



CENTRE NATIONAL D'ÉTUDES SPATIALES



POSEIDON3 DIODE/DEM TRACKING MODE PERFORMANCES

OSTST meeting – Lisboa

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1: CNES - 2: CLS - 3: NOVELTIS

Contents

- **Introduction and Principle**

- **DEM Generation**
 - ◆ **Input DEM Data and surface classification**
 - ◆ **Complementary Database**
 - ◆ **Zones Selection**

- **Results on JASON2 cycle 34. Over:**
 - ◆ **Ocean, coastal area**
 - ◆ **Inland water**

- **Conclusion**

- DIODE/DEM mode is an experimental mode embarked on board Jason2 mission for the first time.
- Was used during commissioning on a few cycles (3+5+7)
- Showed that the method is working well but with some limitations due to the quality of the onboard DEM (which was expected ...)
- A new solution was developed, uploaded and used on cycle 34. This was just a few weeks before Seattle OSTST meeting.

■ The Tracking Function: a matter of data availability

- ◆ To obtain a valid echo, the altimeter must synchronize the reception of the echo with the emission of a replica of the signal with a precision of a few nanoseconds.

◆ Tracking Loop

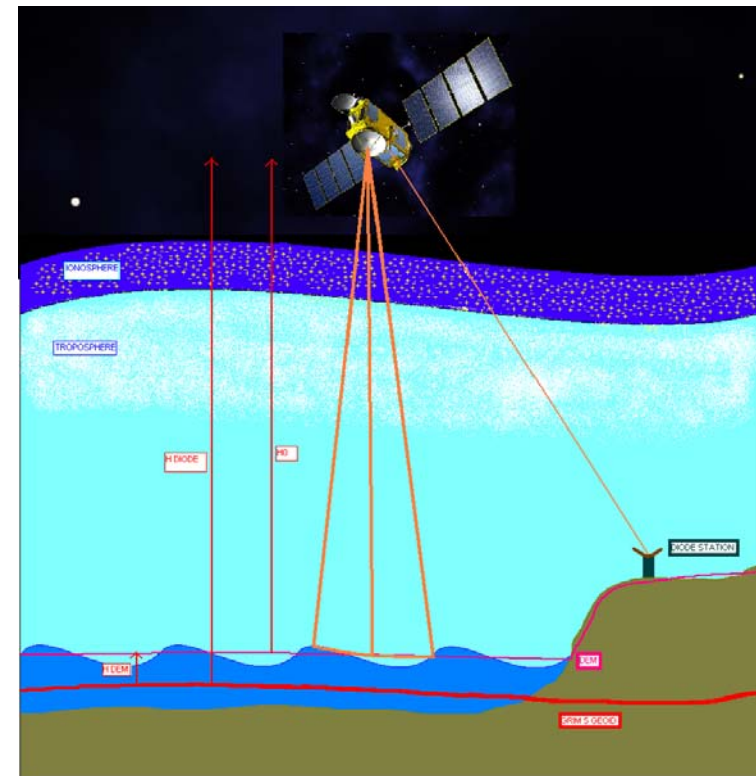
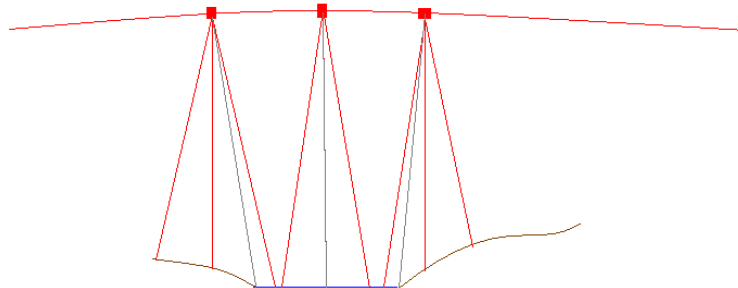
- **Closed Loop** (= autonomous mode): onboard analysis of the echo to predict the instant of reception for the next echo.
 - Used on all past and current flying missions
 - Very good performances over oceans
 - But sensitive to the shape of the echo
 - Need a search phase (no data during this phase) which impacts the data return in some areas
- **Open Loop**: external information to give to the instrument the position of the echo
 - Theoretically, if this information is correct, the altimeter always provides surface data
Corollary: if this information is out of the needed precision range, the altimeter would never provide useful data.

-> Need of accuracy for the echo position information

Onboard navigation software (Diode) provides the position of the satellite on the orbit
 The surface height is then derived by the altimeter based on an onboard DEM (DEM=MNT)

This DEM is not a model of the real surface height (which would require much too large memory space) but a model of the surface height along the track and **“as seen by the altimeter”**

It includes the ionospheric and tropospheric delays.
 The DEM is optimized to track water.



Advantages / Draw backs : Comparison with Autonomous Mode

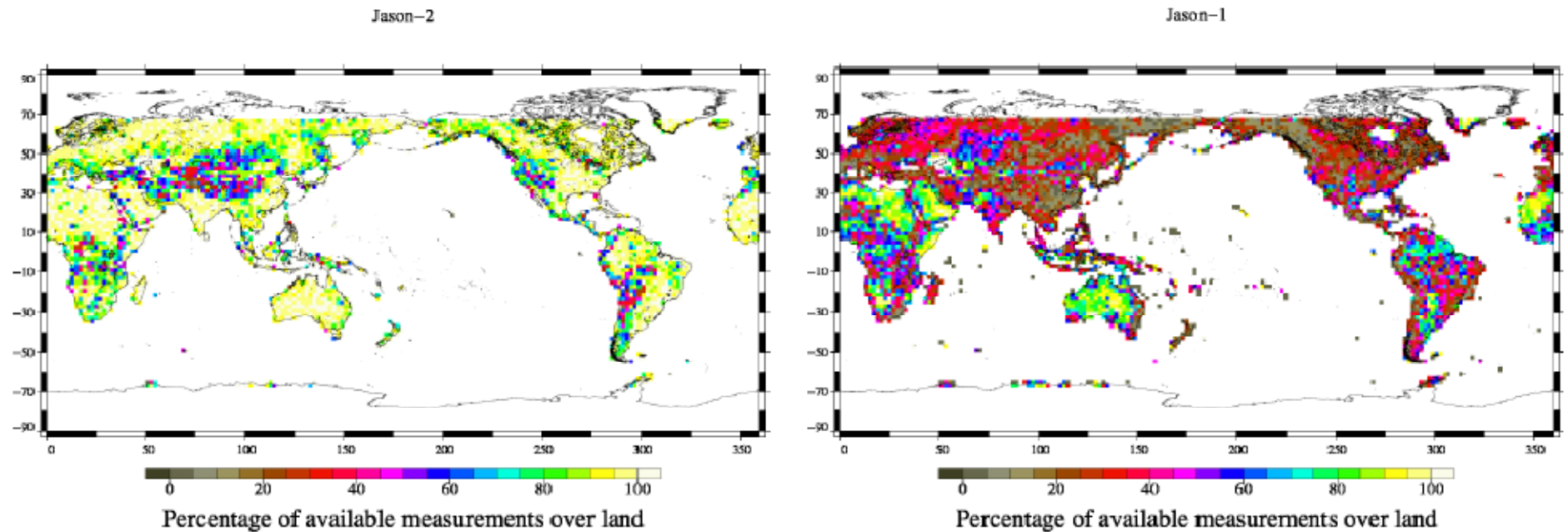


Figure 2: *Map of percentage of available measurements over land for Jason-2 on cycle 43 (left) and for Jason-1 on cycle 282 (right)*

Quality of the DEM ->
direct impact on the data availability

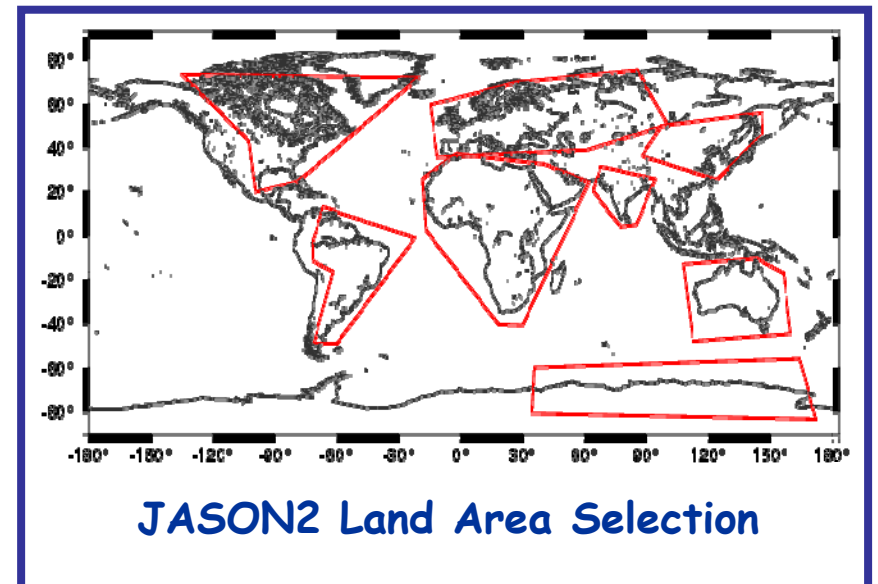
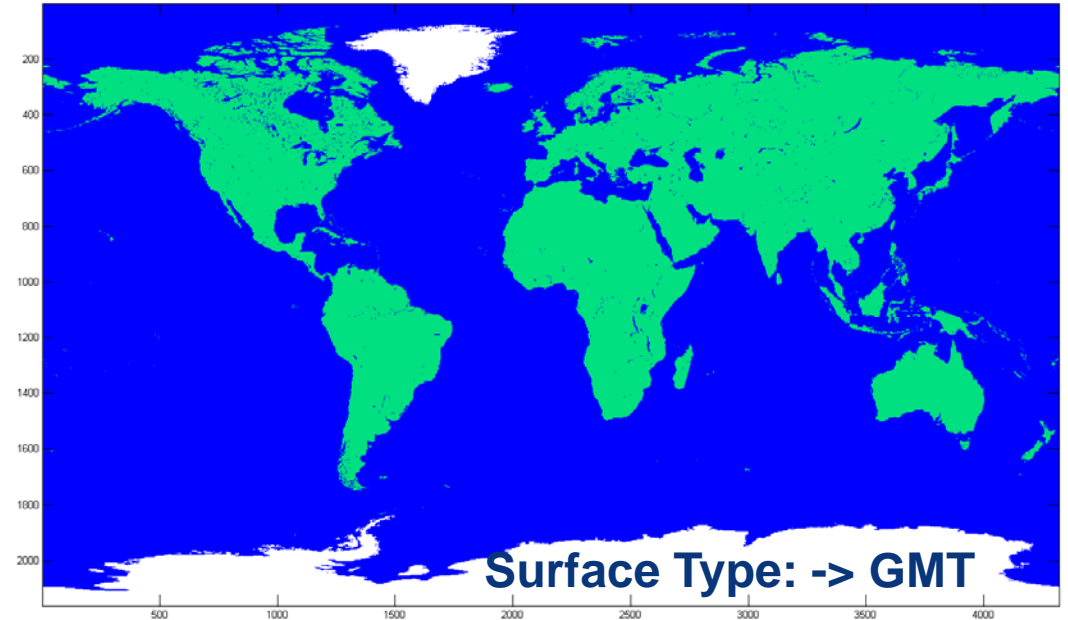
■ **2 types of data**

- ◆ Surface type
- ◆ Surface Height (see next)

■ **Zone selection /**

Hardware limitation :

- ◆ **Priority for the operational mission**
-> **Water Surfaces Measurement**
 - **Water Surfaces: Every Water Point from GMT is coded (Ocean + Inland Water)**
- ◆ **Depending of the remaining place,**
The maximum of land surfaces is coded



- **CNES/ CLS Mean Sea Surface -> Ocean**
- **Bamber DEM -> Ice (Arctic)**
- **RAMP DEM -> Ice (Antartic)**
- **Legos Data Base -> Lakes & River**
- **JASON2 Data from Median -> Lakes (Upgrade: generation of a complementary Data Base)**
- **Ace1 -> Land (+ inland water if not in others DB)**

■ Legos DataBase

- ◆ Very Good Accuracy (checked by Legos Team)
- ◆ Limited size

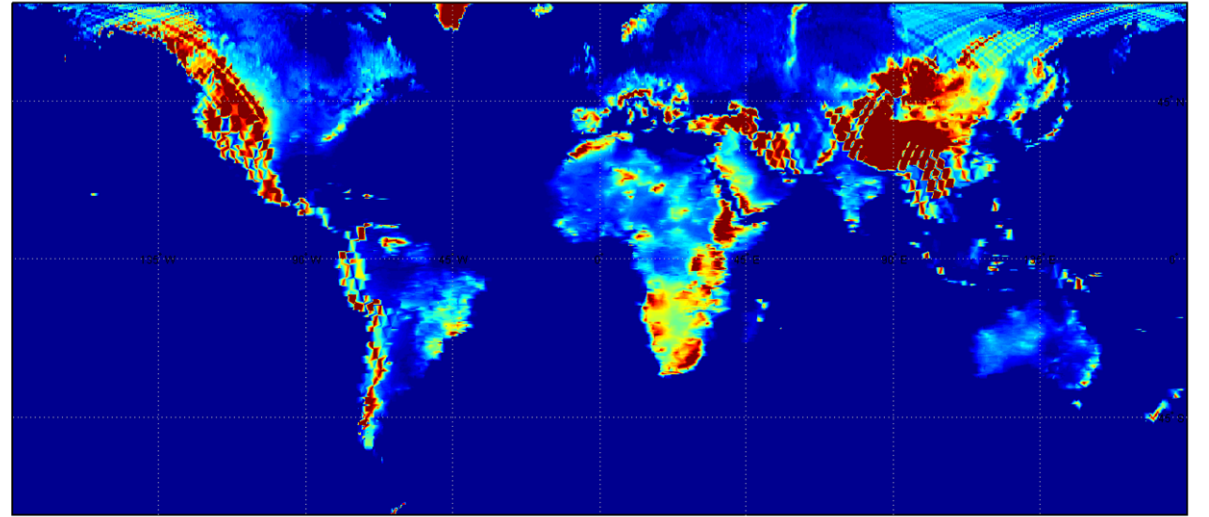
■ -> Generation of a Lakes Database with JASON2 Data

- ◆ Automatic generation (Detection of connexed water points and use POSEIDON Range Median Tracker Data)
- ◆ Objective: DEM Mode as good or better than the Median Mode for lakes

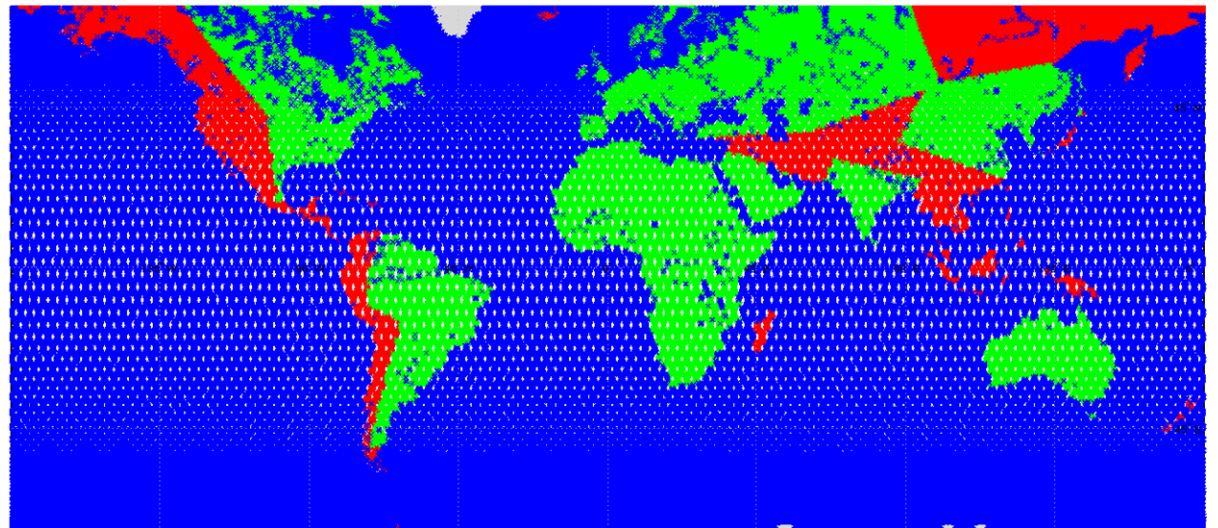
DEM result

Every points declared as water in the surface mask are coded in the DEM even if not in the area selection

On-Board DEM Altitude (m)

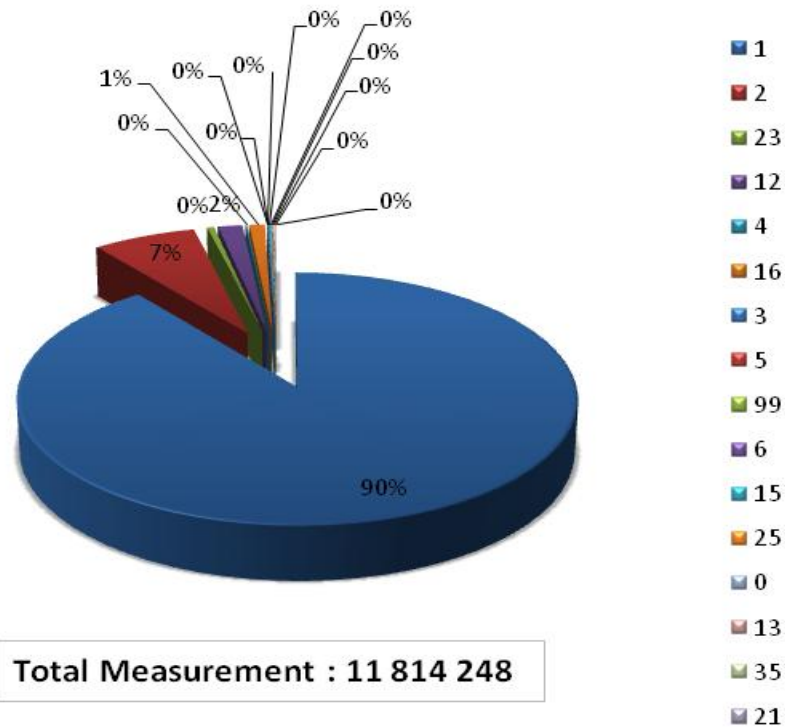


On-Board DEM Included Surfaces

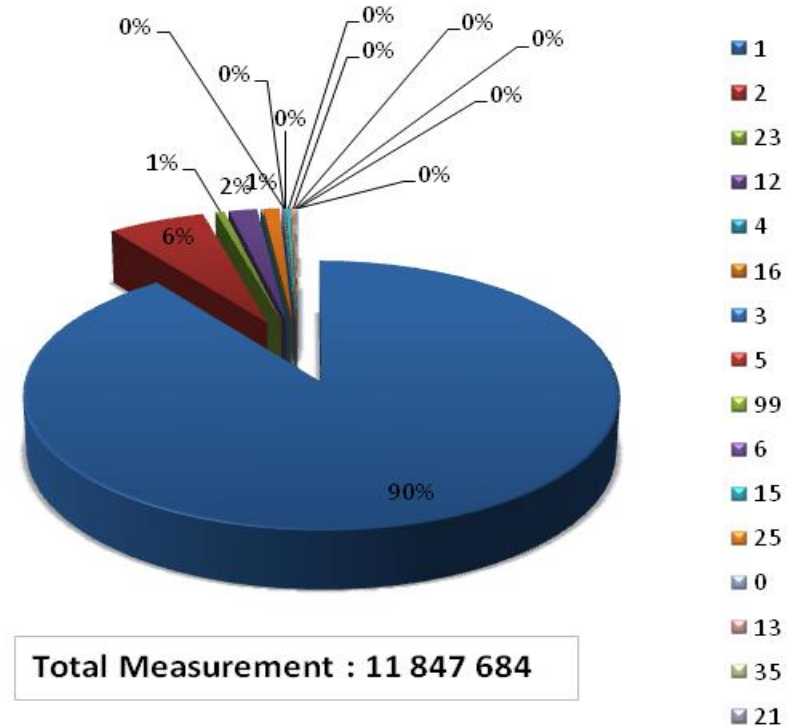


- Excluded Points
- Land Points
- Water Points
- Ice Points

**Waveforms Class Repartition
On Full Ocean Zones
Cycle 35 MEDIAN Tracker Mode**

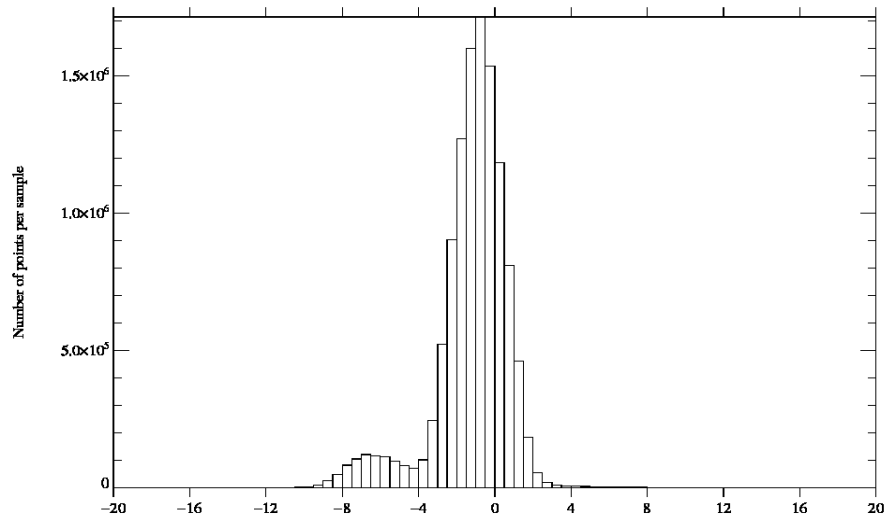
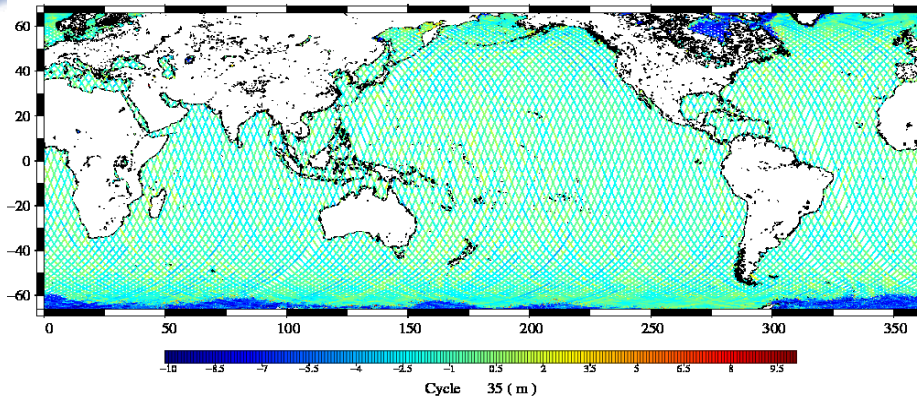


**Waveforms Class Repartition
On Full Ocean Zones
Cycle 34 MNT Tracker Mode**



Over ocean both tracking methods give similar results

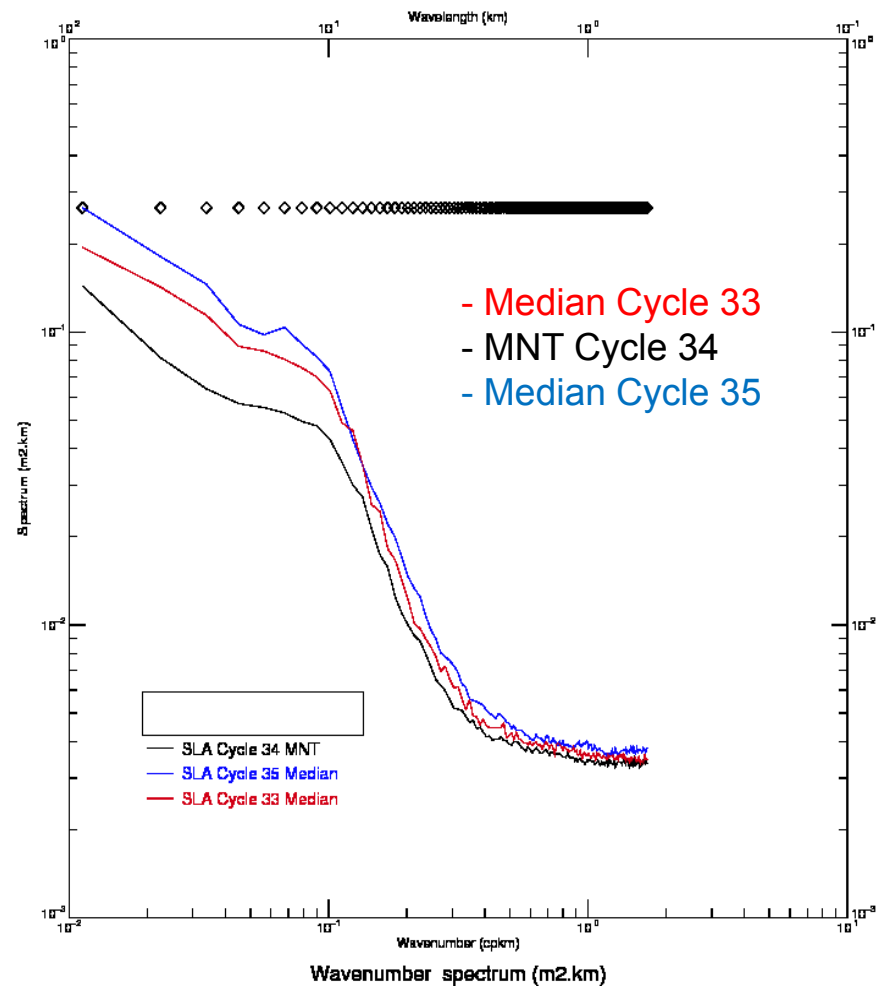
Cycle 35 Ku band



Glob. Nb of pts :	11518764	Sel. Nb of pts :	11518764	Glob. Maximum :	19.969
Glob. Mean :	-1.452	Sel. Mean :	-1.452	Glob. Minimum :	-19.977
Glob. Std :	1.939	Sel. Std :	1.939	Sel. Maximum :	19.969
Glob. Skewness :	-1.192	Sel. Skewness :	-1.192	Sel. Minimum :	-19.977
Glob. Kurtosis :	4.138	Sel. Kurtosis :	4.138	Sample interval :	0.500

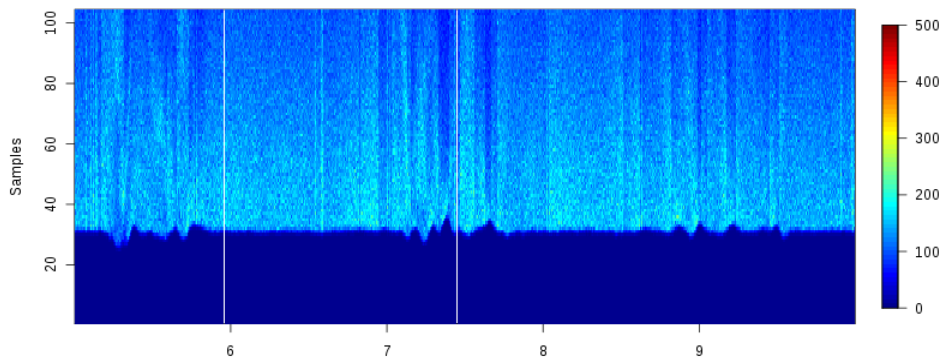
Orbite-Range-MSS spectral analysis

SLA Power Spectrum MNT/Median Tracker, Jason-2 Ku-Band



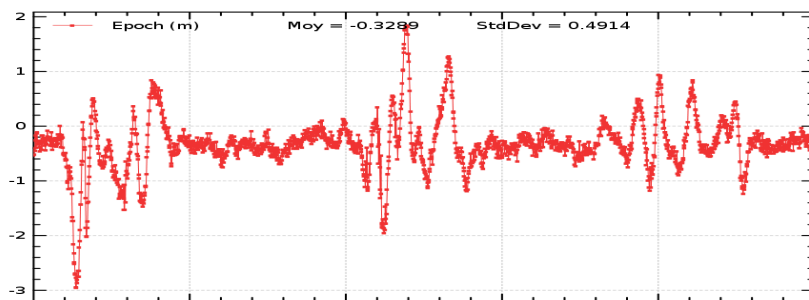
Median Tracker

Waveforms Jason-2, Cycle 35 Pass 137, Median Tracker Mode



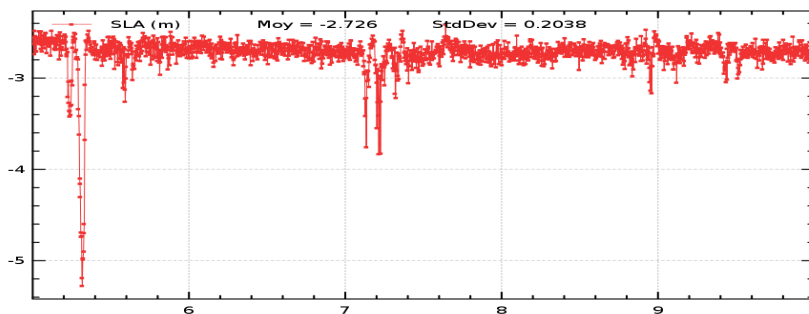
Wvfs

Epoch Jason-2, Cycle 35 Pass 137, MEDIAN Tracker Mode



Epoch

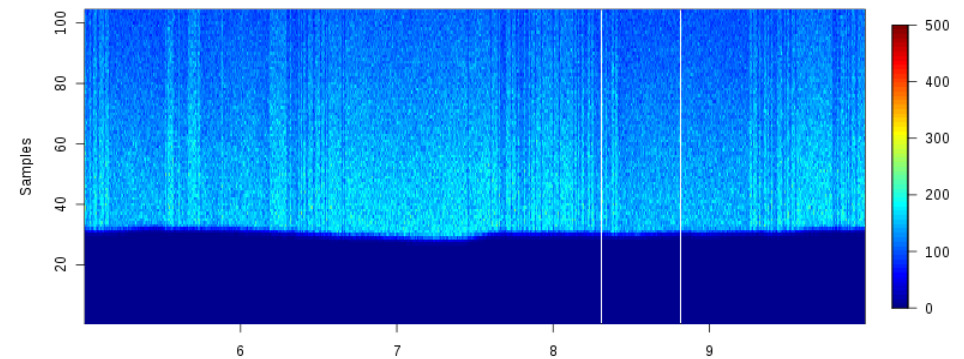
SLA Jason-2, Cycle 35 Pass 137, MEDIAN Tracker Mode



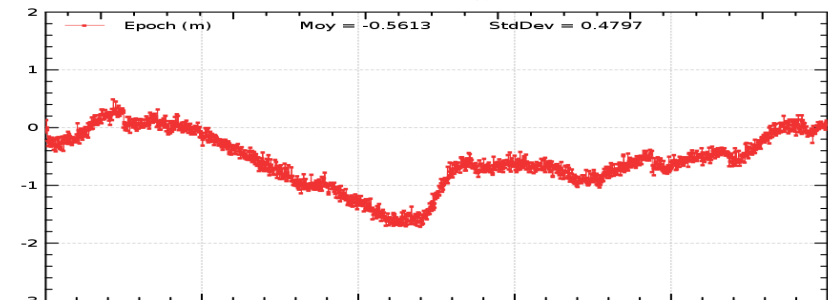
SLA

Diode/MNT Tracker

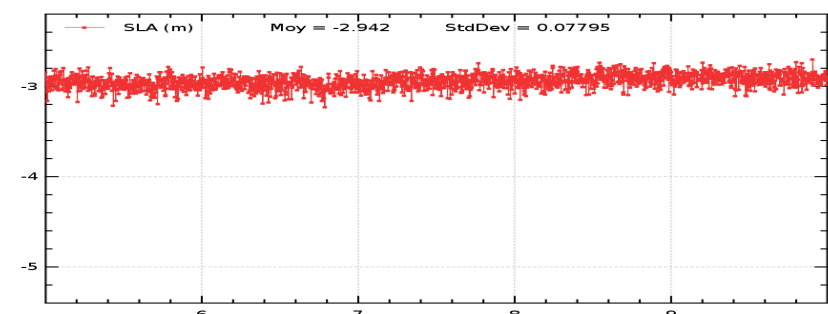
Waveforms Jason-2, Cycle 34 Pass 137, MNT Tracker Mode



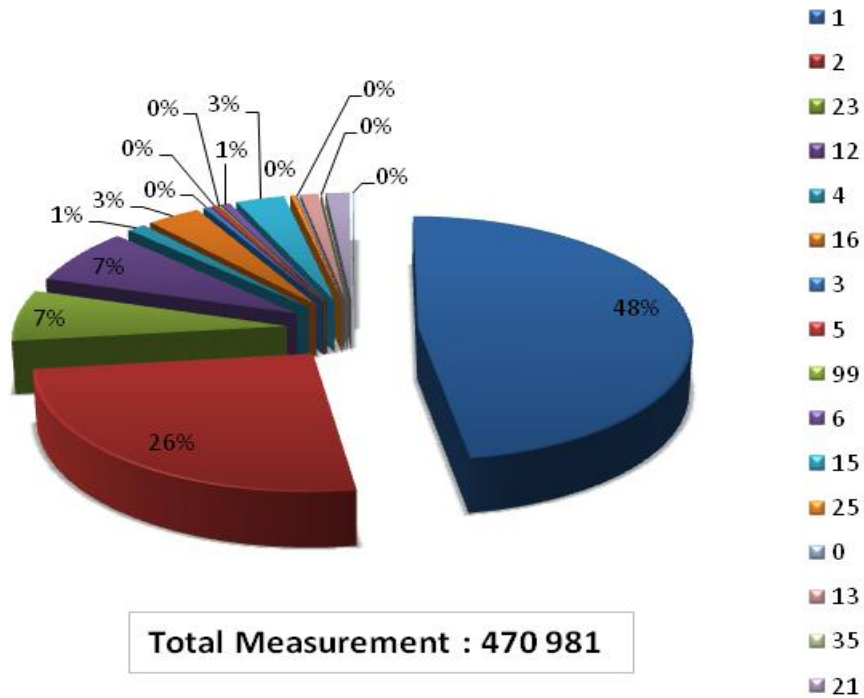
Epoch Jason-2, Cycle 34 Pass 137, MNT Tracker Mode



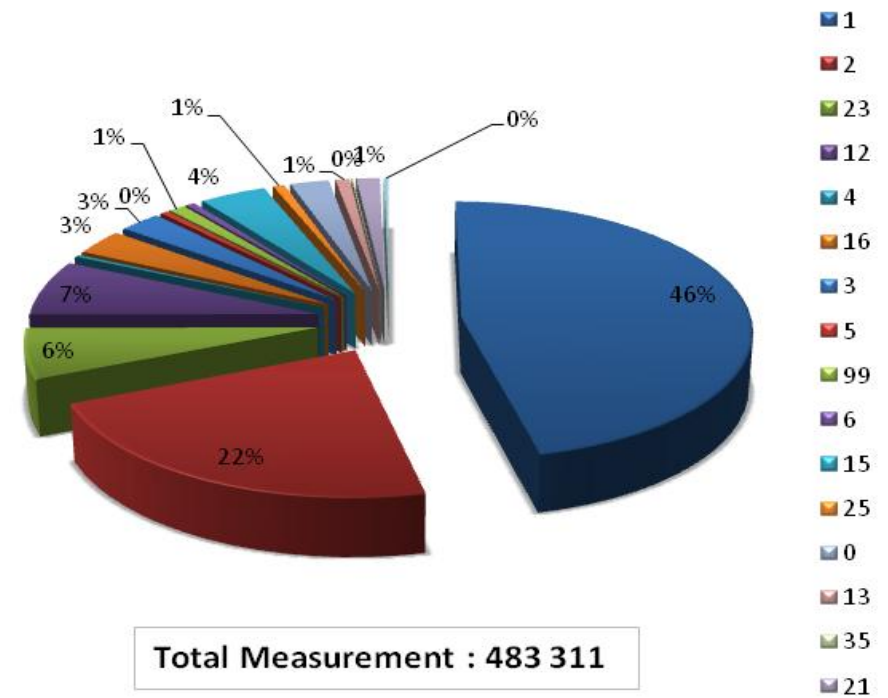
SLA Jason-2, Cycle 34 Pass 137, MNT Tracker Mode



**Waveforms Class Repartition
On Coastal and Hydrological Zones
Cycle 35 MEDIAN Tracker Mode**



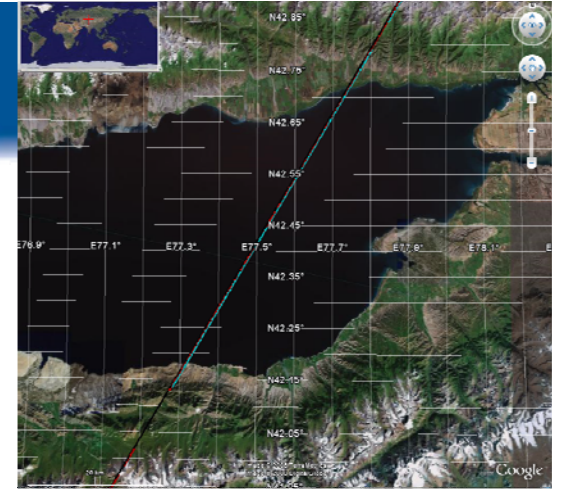
**Waveforms Class Repartition
On Coastal and Hydrological Zones
Cycle 34 MNT Tracker Mode**



3 % more measurements in Diode/MNT mode



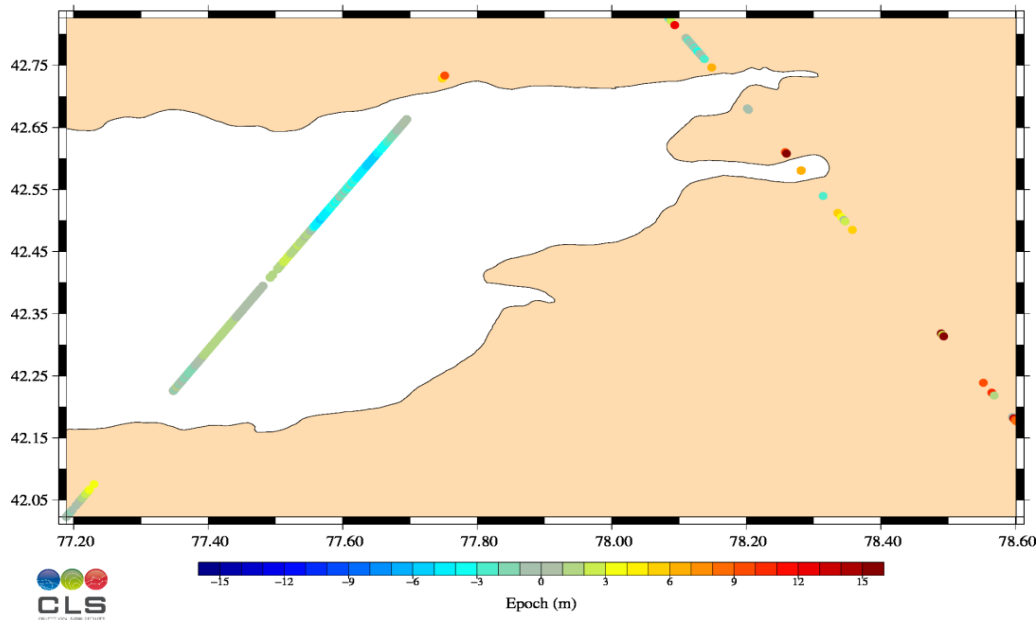
Some examples for inland water Yssyk Koul



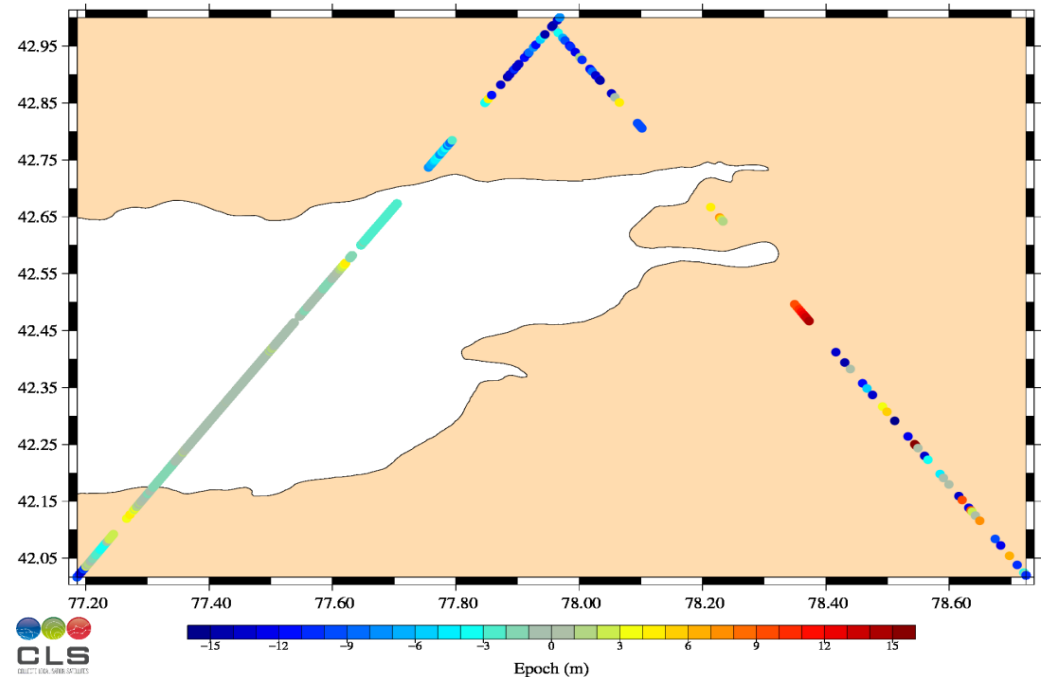
Cycle 35 MEDIAN

Cycle 34 MNT

Cartography of Jason-2 Epoch on Yssyk Koul Lake, Cycle 35, MEDIAN Tracker Mode

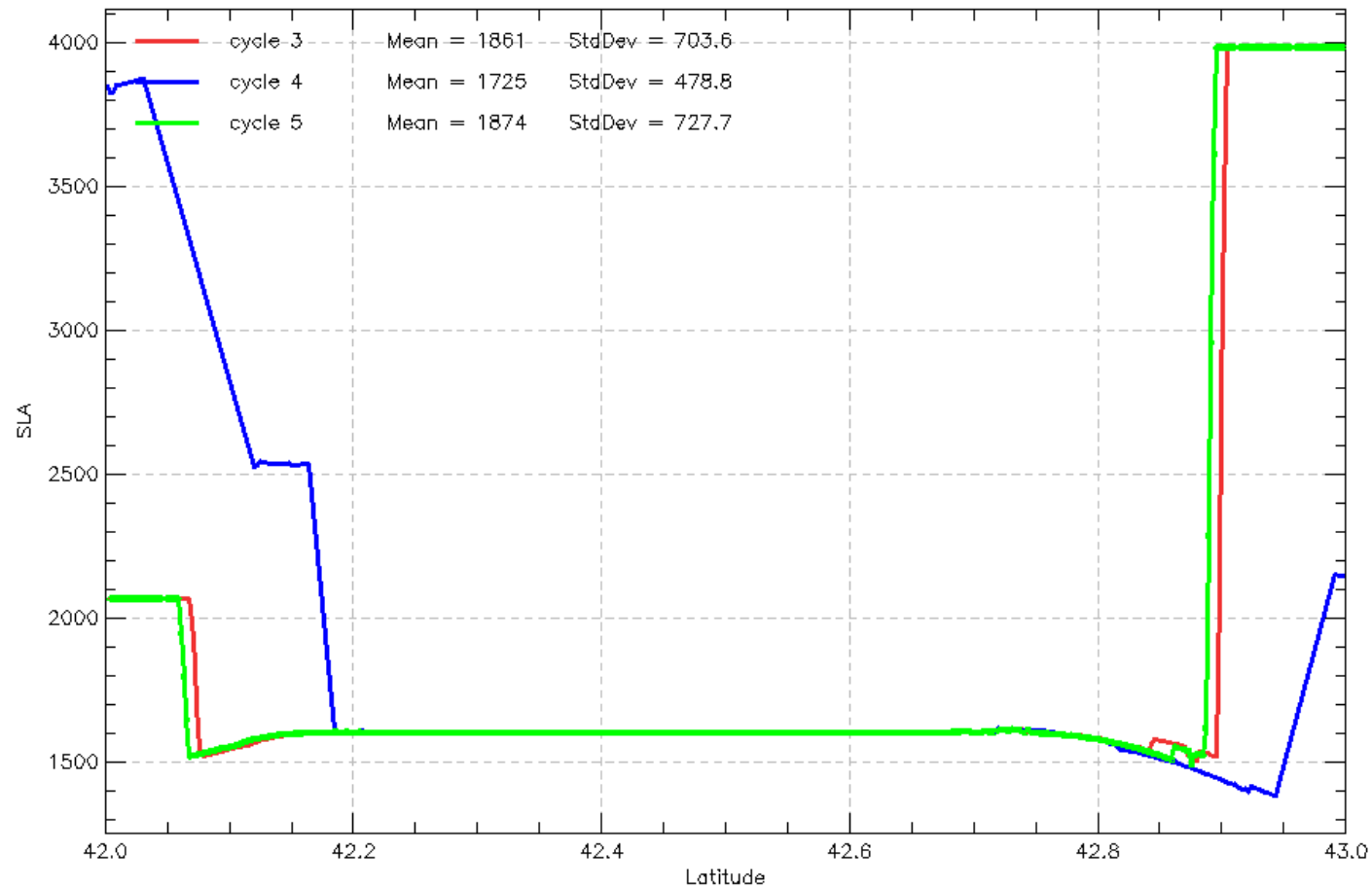


Cartography of Jason-2 Epoch on Yssyk Koul Lake, Cycle 34, MNT Tracker Mode



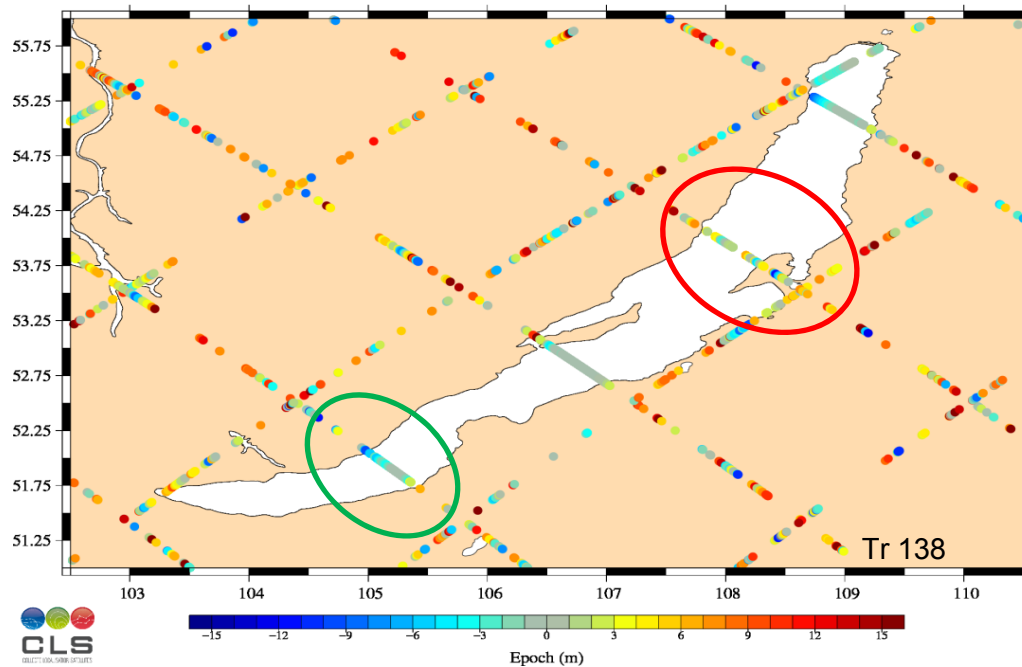
MNT mode give a better coverage of the lake

SLA lac (tropo rad) 20Hz



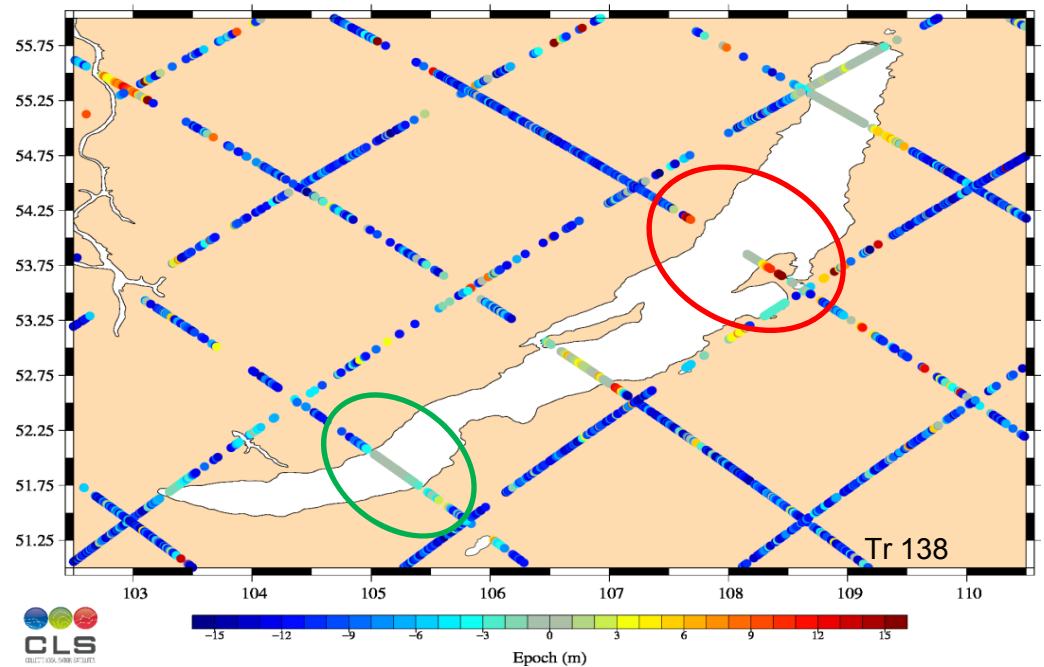
Cycle 35 MEDIAN

Cartography of Jason-2 Epoch on Baikal Lake, Cycle 35, MEDIAN Tracker Mode



Cycle 34 MNT

Cartography of Jason-2 Epoch on Baikal Lake, Cycle 34, MNT Tracker Mode



Improvement for some ground tracks but missing information on other passes

- DIODE DEM mode was modify early Sept. 2010 to include the attitude of the Gavdos tranponder. This allow to test a new mode : we use the DIODE/MNT mode over a dedicated target (requiring ground commanding).

Transponder Signal

