

# CryoSat-SMOS Merged Sea Ice Thickness



## Main Improvements and changes in v203

- We adapted the CS2SMOS processing to changes due to the update to CryoSat-2 sea ice thickness product version v2.3.



## Main Improvements and changes in v202

- The time coverage resolution has been changed from 7 days to 1 day, meaning that the weekly averaged product is updated every day from now on.
- We adapted the CS2SMOS processing to changes due to the update to CryoSat-2 sea ice thickness product version v2.2.
- We adapted the CS2SMOS processing to changes due to the update to SMOS sea ice thickness product version v3.2, which is now processed and provided by AWI.
- An ocean mask is applied to allow for a consistent land/ocean mask throughout the entire data record in order to overcome inconsistencies due to switches of the land masks in the OSI SAF ice concentration products.
- We now use different sea ice concentration products for the operational mode and for the reprocessing mode. In the operational mode, we use the operational OSI-401 ice concentration product, while in the reprocessing mode, the reprocessed OSI -430-b ice concentration product is used. Both are provided by OSI SAF.
- Changes in the NetCDF variable names, fulfilling CF 1.6 conventions.

Version	Date	Comments
v203	07.10.2019	Update to version 203
v202	01.10.2019	Update to version 202
v201	10.01.2019	Official ESA release

## Product Description Overview

Parameter	Sea ice thickness
Spatial coverage	N: 90°, S:16.6°, E:180°, W:-180°
Spatial Resolution	25 km x 25 km
Temporal coverage of the data record:	November 2010 to present
Time coverage resolution	1 day
Time coverage duration	7 days
Data Format(s)	NetCDF
Platforms	CryoSat-2, SMOS
Version	v202

## File naming convention

NetCDF files are named using the following convention:

<convention-prefix>\_<regional code>- <institution>,<platform(s)>,<grid>\_<time>\_<mode>\_<product version>\_<file version>.nc

## Links

[Product description document](#)

[Read-me-first technical note](#)

ESA Websites:

[ESA EO Mission CryoSat](#)

[ESA EO Mission SMOS](#)

Visualization of NetCDF data:

[Panoply](#)

## Contact

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convention-prefix	World Meteorological Organization: W
regional code	European: XX
institution	European Space Agency: ESA
processing level/parameter	level 4 sea ice thickness: l4sit
Platform(s)	satellites: SMOS, CS2
grid	25 km EASE2 grid, Northern Hemisphere: NH_25KM_EASE2
time	time span: yyyyymmdd - yyyyymmdd
mode	reprocessing: r, operational: o
product version	version 2.0.2: v202
file version	version 1: 01

Example NetCDF naming for operationally processed data:

`W_XX-ESA,SMOS_CS2,NH_25KM_EASE2_20190304_20190310_o_v202_01_l4sit.nc`

Example NetCDF naming for reprocessed data:

`W_XX-ESA,SMOS_CS2,NH_25KM_EASE2_20190304_20190310_r_v202_01_l4sit.nc`

## File Format

The weekly grids are given in standardized binary data format (Network common data form: NetCDF v4). Global attributes are given in Table 1. The variables are given as grid arrays, see Table 2. NetCDF files are formatted according to CF conventions: CF-1.6 ACDD-1.3. We use a scaling factor of  $10^{-3}$  and a fillvalue = -2147483647.

Table 1: Global attributes from an example NetCDF file, covering the week from March 04 to March 10, 2019.

Attribute	Value
title	Sea Ice Thickness derived from merging CryoSat-2 and SMOS ice thickness
description	Weekly Arctic sea-ice thickness derived from CryoSat-2 and SMOS using an optimal interpolation scheme
summary	Weekly Arctic sea-ice thickness derived from CryoSat-2 and SMOS using an optimal interpolation scheme
keywords	Cryosphere > Sea Ice > Sea Ice Thickness
product_version	202
processing_mode	r
time_of_creation	Fri Oct 11 09:04:06 2019
history	Fri Oct 11 09:04:06 2019 creation
Conventions	CF-1.6
spatial_resolution	25.0 km grid spacing
geospatial_lat_min	16.623929977416992
geospatial_lat_max	90.0

geospatial_ lon_min	-180.0
geospatial_ lon_max	180.0
geospatial_ vertical_min	0.0
geospatial_ vertical_max	0.0
time_cover age_start	2019-03-04T00:00:00Z
time_cover age_end	2019-03-11T00:00:00Z
time_cover age_durati on	P7D
time_cover age_resolu tion	P1D
platform	CryoSat-2, SMOS
project	CS2SMOS PDS: SMOS & CryoSat-2 Sea Ice Data Product Processing and Dissemination Service
institution	Alfred-Wegener-Institut Helmholtz Zentrum für Polar und Meeresforschung (AWI), <a href="http://www.awi.de">http://www.awi.de</a>
creator_na me	Alfred-Wegener-Institut Helmholtz Zentrum für Polar und Meeresforschung (AWI), <a href="http://www.awi.de">http://www.awi.de</a>
creator_type	institution
creator_url	<a href="https://spaces.awi.de/confluence/x/DwVmEQ">https://spaces.awi.de/confluence/x/DwVmEQ</a>
publisher_ email	robert.ricker@awi.de
references	Ricker, R., Hendricks, S., Kaleschke, L., Tian-Kunze, X., King, J., and Haas, C.: A weekly Arctic sea-ice thickness data record from merged CryoSat-2 and SMOS satellite data, <i>The Cryosphere</i> , 11, 1607-1623, <a href="https://doi.org/10.5194/tc-11-1607-2017">https://doi.org/10.5194/tc-11-1607-2017</a> , 2017.
_CoordSys Builder	ucar.nc2.dataset.conv.CF1Convention

Table 2: NetCDF file content. Note, that we use a scaling factor of  $10^{-3}$  and a fillvalue = -2147483647.

Variable	Description	Unit	Type	Dimension
Lambert_Azimuthal_Grid	proj4_string: +proj=laea +lon_0=0 +datum=WGS84 +ellps=WGS84 +lat_0=90.0	-	int	-
time_bnds	start and end time of the weekly retrieval	seconds since 1978-01-01 00:00:00	double	2
analysis_sea_ice_thickness	CS2SMOS weekly merged sea ice thickness	m	int	1,432,432
background_sea_ice_thickness	background field, interpolation using CS2 and SMOS sea ice thickness data	m	int	1,432,432
weighted_mean_sea_ice_thickness	weighted mean of weekly CS2 and SMOS ice thickness retrievals	m	int	1,432,432
innovation	difference between background and analysis ice thickness	m	int	1,432,432
sea_ice_concentration	sea ice concentration	%	int	1,432,432
sea_ice_type	sea ice type	-	int	1,432,432
correlation_length_scale	correlation length scale of background ice thickness	m	int	1,432,432
analysis_sea_ice_thickness_unc	uncertainty of the merged sea ice thickness	m	int	1,432,432
smos_sea_ice_thickness	weekly averaged SMOS ice thickness	m	int	1,432,432
cryosat_sea_ice_thickness	weekly averaged CryoSat-2 ice thickness	m	int	1,432,432
time	reference time of product (middle of the week)	seconds since 1978-01-01 00:00:00	double	1
xc	x coordinate of projection (eastings)	km	float	432
yc	y coordinate of projection (northings)	km	float	432
lon	longitude coordinate	degrees_north	float	432,432
lat	latitude coordinate	degrees_east	float	432,432

## Grid

All grids are projected onto the 25 km EASE2 Grid, which is based on a polar aspect spherical Lambert azimuthal equal-area projection (Brodzik et al., 2012). The grid dimension is 5400 km x 5400 km, equal to a 432 x 432 grid. The grid is centered on the geographic Pole, meaning that the Pole is located at the intersection of center cells (Figure 1).

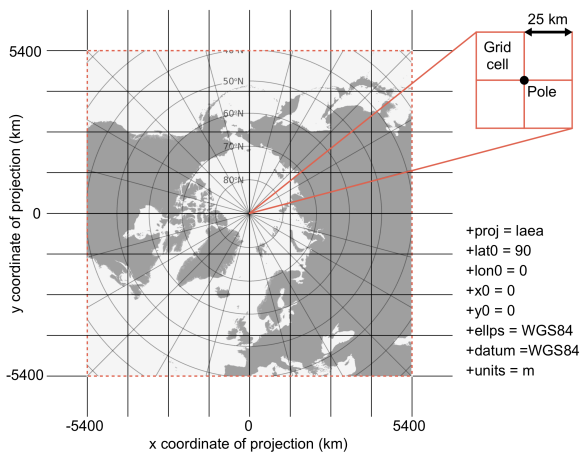


Figure1: Specifications of the EASE2 25 km grid, which is used for the merged product.

