LOTUS Cryosat2 Surface Soil Moisture (CSME) Demonstration Dataset Description

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1. Context

This document contains a description of the field structure and content of the LOTUS Cryosat2 Surface Soil Moisture (CSME) demonstration data products derived from Cryosat2 SRAL Level 1B data (REF1) over the designated desert test regions as specified in REF2.

2. Desert Test Regions

The three defined primary test regions for soil surface moisture production are listed in Table 1. The Latitude/Longitude boundary coordinates form the primary geographically based selection of data over the regions of interest.

Table 1 LOTUS test areas for Surface Soil Moisture derivation from Cryosat2 data

Desert	Lower Longitude Bound (Degrees)	Lower Latitude Bound (Degrees)	Higher Longitude Bound (Degrees)	Higher Latitude Bound (Degrees)
Simpson	135.0 E	28.0 S	139.0 E	24.0 S
Tenere	9.0 E	15.0 N	16.0 E	21.0 N
Kalahari	18.0 E	27.0 S	28.0 E	17.0 S

A secondary selection is made when the data are confronted with the Dry Earth model (DREAM) for the region. Datapoints lying beyond the DREAM bounds or lying within a masked part of the DREAM are excluded from further analysis and are discarded.

2.1 Simpson desert

The Simpson desert Dry Earth Model (DREAM), re-formed and re-masked for use with Cryosat2 data, is shown in Fig.1.

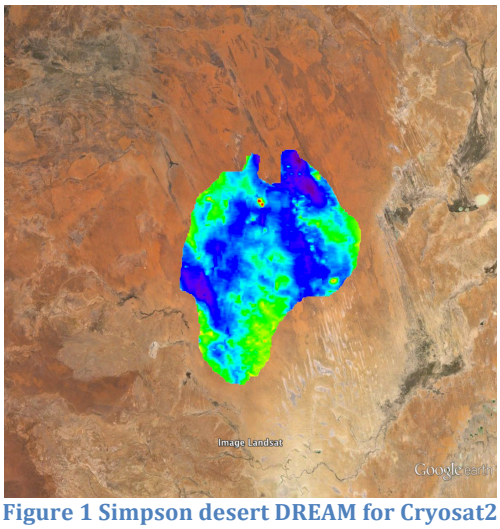

Figure 1 Simpson desert DREAM for Cryosat2

2.2 Tenere desert

The re-calculated Tenere desert DREAM for Cryosat2 is illustrated in Fig.2. Note that further dynamic masking is performed on data over this model in addition to the masking within the DREAM (DREAM masking is shown here as transparent zones within the model).

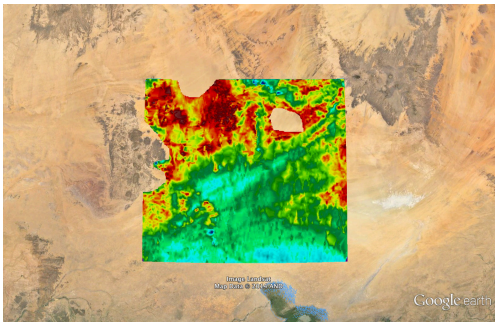

Figure 2 Tenere desert DREAM for Cryosat2

2.3 Kalahari desert

The Cryosat2 DREAM for the Kalahari desert is shown in Fig.3. For this desert, the masking used for the ESA SMALT project (REF3; REF4) is retained, with additional dynamic masking utilized during data production for this desert. Note that part of the Eastern Kalahari desert has been excluded from this model, following the ESA SMALT masking protocols (ibid), due to the presence of the Okavango delta and its input rivers.

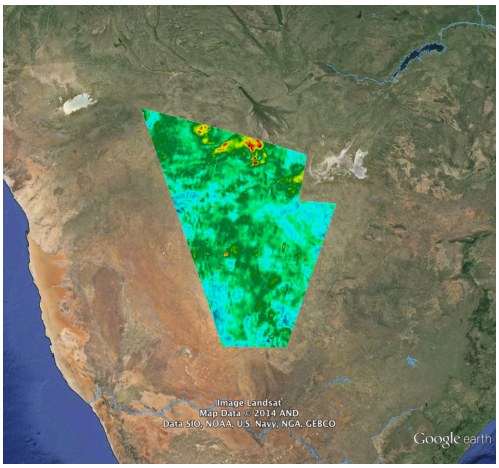

Figure 3 Kalahari desert DREAM for Cryosat2

3. CSME Product Structure and Content

Each LOTUS CSME Demonstration Dataset contains a space delimited ascii text file. Each dataset comprises two header files, and a datafile containing surface soil moisture estimates derived from the Cryosat2 altimeter. Currently, all desert regions are overflown in LRM mode. Data have been generated for a period of one year from 01/01/2013 to 31/12/2013 for all test areas.

3.1 CSME Header 1

The first product header gives information on the data origin (altimeter mission identifier) and the version of the processing scheme used to generate the product. Information on the data originator, data generation date and the region identifier are also given. The header structure is summarized in Table 2.

Table 2 Content of CSME Dataset Header 1

Altimeter (Cryosat2) and mode of operation (SAR or LRM)	Text fields
Pre-processor version and revision numbers	Textfields
CSME processor version	Textfield
Desert identifier	Textfield
Data originator and project	Textfields
Creation date	Date field dd/mm/yyyy

3.2 CSME Header 2

This header contains the following information on data content.

Table 3 Content of CSME Dataset Header 2

Name of desert region.	Textfield
Data Location information	Textfield
Time field information	Textfield
Input record information	Textfield
Soil moisture field information	Textfield

3.3 CSME Dataset

Table 4 shows the fields included in the LOTUS Cryosat2 soil moisture demonstration product. Each estimate is an averaged value along an arc of the satellite overpass. The start and stop locations for the arc used to generate the soil moisture estimate are given, together with the number of points used to form the estimate. It is noted that the current protocol of averaging each overpass to yield one value of soil moisture may be relaxed with further enhancements to the DREAMs.

Table 4 Content of CSME Surface Soil Moisture Dataset

Parameter	Unit
Segment start Latitude	Decimal degrees
Segment start Longitude	Decimal degrees
Segment end Latitude	Decimal degrees
Segment end Longitude	Decimal degrees
Date at centre of track segment	Year / Month / Day
Fraction of day at centre of track segment	Hour / Minute / Second
Number of points used to form estimate	None
Soil moisture mean estimate	Percent surface soil moisture

References

REF 1: Cryosat Product Handbook, 2012: CryoSat-PHB-17apr2012.pdf.

REF 2: D2.4 Cryosat2 Soil Surface Moisture Algorithm Theoretical Basis Document v.1.1. LOTUS_D2_4_NEWC.pdf, June 2014.

REF 3: Berry, P.A.M., Dowson, M., Smith, R.G., Benveniste, J., 2012. Soil Moisture From Satellite Radar Altimetry (SMALT). Proceedings of the ESA Living Planet Symposium 2012.

REF 4: SMALT Product Handbook, 2014. DMU-SMALT-PRODSPEC-001, http://tethys.eaprs.cse.dmu.ac.uk/SMALT/.