WP 2

Processing SRAL SAR mode waveforms over land (lead UNEW)

The objective of this workpackage was to develop processing scheme for:
- Extracting high-resolution river and lake heights,
- Extraction of soil moisture,
- Extraction of snow depth.

Task 2.1 State of the Art

Task 2.2 Scientific Requirements Consolidation [DHI]

Task 2.3 Selection of test areas [Starlab]

Task 2.4 Develop processing for River and Lake Levels [DTU/UNEW]

Task 2.5 Develop processing for Soil Moisture [UNEW]

Task 2.6 Develop processing for Snow Depths [Starlab]

WP 2 Deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D2.1	State of the art review of SAR mode data over land	1	3.00	R	PU	2
D2.2	Scientific requirements for SAR mode	5	5.00	R	PU	4
D2.3	Theoretical Basis Document for river and lake levels algorithms	6	10.00	R	PU	12
D2.4	Theoretical Basis Document for soil moisture	6	8.00	R	PU	12
D2.5	Theoretical Basis Document snow depth	2	3.00	R	PU	12
D2.6	Snow depth determination with SRAL	2	1.00	R	PU	12

Task 2.4 Develop processing for River and Lake Levels [UNEW/DTU]

This activity will depend on the results of Task 2.1 and Task2.2, as well as on previous work done by the consortium in ESA funded predecessor projects. The activities envisioned by this task include:

- Enhance existing global masks for river and lake locations, to allow retrieval of inland water heights utilising the SAR FBR capability of Sentinel-3

- Augment the existing BES (Berry Expert System) and the LARS (the Lars advanced retracking system) to retrack SRAL waveforms (SAR 20Hz, SAR FBR) over land, utilising novel retrackers already prototyped and successfully utilised in the BES with Cryosat-2 FBR waveforms.

- Globally, retrack Sentinel-3 altimeter data over inland water, and obtain river and lake time series of orthometric heights for dissemination to the global community.
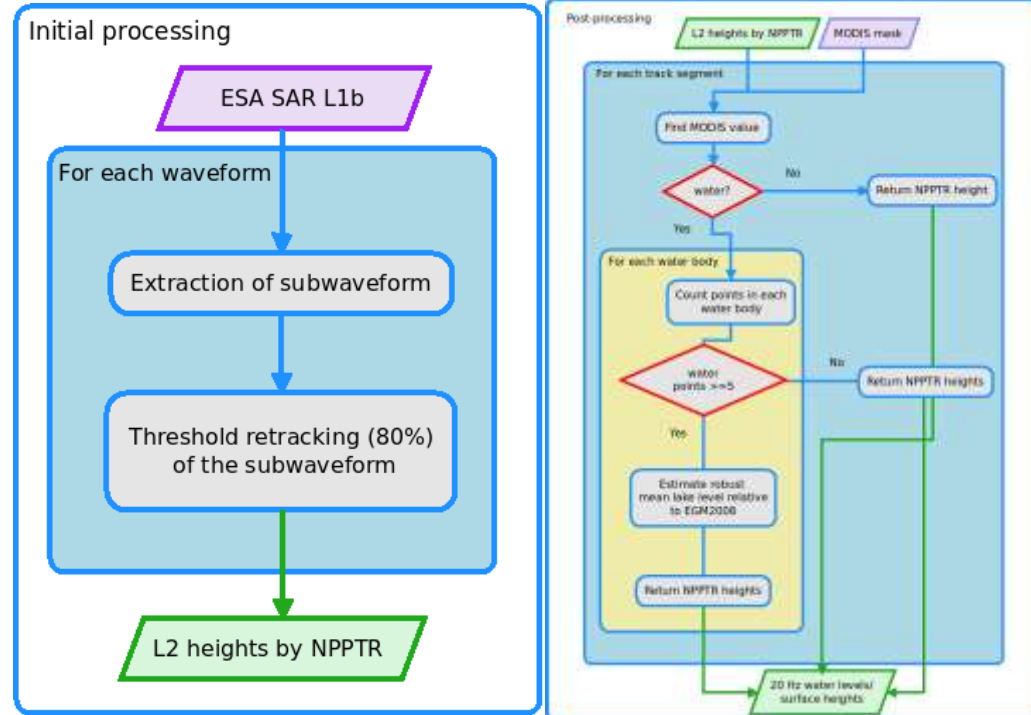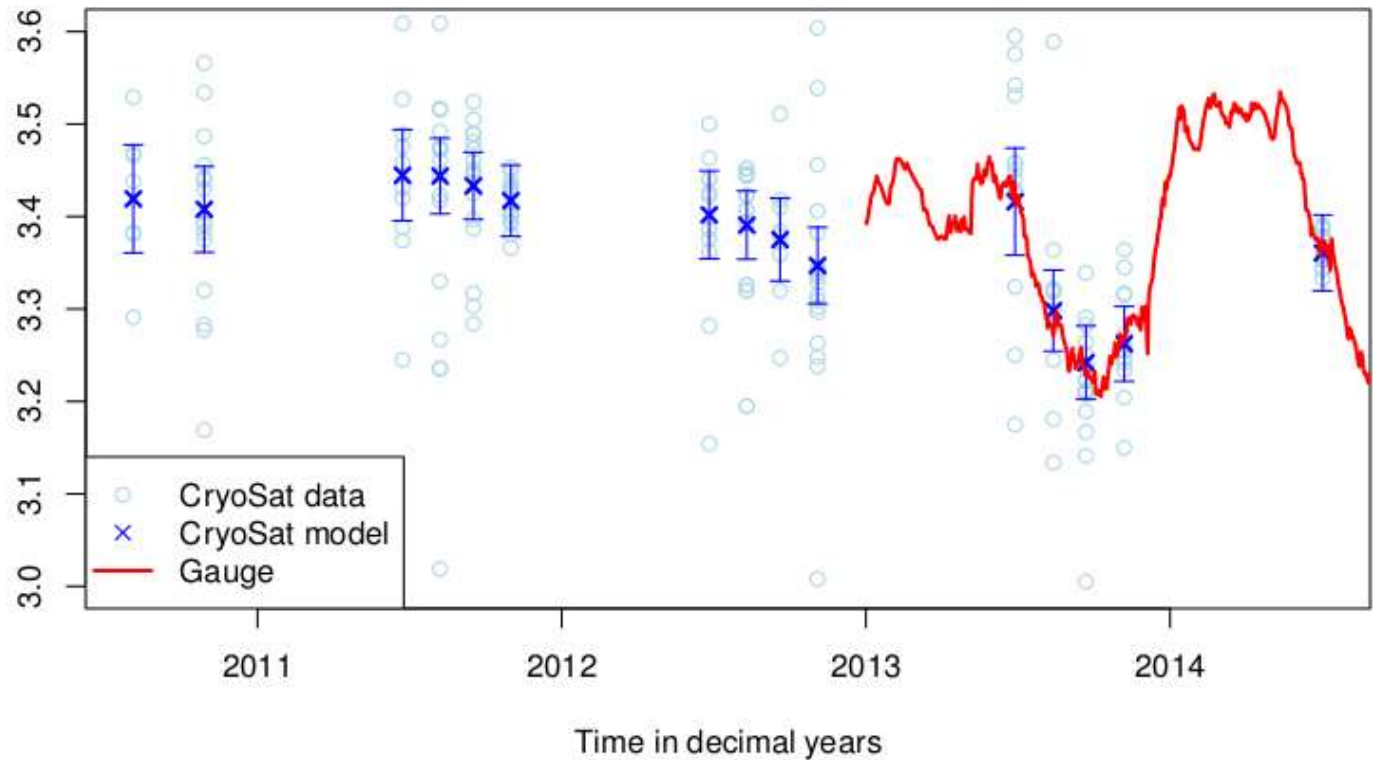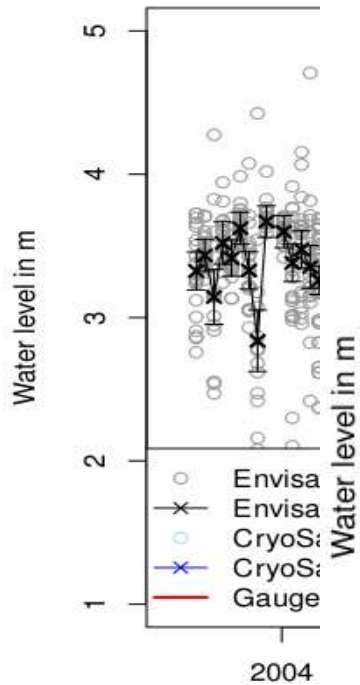
Two step processing
- Initial
  - Extraction of sub-waveform
  - 80% threshold retracker
- Post
  - Identify water with modis mask
  - Estimate robust mean water level for objects that contains at least 5 observations
  - Estimate water level relative to EGM2008
  - Stable results in **even small lakes** (sub 10km2)

DTU Space
National Space Institute

Arresø (roughly 7 x 7 km),

- CryoSat-2 SAR based water levels much more stable compared to Envisat (LRM)
- CryoSat-2 detect water level changes below the decimeter level in
- (low topography) conditions

**Task 2.5 Develop processing for Soil Moisture [UNEW]**

This activity will depend on the result of Task 2.1 and Task 2.2, as well as on previous work done by the consortium in ESA funded predecessor projects. The activities in this task aims at:

- Utilising the successful DMU DREAMS approach (Dry EArth ModelS) which obviates the requirement for detailed ground truth, extend the application of this technique from the current generation of radar altimeters to SRAL altimeters, to determine soil moisture in arid and semi-arid regions.
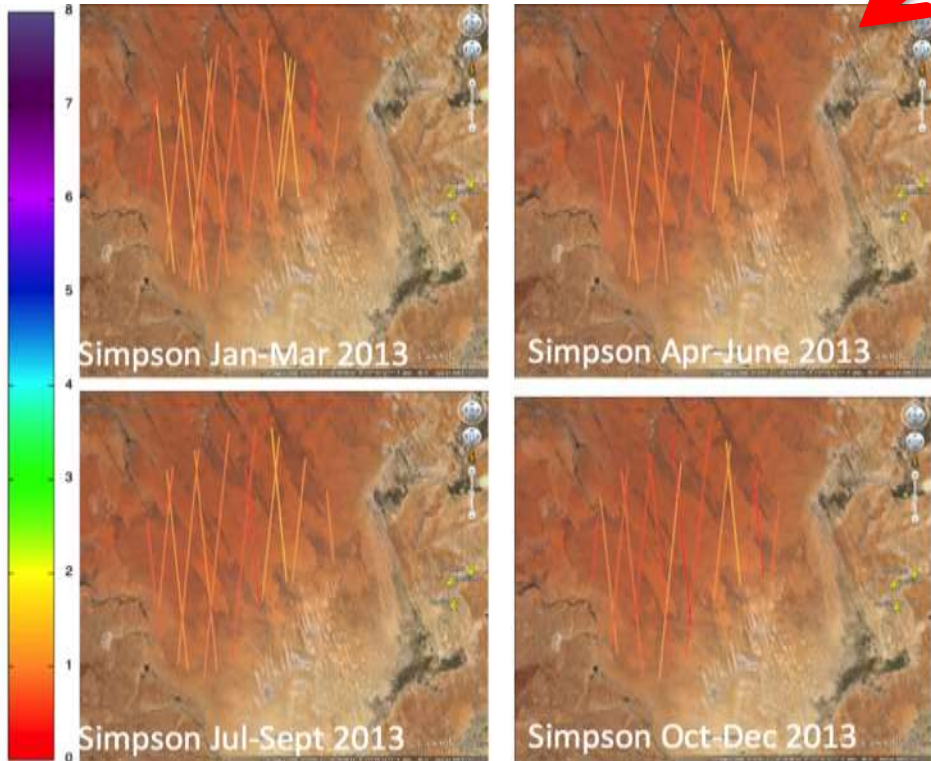
CSME Products - Simpson

Simpson track repeats with DREAM
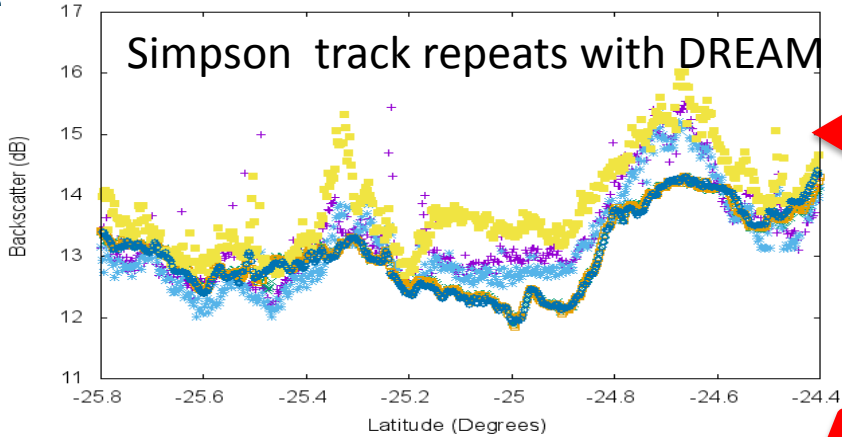
- Simpson recrafted DREAM works well for Cryosat2 backscatter

- Simpson very arid, no surface drainage. Little signal in validation year in CSME data

Simpson Jan-Mar 2013

Simpson Apr-June 2013

Simpson Jul-Sept 2013

Simpson Oct-Dec 2013

Task 2.6 Develop processing for Snow Depths [Starlab]

This activity is focussed in the extraction of the snow depth by SRAL data. The activity will adapt current algorithms (defined for Cryosat-2) to be applied to Sentinel-3. Identifying scientific constrains for the methods and models to this purpose, if any, and propose remedial solutions. This parameter will be used to be combined with Snow density (from polarimetric SAR) in order to extract Snow Water Equivalent (parameter to be assimilated into the hydrological model)

The activities envisioned by this task include:

- SAR mode algorithm improvements for their application to snow depth retrieval.

- Algorithm development and improvement for determination of snow density from full polarimetric SAR.

- Adaption of algorithms to Sentinel-3.