CENTRE NATIONAL D'ÉTUDES SPATIALES

POSEIDON3
DEM/Diode Coupling Mode

OSTST meeting – Seattle

June 2009

Jean-Damien DESJONQUERES (CNES)

OSTM JASON-2

Contents

- Basics
- Comparison with Autonomous Mode
- DEM Generation
  - Data
  - Complementary Database
  - Data Processing
  - Zones Selection
- Update Strategy
- Preliminary Results
- Conclusion

Basics 1

- **To obtain in the TM an 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.
      - Very good performances over oceans
      - Sensitive to the shape of the echo
      - Need a search phase (no Data during this phase)
    - 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

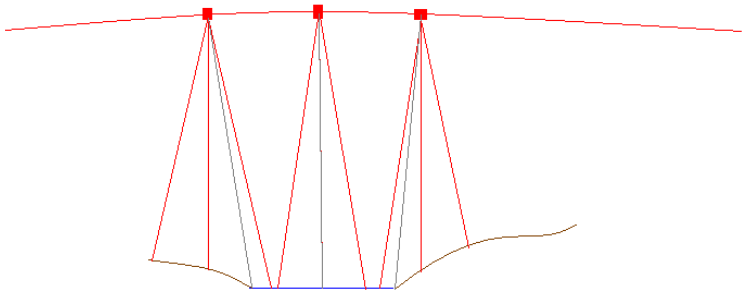
        Corollary: if this information is out of the needed precision range, the altimeter would never provide useful data.

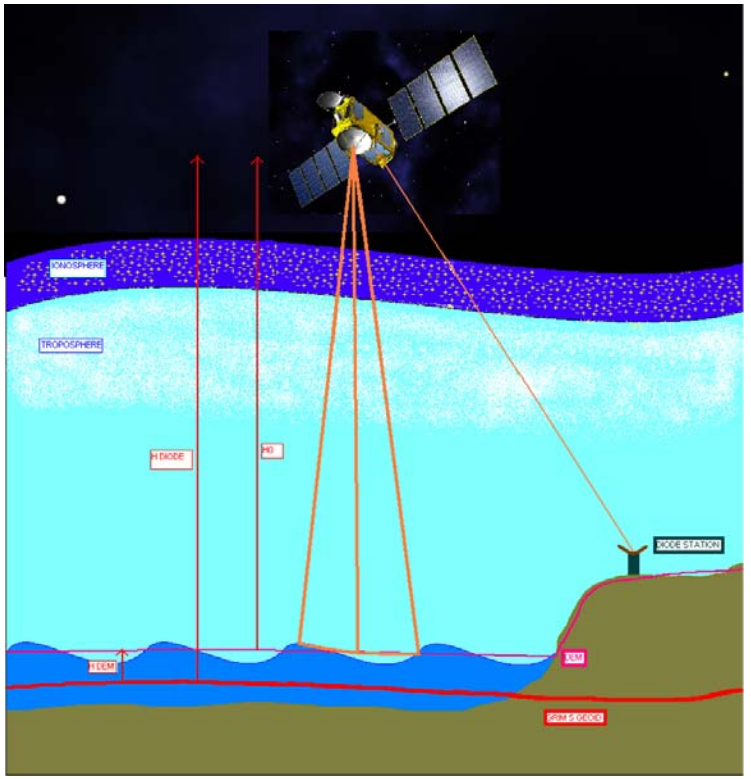
        -> Need of accuracy for the echo position information

Basics 2

Diode provides the position of the satellite on the orbit
The surface height is given by the pseudo DEM (DEM=MNT) stored in POS3

This pseudo DEM is not a model of the real surface height but a model of the surface height “as seen by the altimeter”
It includes the ionospheric and tropospheric delays.
The DEM is optimized to track water.





Comparison with Autonomous Mode

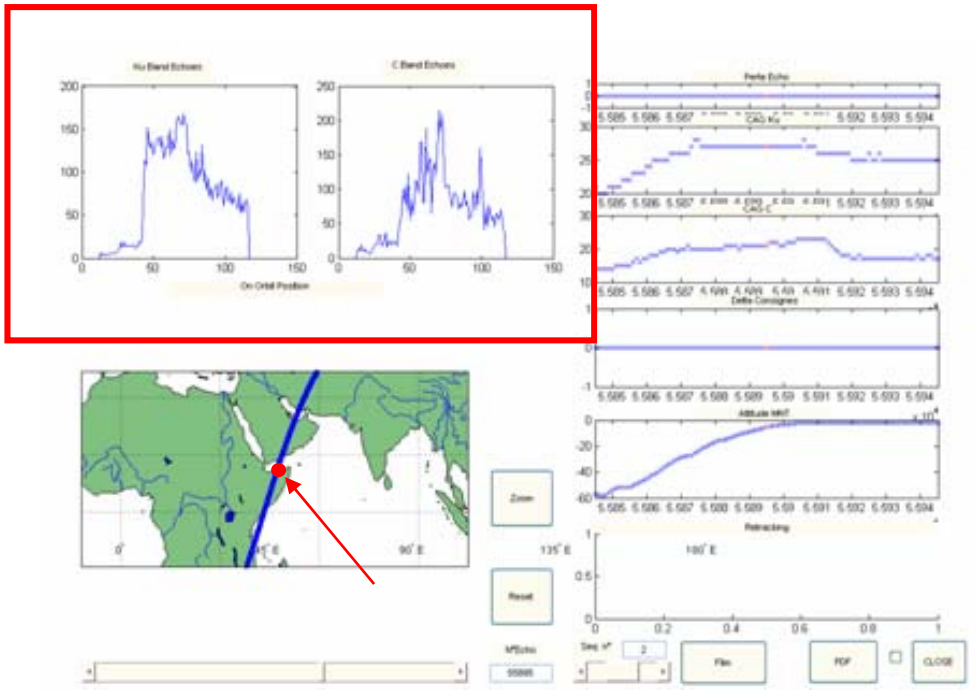
Median Tracker

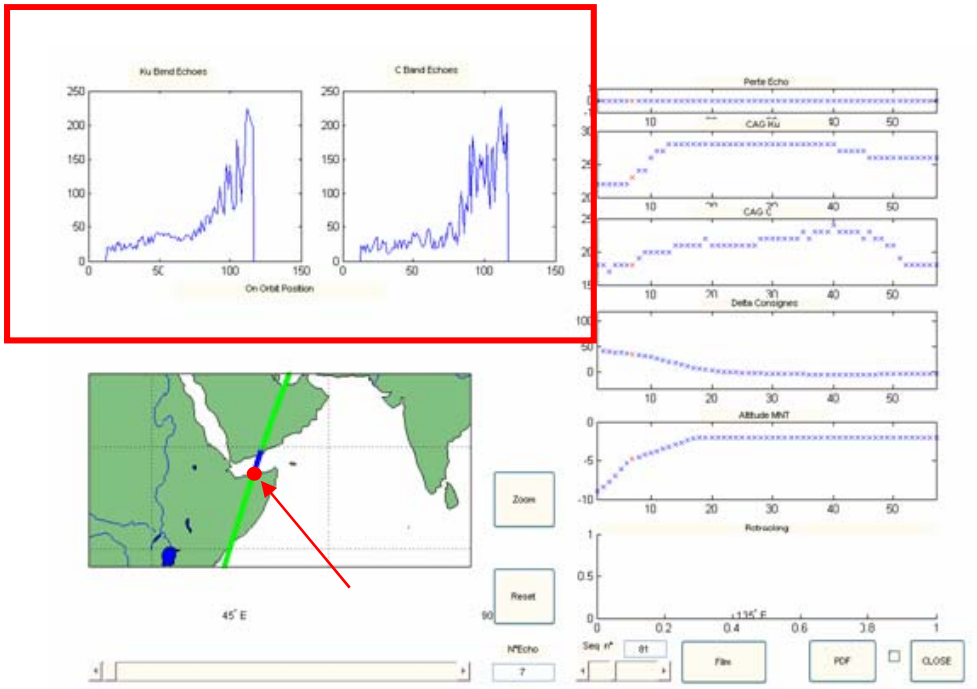
- Tracks echoes over most surfaces
- No priority
  - Land surface tracking instead of water surface
- Sensitive to echo shape
  - Loss of tracking
- Search Phase is needed
  - 0.5s

Diode/DEM Mode

- If a point is not included or false in the DEM, the echo can not be received in TM
- Water Surface can be prioritized even over land surfaces
- Altimeter always in tracking mode (+ for coastal area and small Inland Water)

Comparison with Autonomous Mode





Diode/DEM **Médian**

Coastal Zone Illustration

OSTM/JASON-2

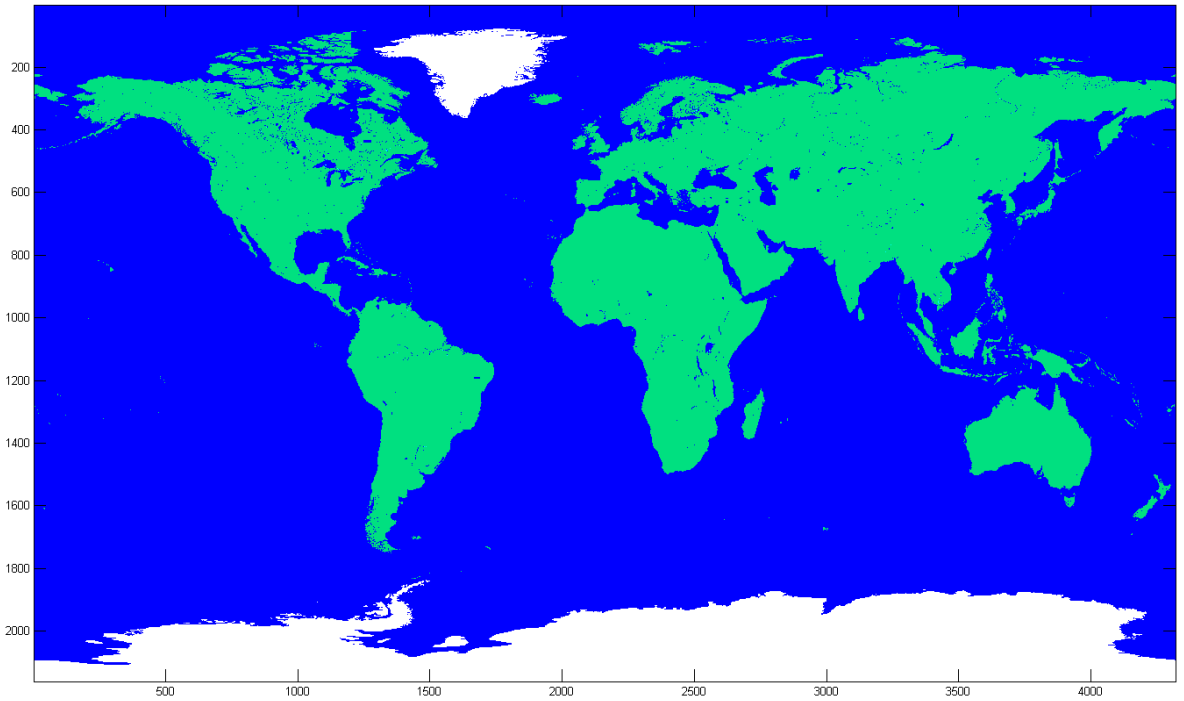
DEM Generation

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

- **2 types of data**
  - **Surface type**
  - **Surface Height**
- **Data Processing**
- **Zone selection / Hardware limitation**
- **Update strategies**

Data 1/2

- **Surface Type: -> GMT**
  - Give the surface type (Ocean / Lake / Land…)
  - Modified to include 8 missing Lakes



Data 2/2

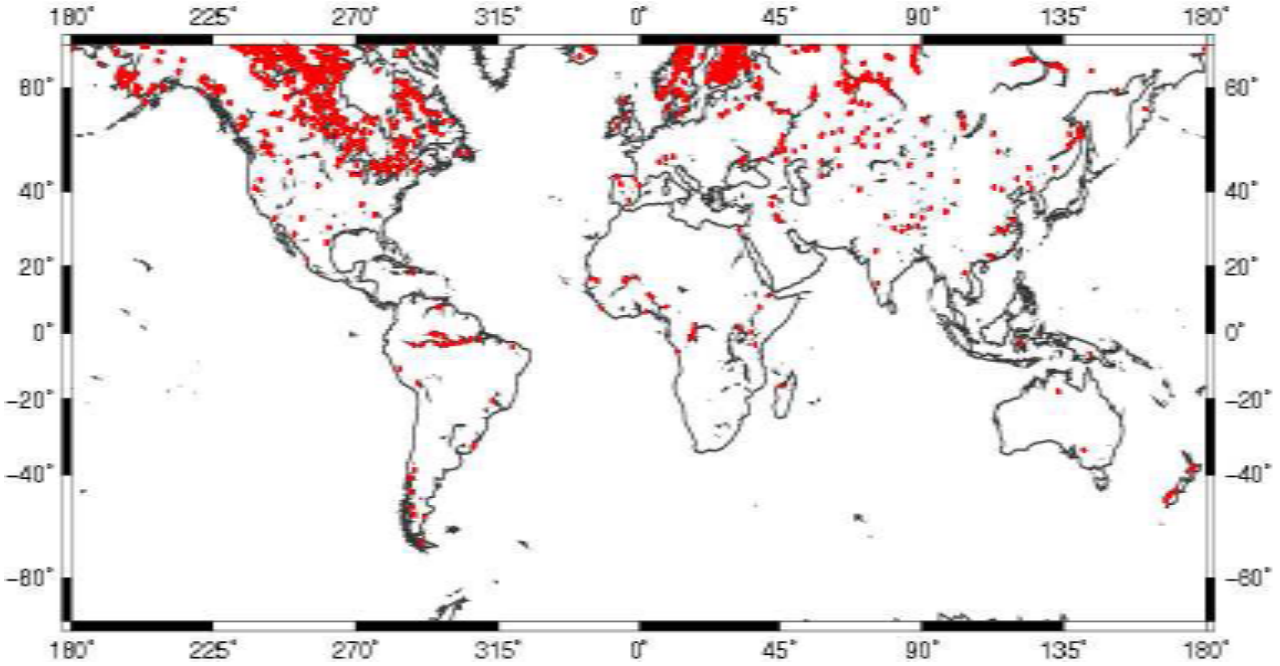
- CNES/ CLS Mean Sea Surface -> Ocean
- Bamber DEM -> Ice (Artic)
- RAMP DEM -> Ice (Antartic)
- Legos Data Base -> Lakes & River
- JASON2 Data from Median -> Lakes (Upgrade: generation of a complementary Data Base)
- Ace1 -> Land (+ inland water if not in others DB)

Complementary Database

- 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

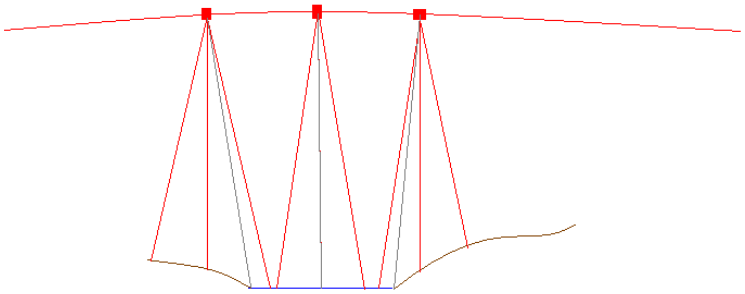
Complementary Database



Modified Points (courtesy Noveltis)

Data Processing

- **Merging of Height Data**
  - **Replacement of the height altitude depending of the data type**
    - For Lakes
      - If included in Legos Data Base -> BD Height
      - Else If included in complementary Data Base -> Use Jason2 Height
      - Else Use Ace1 Height



- **Sampling of the DEM along the orbite**
  - **Water surface extension**
  - **Priorities**
    - Ocean
    - Ice
    - Lake + River
    - Optimization (extension of water segment)
    - Land

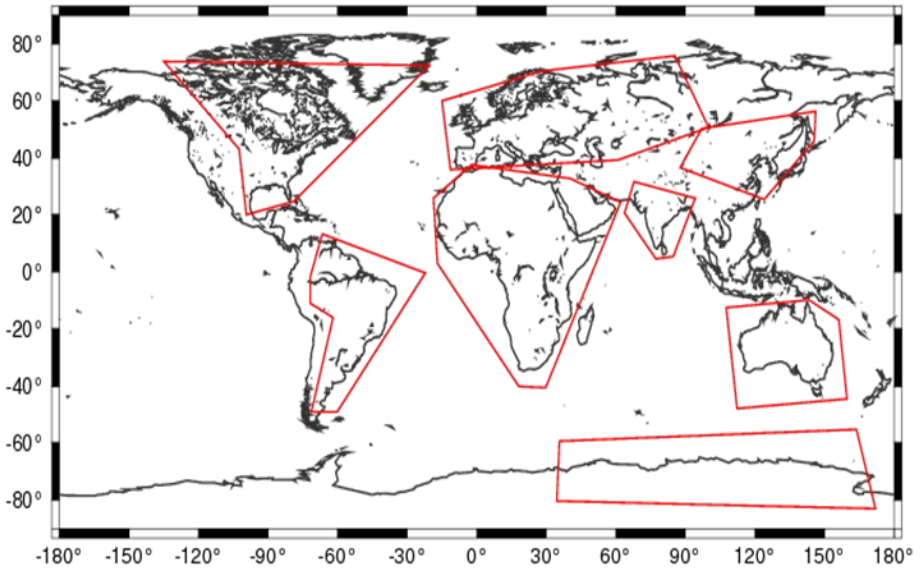
Zones Selection

- **Hardware Limitation -> not possible to have a complete DEM**

  - **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**

Current Land Selection



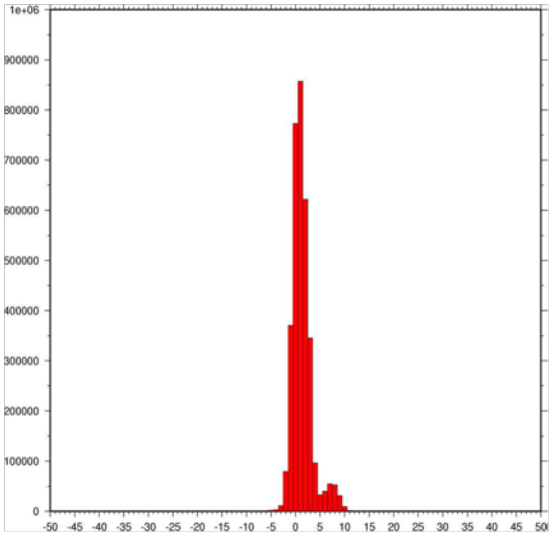
Update Strategy

- **Full Upload**
  - For major changes, change of land selection….
  - Takes long times (~ 3h45 over ground station visibility area, 3 days of operation)

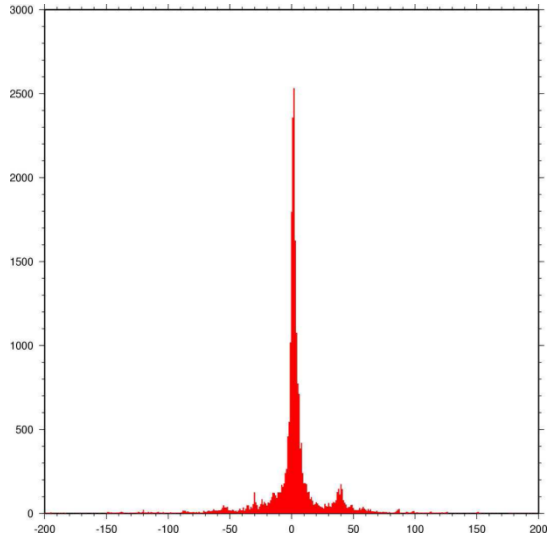
- **Partial Upload**
  - To upgrade River & Lakes Height (Seasonal Variations)
  - Shorter Time. Depending of Number of Modified Lakes

Preliminary Results 1/2

Difference between Median and DEM Tracker Range (courtesy CLS)

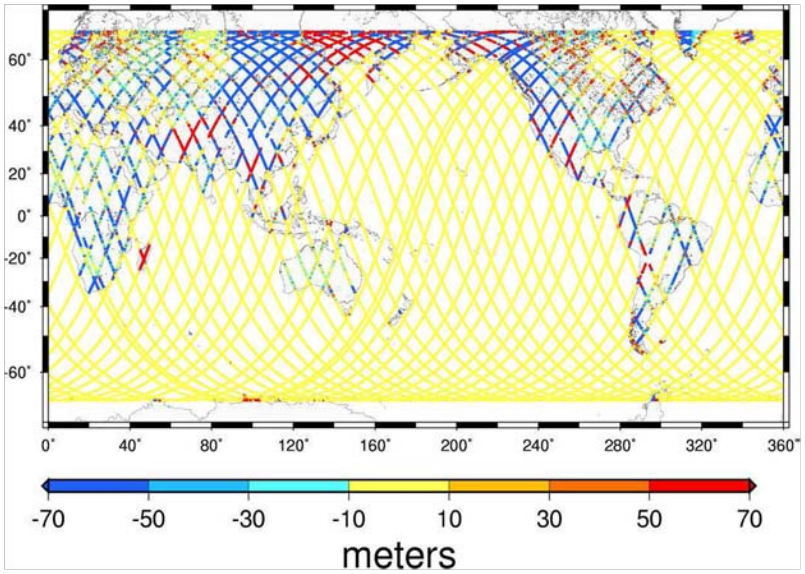


Ocean
Histogram



Lakes + Ponds

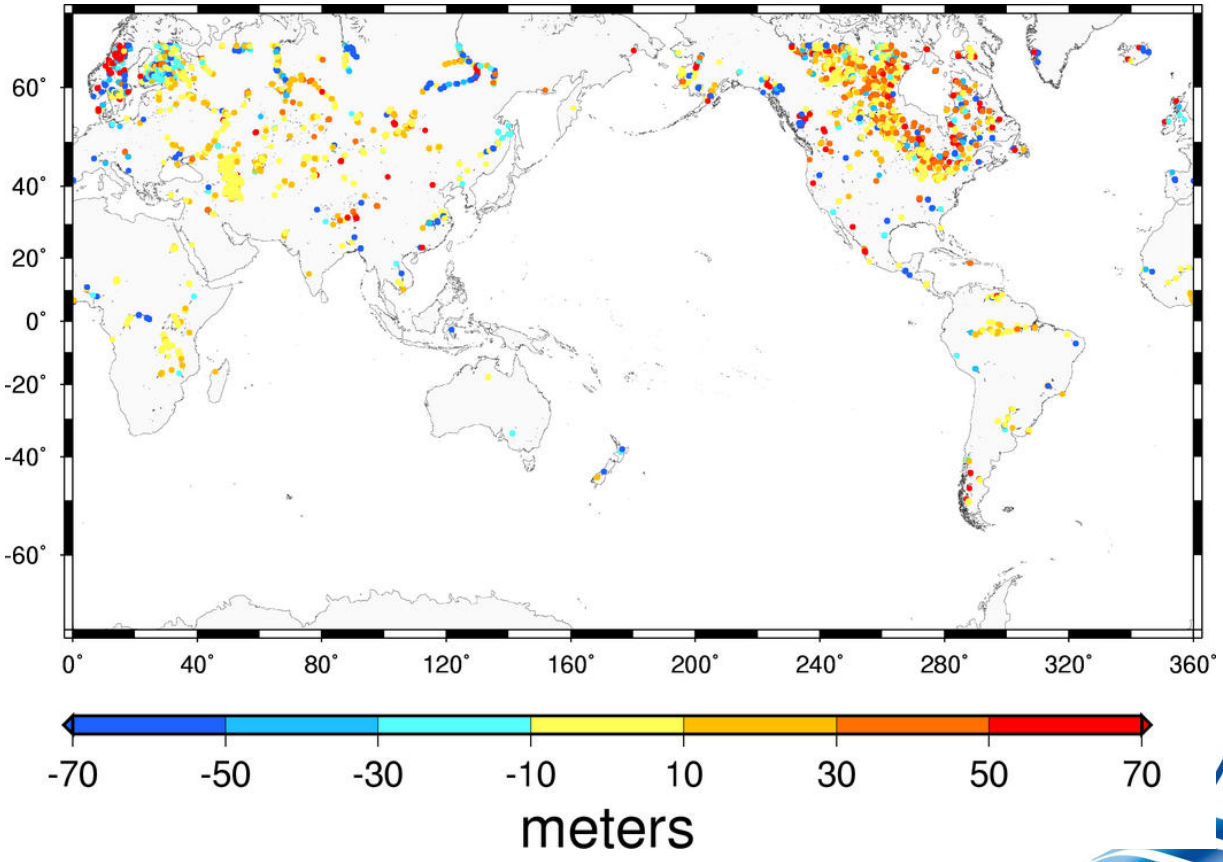
Histogram



OSTM/JASON-2

Preliminary Results 2/2

Results for Lakes and Rivers



Conclusion

- DEM Limitation concerns mainly Land Surfaces
- A new DEM has been uploaded to optimize the data availability on Inland Water and the altimeter has been configured in Diode/DEM Mode during the cycle 34
- Evaluation of the New DEM is in progress
  - Comparison between Applied and Computed Range Command
  - Processing of the Cycle 34 (Diode/DEM Mode)
- This Mode will be implemented on others missions (SARAL,S3,Jason3…)
- The use of alternative data (Type Surface Data + DEM Data) is studying.
- Decisions
  - Choice of the operational mode
  - The Land Selection can be discussed (but hardware limitation still exists!)

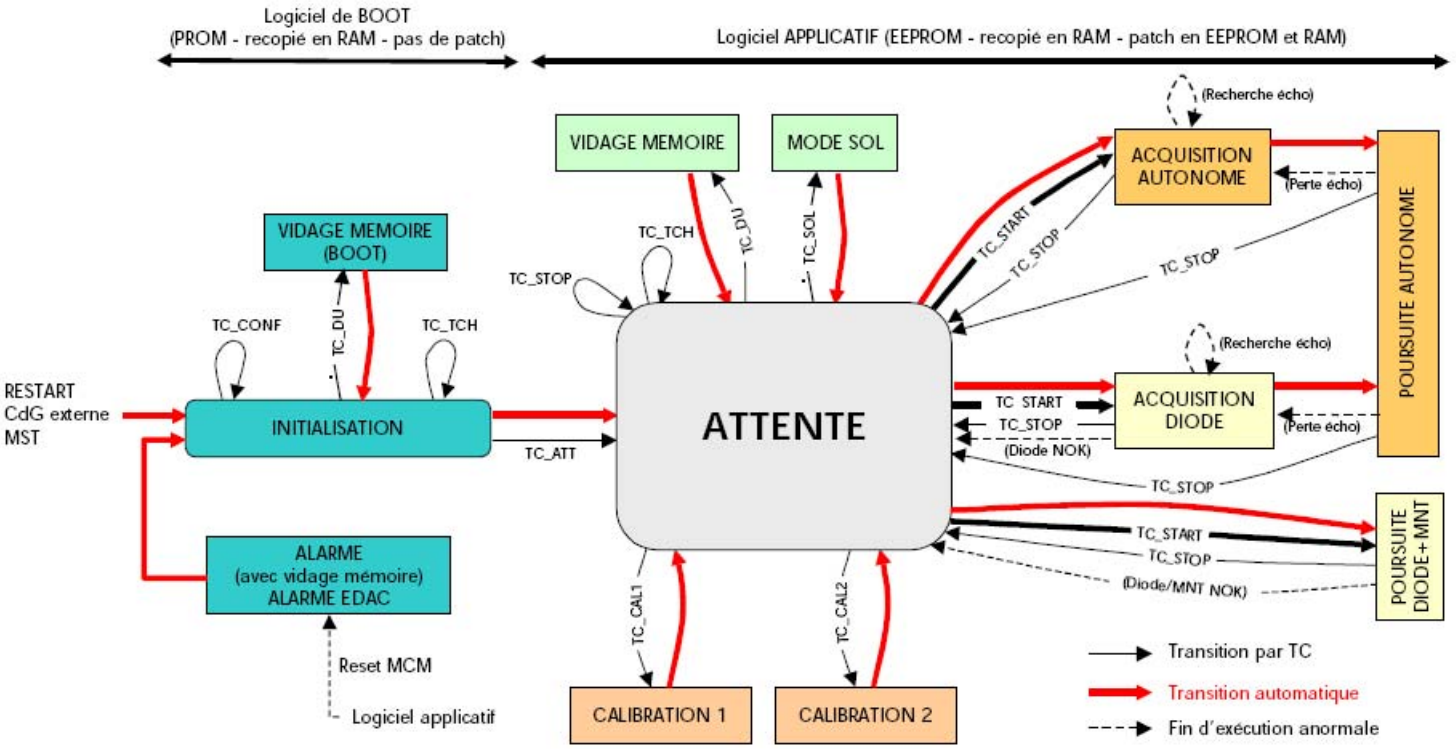
Back Up SLIDES

Data Processing

Compression

- **Points are gathered in segments**
- **Absolute coding: 1 altitude for a segment**
  - Water surfaces + no interest Area
- **Incremental coding: first altitude + Altitude increment between consecutives points**
  - Ice, Land + optimization

POSEIDON3 Modes



Diode/MNT coupling Mode

- This mode is the much more innovative mode.
- There is no more acquisition phase
- The tracking loop is an open loop using a pseudo Digital Elevation Model
  - ->NOT SENSITIVE TO THE ECHO SHAPE AND LAND BACKSCATTER CONTAMINATION