

#### Transponder calibration of the Cryosat-2 altimetric mission and the permanent ESA altimeter calibration site for the Sentinel-3

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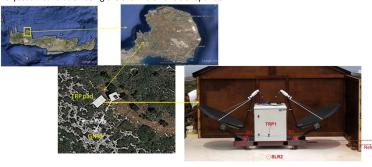


#### Abstract

The new prototype microwave transponder has been used for the calibration of the Cryosat-2 mission. This transponder has been initially set up, in 2013 and 2014, for testing and evaluation at the SLR2 site within the University campus for the Cryosat-2 calibration, before its final and permanent deployment at the CDN1 site in west Crete, Greece. The permanent altimeter transponder site, CDN1, is located on a triple cross-over of the ESA Sentinel-3A & 3B missions, the Jason satellites, but is also adjacent to SARAL/AltiKa satellite. In this work, successful responses of the transponder as well as calibration results for the Cryosat-2 will be presented, even when the satellite is 7 km off the transponder location.

### Transponder Calibration with Cryosat-2 @ SLR2 site, Greece.

The SLR2 site inside the TUC Campus, Chania, Crete, Greece has been used for the Cryosat-2 calibration using the the microwave transponder.

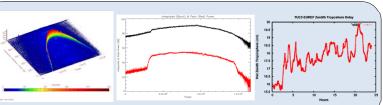


Five successful Cryosat-2 transponder calibration campaigns have been performed in 2013 & 2014 at the SLR2 site. For each campaign the transponder response was quite clean and smooth using the Cryosat-2. The atmospheric delays have been determined using permanent GNSS arrays colocated with the transponder site at SLR2.

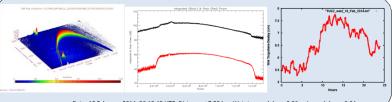
# Cryosat-2 SAR raw waveforms

Integrated & Peak signal power Versus pulses

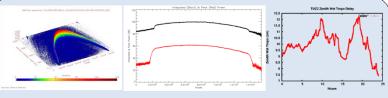
Wet tropo delays over time



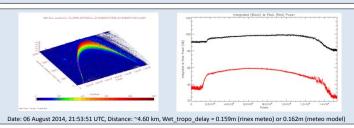
Date: 10 May 2013, 20:21:40 UTC, Distance: ~0.24 km, Wet\_tropo\_delay = 0.191m, Iono\_delay = 0.03m



Date: 18 February 2014, 06:18:49 UTC, Distance: ~7.20 km, Wet tropo delay = 0.06m, Iono delay = 0.04m



Date: 14 May 2014, 02:06:13 UTC, Distance: ~1.10 km, Wet\_tropo\_delay = 0.097m, lono\_delay = 0.03m



Date: 06 October 2014, 07:06:06 UTC, Distance: ~1.10 km

n produced with the financial assistance of the European Union. The views expressed herein can in no ie official opinion of the European Union and/or European Space Agency.

#### 2. CDN1 permanent Sentinel-3 Transponder Calibration Site









2.1 Transponder Housing





The transponder "igloo" roof (left) and current construction status(right)

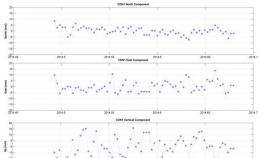


The polyester "igloo" moving roof.

## 2.2 GNSS & Meteo stations operational @ CDN1 as of June 2014







#### CDN1 Coordinates:

Lat= N 35°20'16.023939", Long= F23°46'46.855157" Height=1049.517m (ellipsoidal)

#### 3. Conclusions & Future Plans

- •The "CDN1" site will be fully operational in 2014 to support the Sentinel-3 commissioning phase;
- •The "CDN1" will be used for S3A, S3B, Jason-2, and Cryosat-2 calibration;
- •The transponder has been effectively used for five Cryosat-2 calibration campaigns at the "SLR2" site;
- Wet\_tropo and iono delays have been determined by in situ GNSS arrays;
- Preliminary Cryosat-2 calibration values have been determined as: B = 0.638m (FBR data), and B= 0.745m (stack data) for May-2013 campaign; More Jason-2 & Cryosat-2 campaigns will take place in 2015.