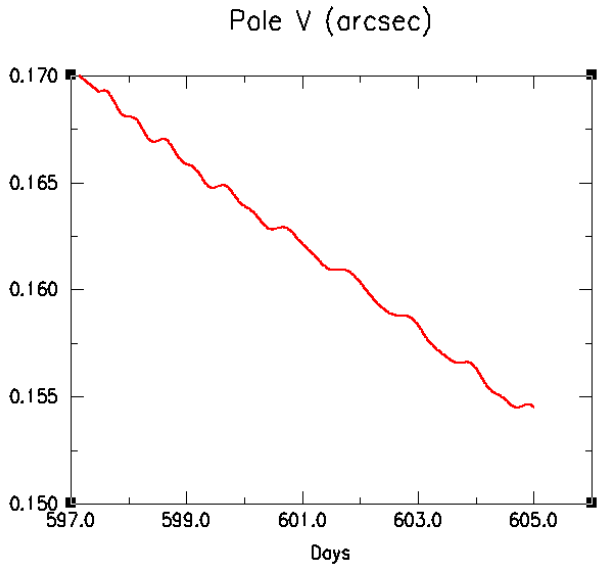


- Variation model for period < 1 day
  - Described in IERS conventions
- Outputs
  - Smoothed mean pole coordinates
  - Mean pole drift

Simulation

- Measurement simulation:
  - Dynamical orbit
  - Variable pole: IERS Bulletin B + sub-diurnal variation model





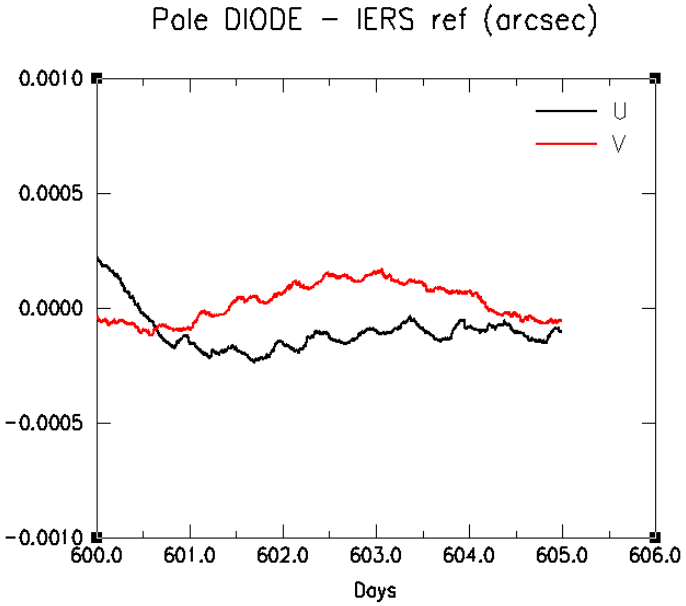
Amplitude variation of the model for a day: ~ 1mas

  - Modelled measurements

- DIODE restitution (orbit and pole)

Simulation results

- Physical pole coord. comparison: (after convergence)



	MINIMUM	MAXIMUM	MEAN	ST DEV	RMS
	**********	*********	**********	*********	*********
POLE_U	-2.340E-04	2.220E-04	-0.103E-03	8.678E-05	0.135E-03
POLE_V	-1.190E-04	1.730E-04	0.028E-03	8.116E-05	0.086E-03

- IERS Bulletin A prediction error: < 0,1 mas

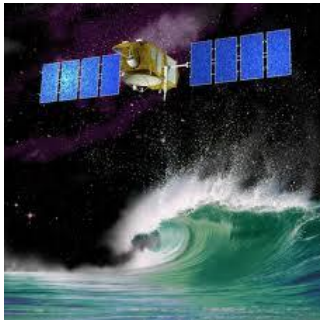
Pole: inter-satellite comparison

- In theory, same pole for all the satellites

- Ground activation with the last DIODE version
  - On a calm period without maneuver or event

Cryosat2

HY2

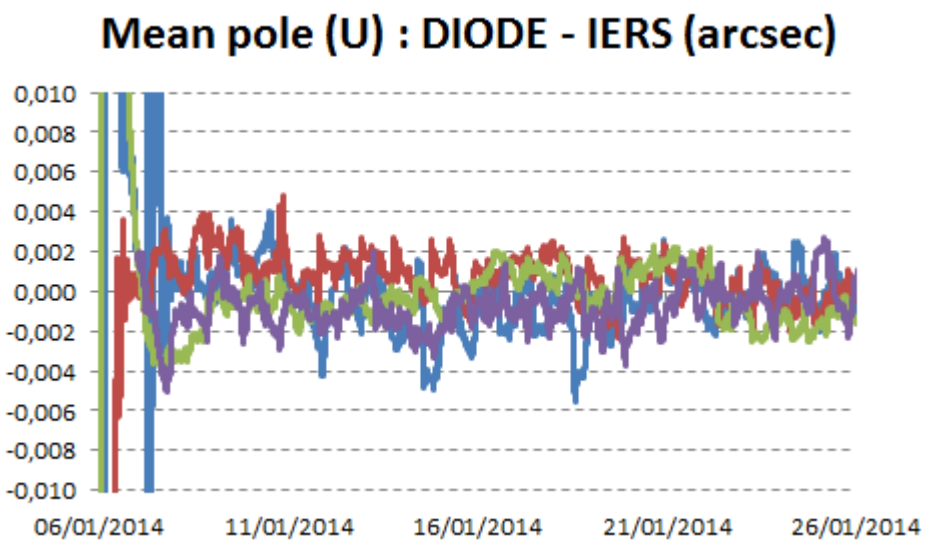


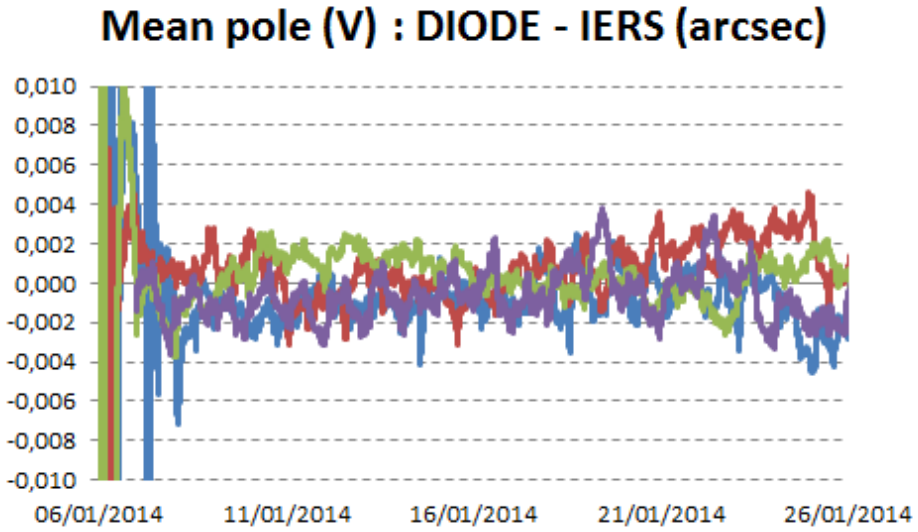
Jason2

Saral

Pole: inter-satellite comparison

- Mean pole comparison: DIODE – IERS bulletin B



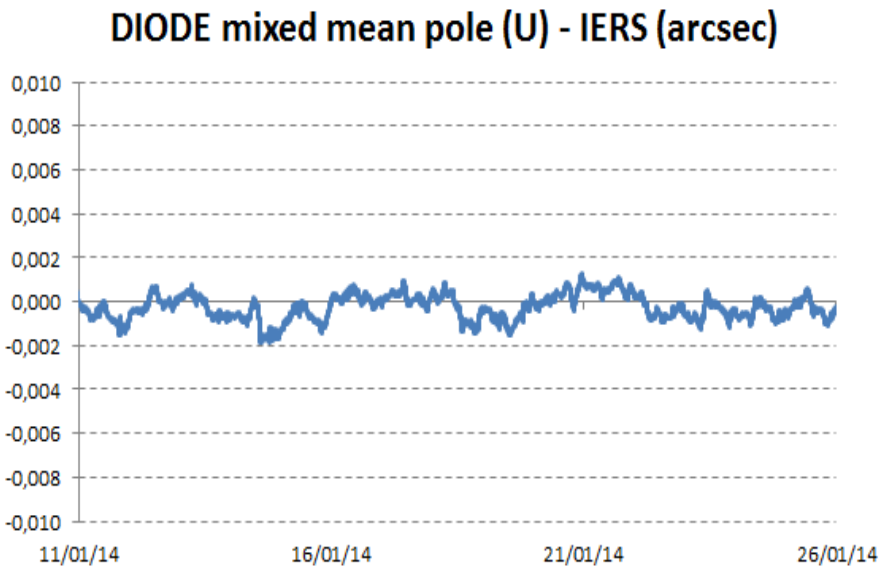


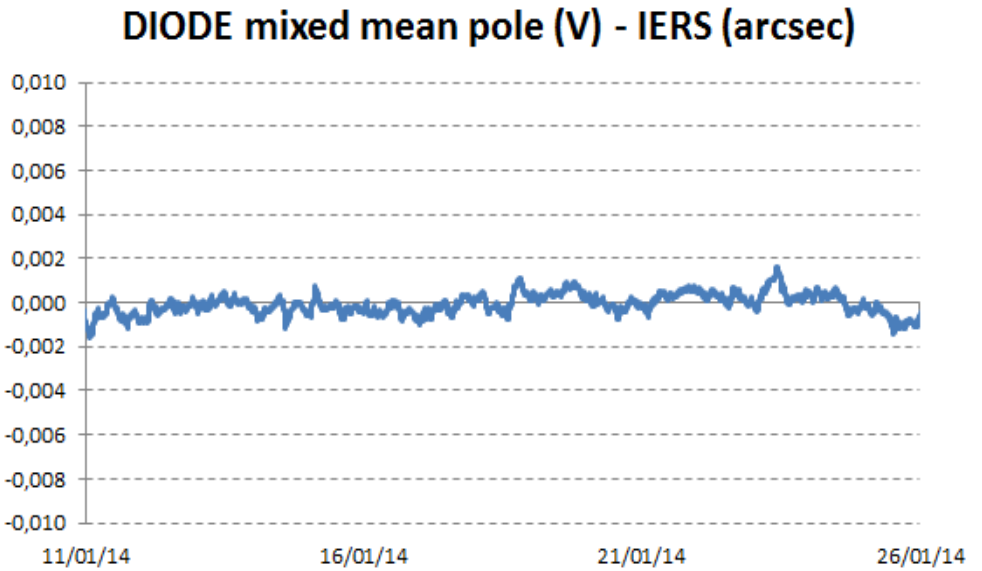
	Cryosat2	HY2	Jason2	Saral
POLE_U	1.499E-03	1.427E-03	1.223E-03	1.242E-03
POLE_V	1.597E-03	1.491E-03	1.099E-03	1.384E-03

RMS (arcsec) on the converged period

Pole: multi-satellites melting

- The four poles estimates are mixed: composite value

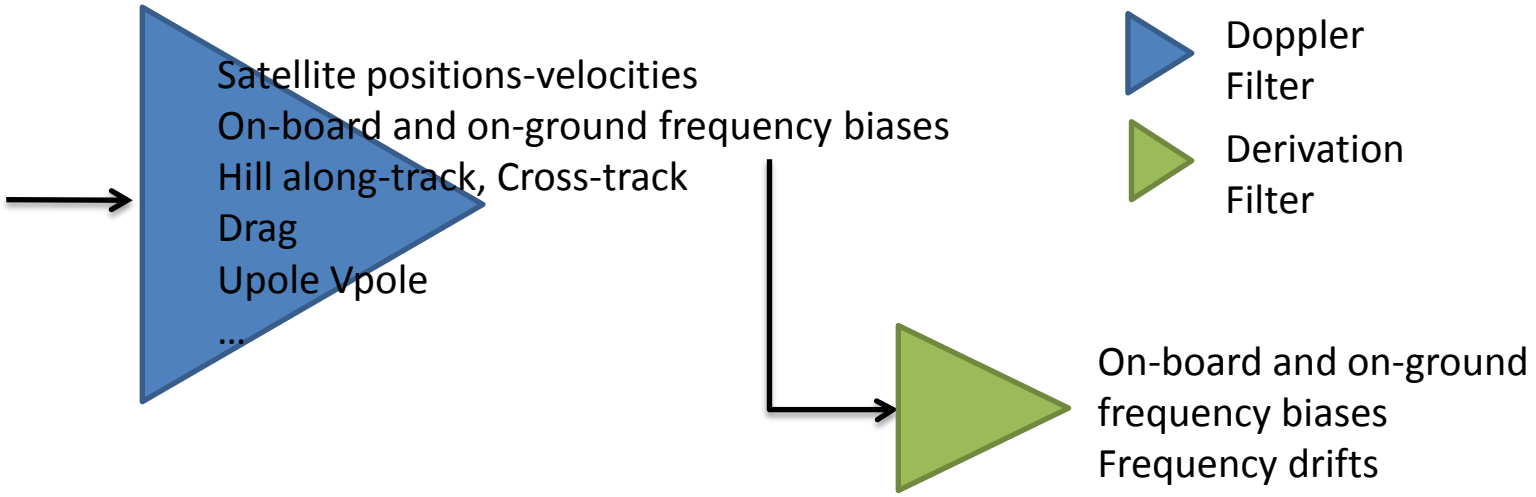




	MINIMUM	MAXIMUM	MEAN	ST DEV	RMS
	**********	*********	**********	*********	*********
POLE_U	-1.874E-03	1.472E-03	-0.151E-03	6.023E-04	0.621E-03
POLE_V	-1.635E-03	1.651E-03	-0.121E-03	4.621E-04	0.477E-03

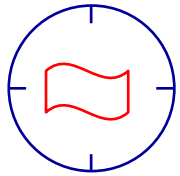
Frequencies and drifts

- DIODE estimation strategy



- Outputs
  - Smoothed on-board and on-ground frequency estimations
  - On-board and on-ground frequency drifts

Frequencies and drifts

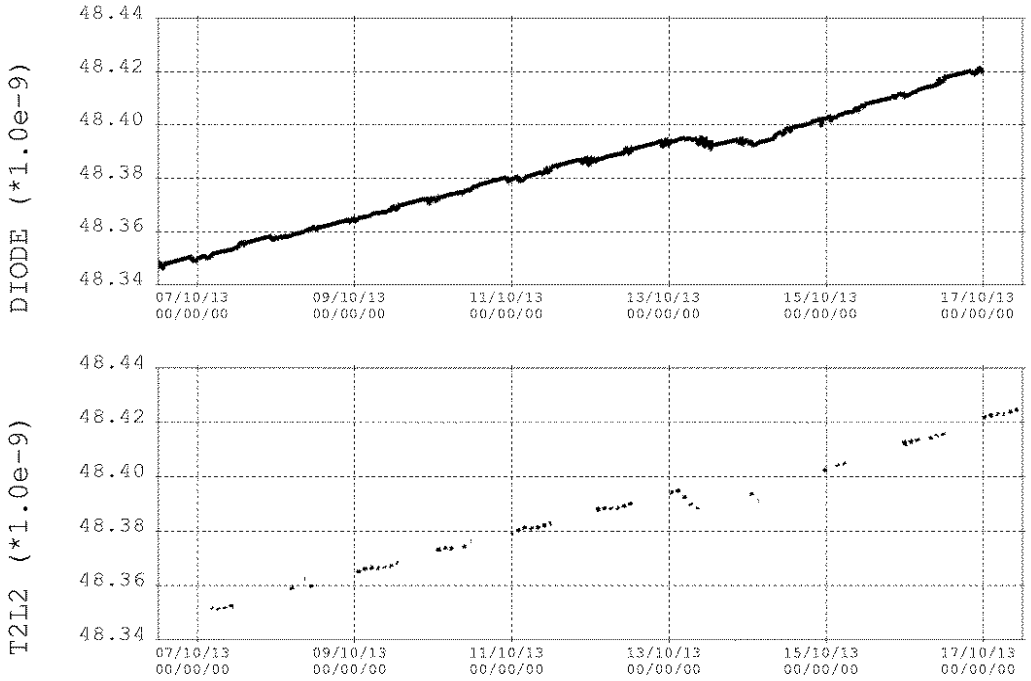


- On-board and on-ground allocations are differentiated thanks to the Time and Frequency Beacons :
  - TF-B are tied to atomic clocks => long-term stability
  - Their USO is in a highly controlled environment => mean-term stability
  - During passes over TF-B, Doppler biases are allocated to on-board USO

- Beacon frequency determination is a part of the DREAM (DORIS REal-time Autonomous Monitoring) function
  - Network survey from space
  - Warnings sent to the integrity team

Smoothed on-board frequency

- Comparison to T2L2 on Jason2



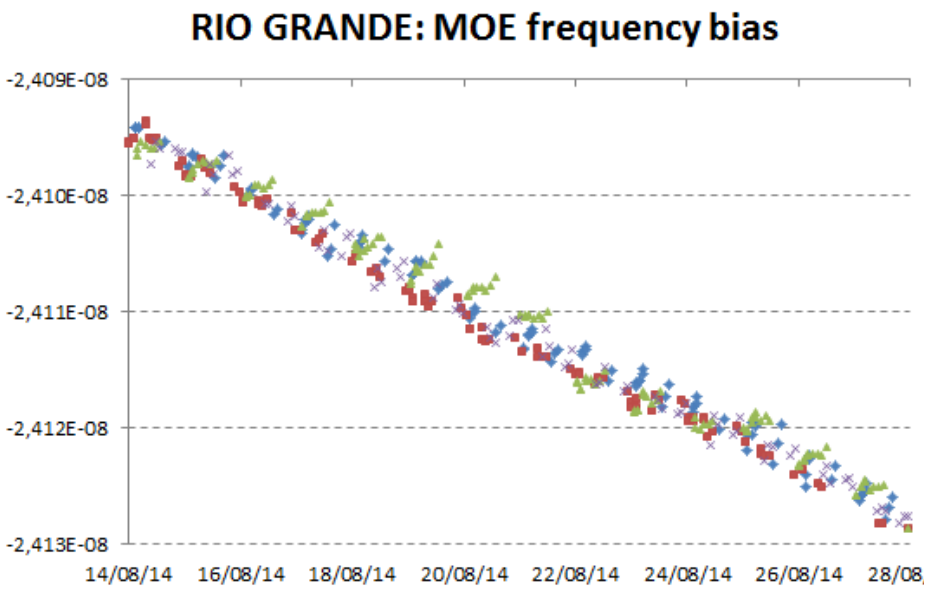
Compliance : 1.2 10^{e-12}

Results presented in next JASR issue

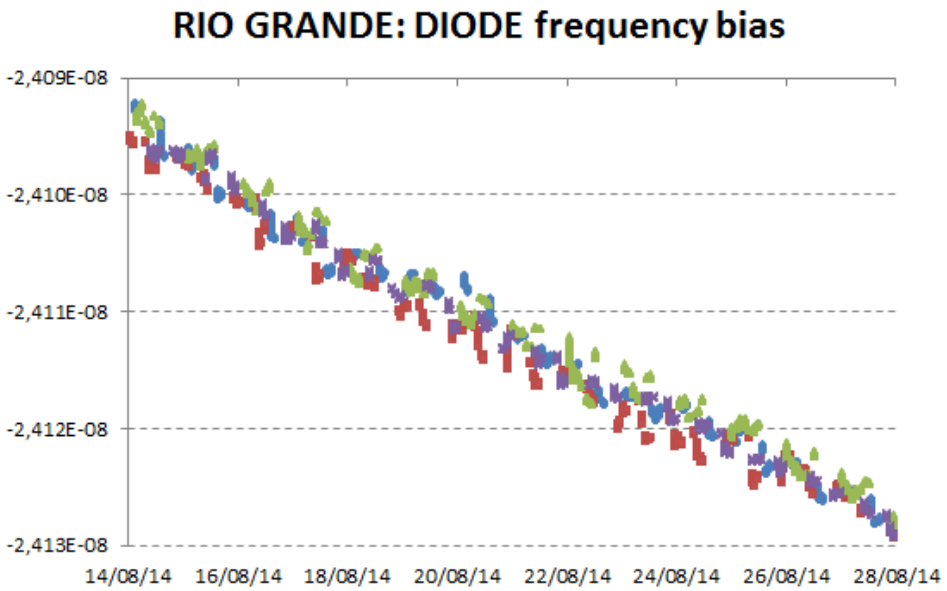
- On-board Sentinel 3: GNSS receiver for direct comparison

Frequencies: inter-satellite comparison

- On-board frequency depend on the satellite
- But same beacon frequencies for all satellites



(One estimate per pass)

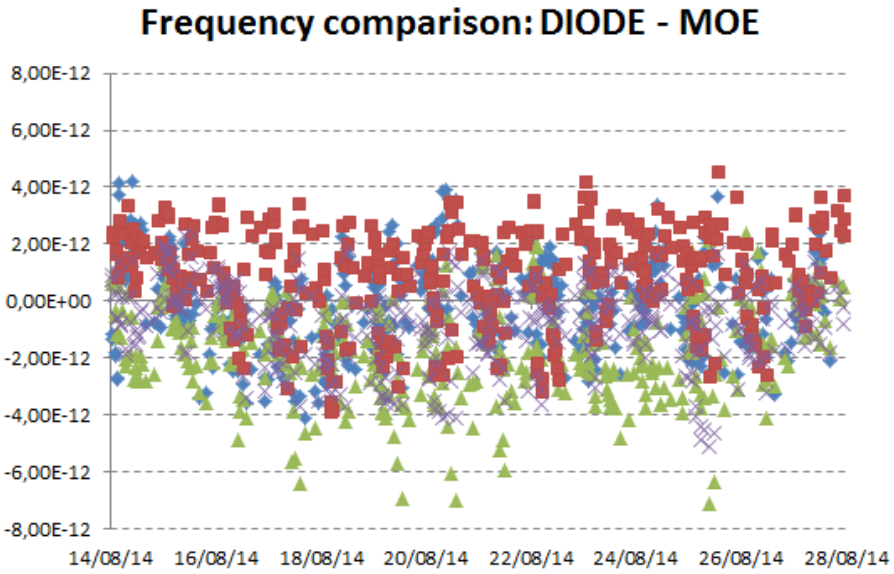


(One estimate per sequence)

- Good consistency at first sight

Frequencies: inter-satellite comparison

- DIODE frequency drift used for extrap. between two passes



	Cryosat2	HY2	Jason2	Saral
Mean	-0,149E-12	-1.477E-12	0.813E-12	-0.754E-12
RMS	1.635E-12	2.264E-12	1.898E-12	1.610E-12

Statistics ($\frac{\delta f}{f}$) on the converged period

- Futur REGINA GNSS receivers for direct comparison

Conclusions

- Poles coordinates :results are promising
  - RMS of mixed solution: ~0.5 mas
  - Need parameters optimization (kalman filtering)
  - Information can be reduced to one point every 3h/6h

- Smoothed frequencies
  - RMS on-board as on-ground: < 2.0 10^{e-12}
  - Further investigation for short/mid-term frequency estimation
  - Useful for integrity survey