

TanDEM-X for Cryosphere Applications

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Knowledge for Tomorrow



TerraSAR-X-add-on for Digital Elevation Measurements

Launched: 21-Jun-2010

acquisition of a global DEM
according to Level-3 standard

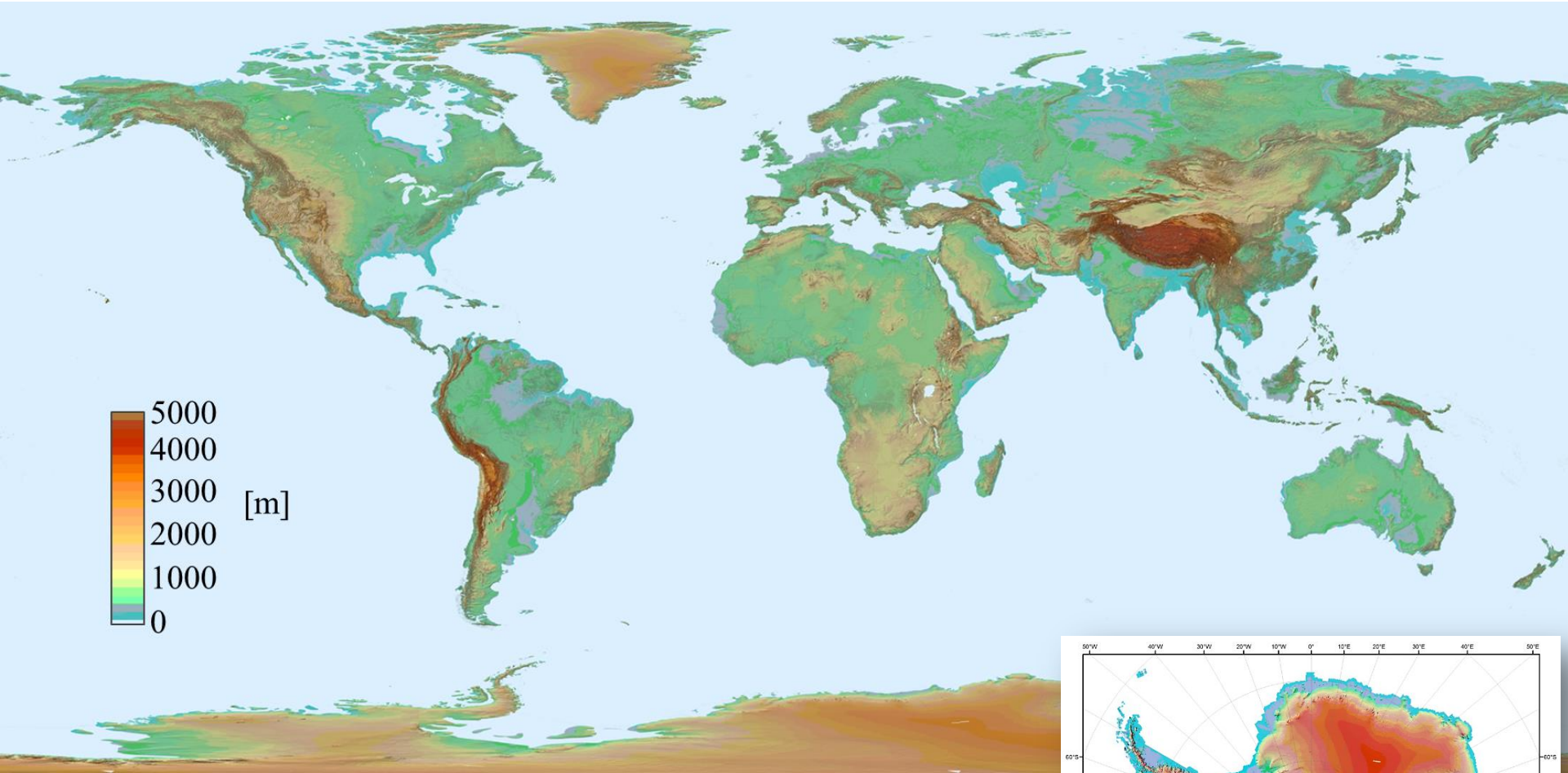
generation of local DEMs with
Level-4 like quality

demonstration of innovative
bistatic imaging techniques
and applications

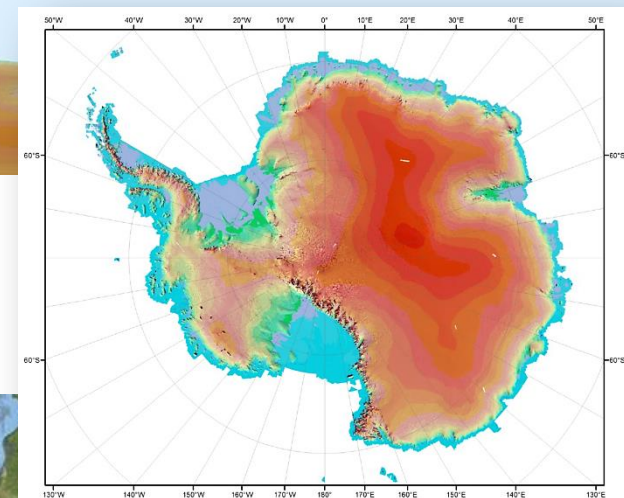
10 Years of TanDEM-X



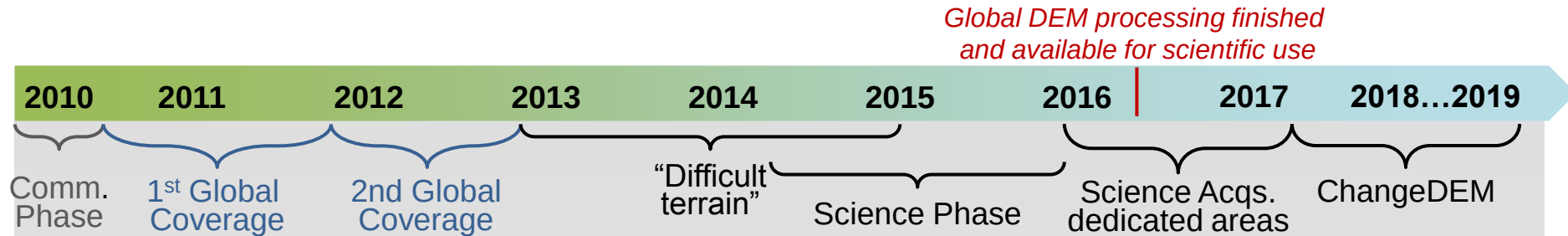
Final 12 m DEM Generation (Total 19,389 tiles)



Digital Elevation Models are available for scientific use over the DLR TanDEM-X webportal



TanDEM-X Global DEM & Science Acquisition Plan



1st Global Coverage (2011-2012)

- Small baseline (~200 m), HoA* ~ 50 m

2nd Global Coverage (2012-2013)

- Increased baseline (~300 m), HoA* ~ 35 m
- Combination:
 - Dual Baseline Phase Unwrapping
 - Improved Height Accuracy

Additional Global DEM Acqs. (2013-2015)

- "Difficult Terrain" to account for shadow & layover
 - Different viewing geometry
- Antarctica, deserts, filling of gaps

Science Phase (2014-2016)

- Acquisitions with special formations
- ATI, multistatic, PolnSAR, digital beamforming, etc.
- Higher resolution DEMs with local extend

Science Acquisitions (2016-2017)

- Areas of high dynamics w.r.t. local height changes
- Antarctica costal regions
- Greenland and permafrost
- Forest

ChangeDEM Acquisitions (2017-2020)

- Topographic changes on a global scale
- Quality improvements of the global DEM



*HoA: Height of Ambiguity $\leftrightarrow 2\pi$ Interferometric Phase

Applications Domains of TanDEM-X:

Bio/Geo/Cryo/Hydro Sphere

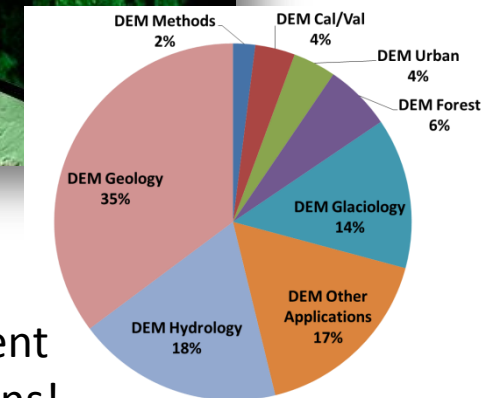
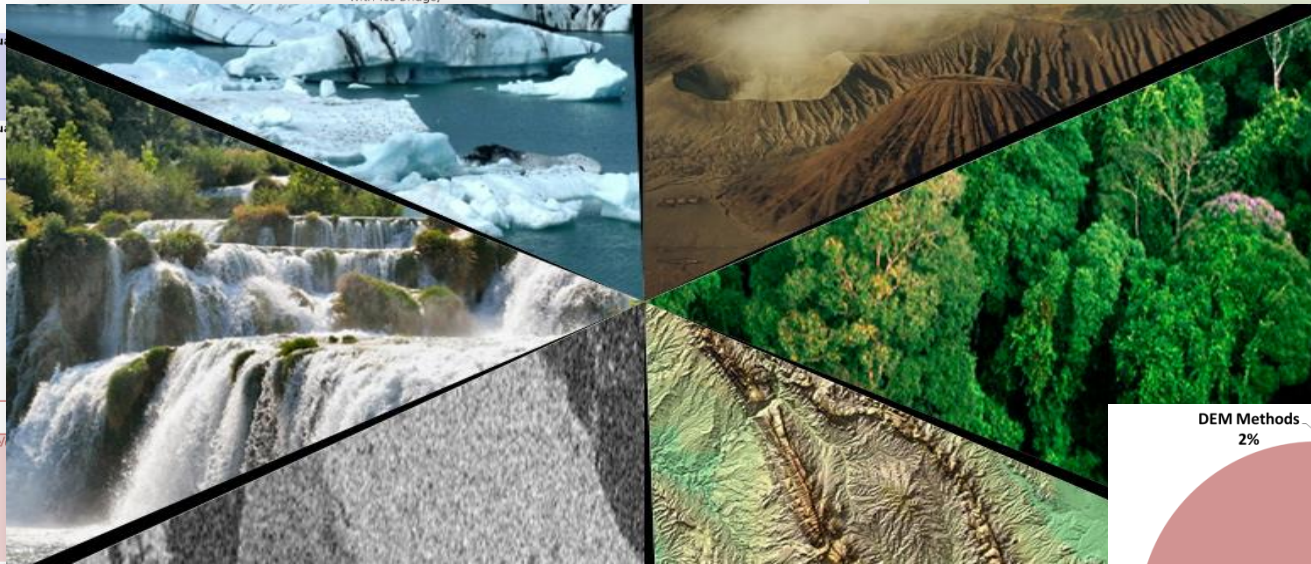
Application	InSAR Mode	Imaging Mode	DRA	Baseline	Coverage	Time	Comments
Sea Ice Topography	Bistatic	SM	single/dual	Huge baselines (3-4 km)	- Super test sites - Selected site at the Northern hemisphere - North Greenland /Svalbard	Polar winter (4-5 cycles)	Deci-meters to centimeters height resolution; combination with ground campaign
Surface Elevation Change/Mass Balance	Bistatic or PM	SM	Single/dual	Normal baselines (200-500 m)	- Super test sites - Selected sites	Spring/summer; (3-4 cycles)	Combination with ground/airborne/satellite and coordinated with Ice Bridge.

Snow/Ice structure	Bistatic or PM	SM	Dual/quad				
Snow Depth	Bistatic or PM	SM	Dual/quad				

Application	InSAR Mode	Imaging Mode	DRA
Volcano Monitoring	Bistatic or PM	SM SL	single/
Tectonic Monitoring	Bistatic or PM	SM	single/dual

Application	InSAR Mode	Imaging Mode	DRA	Baseline	Coverage	Time	Comments
City Monitoring	Bistatic or PM	SM SL	single/dual	set of across-track baselines (100-1000 m) for tomography	- Super test site - Megacities (London, Paris, Beijing, LA, Mexico)	All year as many as possible	

Application	InSAR Mode	Imaging Mode	DRA	Baseline	Coverage	Time	Comments
Forest height	Bistatic	SM SL	single/dual/quad single/dual/quad	set of short across-track baselines (100-300 m)	- Northern/Southern hemisphere - boreal forest - Amazon basin	All year around Leaf on/off	Need access to global DEM data
Forest structure	Bistatic or PM	SM SL	single/dual/quad single/dual/quad	set of short across-track baselines (100-300 m) for Tomography	- Northern/Southern hemisphere - boreal forest	All year around Leaf on/off	Need access to global DEM data
Forest mapping	Bistatic and AB	SM	dual	Large to very large baselines	Amazon Basin	2 times acquisition: wet/dry season	AB with 20 m HoA



TDX is serving different application domains!



DEM Differencing over Retrogressive Thaw Slumps (RTS)

Philipp Bernhard

DEMs from 2011 to 2017 – Evolution of RTS

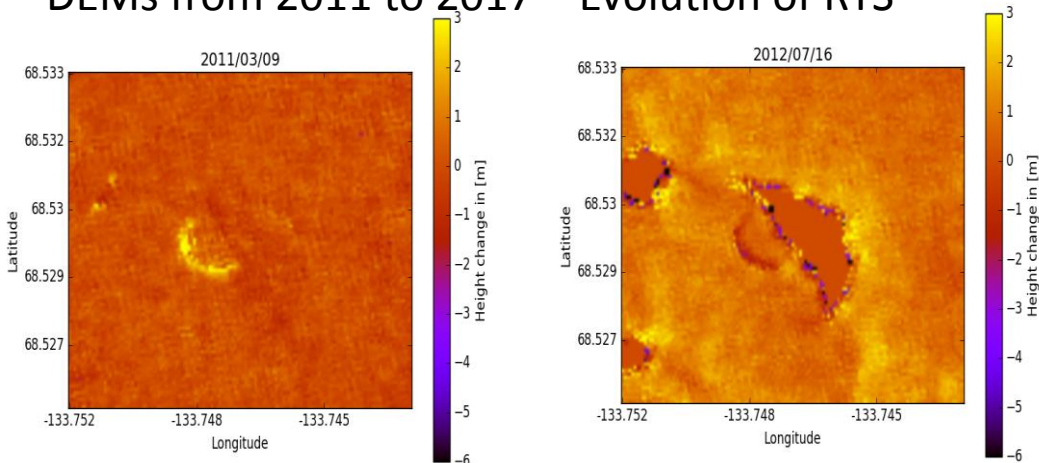
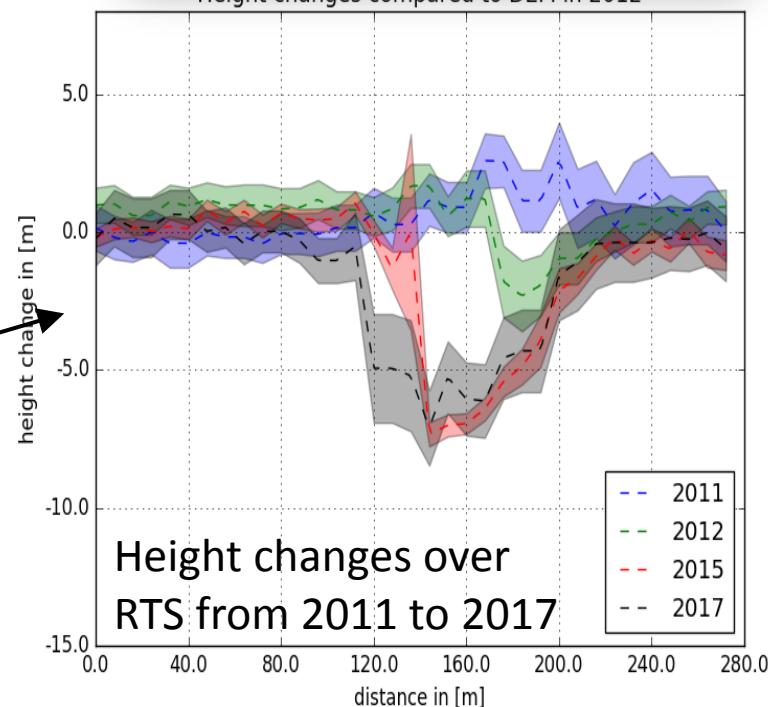
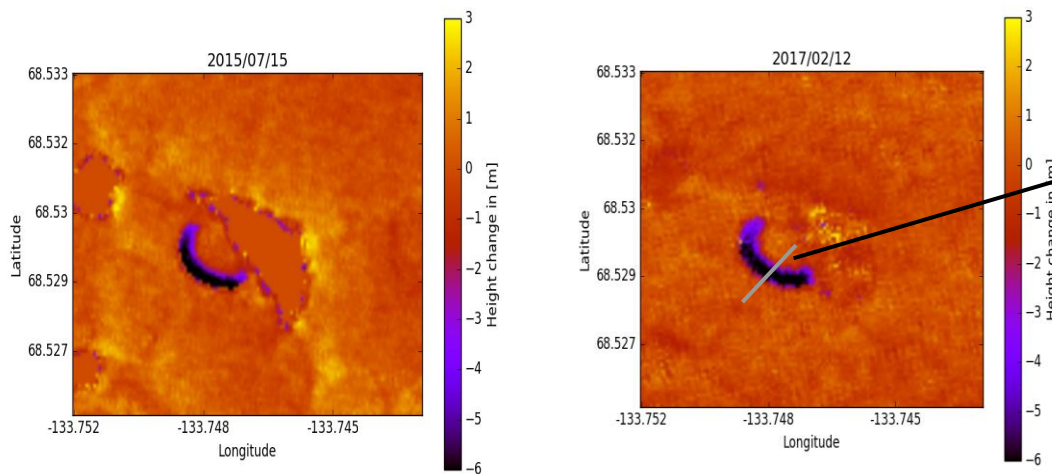


Photo: Rory Nichols

Height changes compared to DEM in 2012



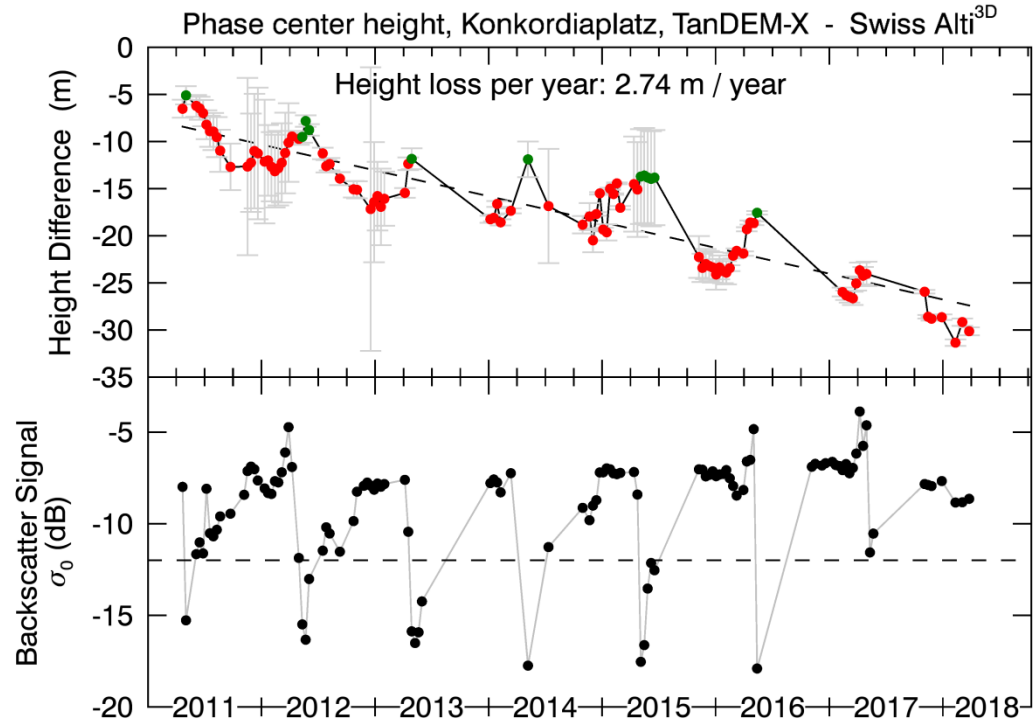
DEM Differencing = DEM T0 to T1 changes



Height loss of Aletschgletscher 2011 - 2018

Silvan Leinss

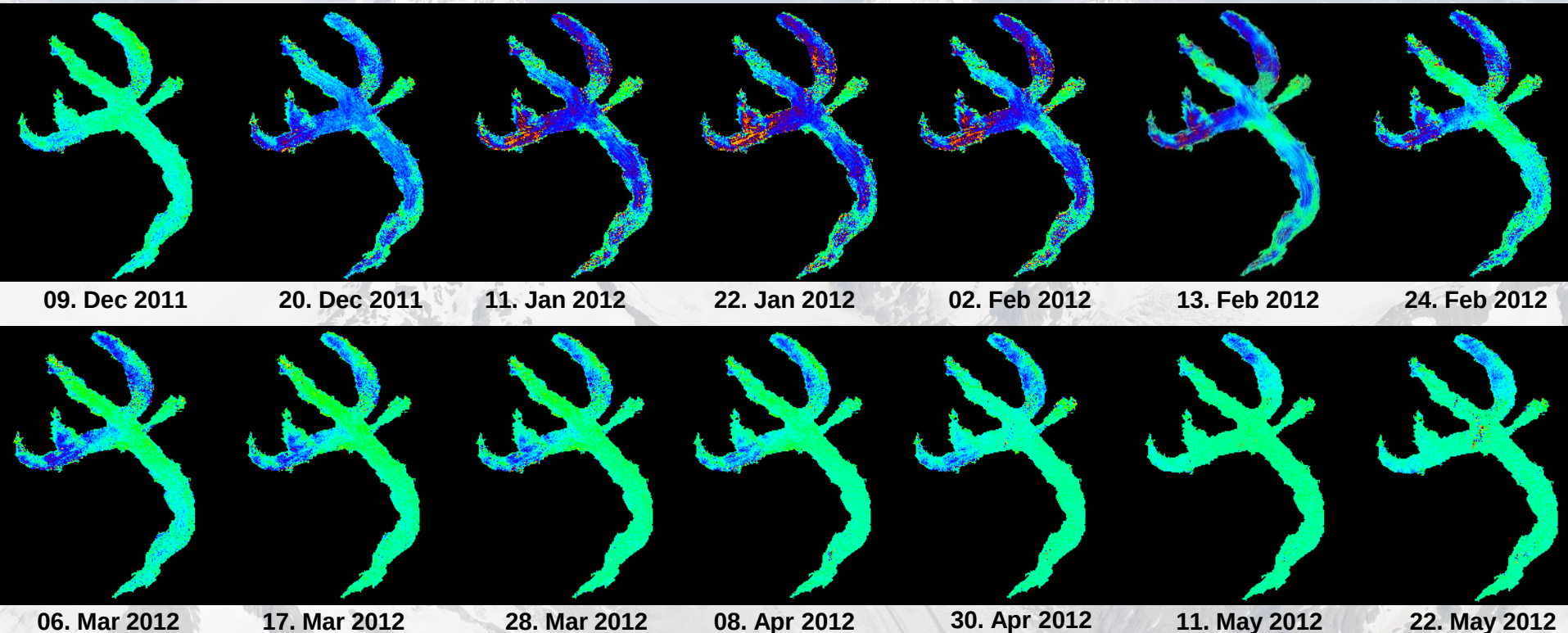
TanDEM-X vs. SwissAlti3D (2009)



- Agreement with results of climate scenarios:
DEG2: -2.1 m / year (political aim)
ENSmed: -3.6 m / year (business as usual)
- Periodic seasonal changes
- Height increase at the onset of snow melt (wet snow detected by low backscatter).

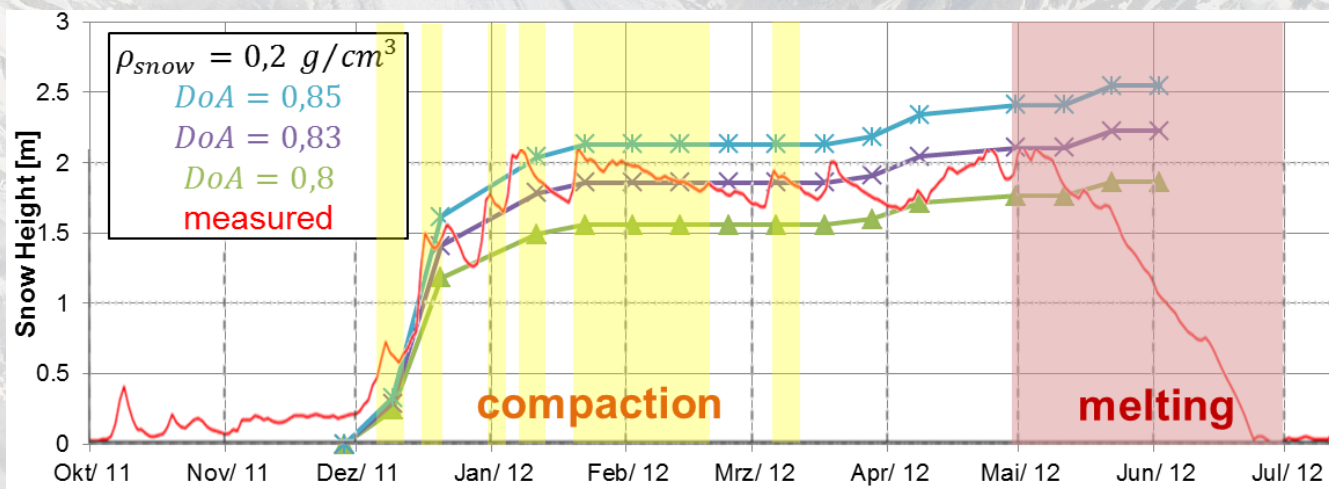
TDX VV-HH Phase Difference for Snow Height: Aletschglacier

Giuseppe Parrella/ Miriam Schönfeldt



$\phi_{VV-HH} \uparrow \Rightarrow$ fresh snow,
 l increases

$\phi_{VV-HH} \downarrow \Rightarrow$ snow ages,
 l stays the same



TanDEM-X DEM: Science Service System

<https://tandemx-science.dlr.de>

Please contact us for data request!



Science Service System

You are here : Home : TanDEM-X Science Service System

For registered users only

Username:

Password:

[Login](#)

Registered User Access

- Investigator
- Evaluator
- Coordinator

Basic User Registration

- Investigators Registration

Documents (Download)

- Bandwidth Considerations
- Science Plan
- TanDEM-X Science Phase
- Manual Science Service System
- TanDEM-X Experimental Product Description
- TanDEM-X CoSSC Generation and Interferometric Considerations
- TanDEM-X DEM Product Specification
- TerraSAR-X Basic Products
- TerraSAR-X L1b Product Description
- User License Agreement
- COFUR Price List (Scientific Use)

Demo Data (Download)

- Free Final DEM Demo Data

DEM Gallery

- TanDEM-X DEM Gallery

Links

- Microwaves and Radar Institute

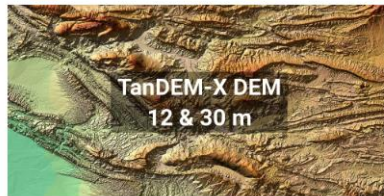


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TanDEM-X Basic Products

Welcome to the TanDEM-X Science Service System, the web interface for the submission and evaluation of scientific proposals. Since August 2016 the 12 m and 30 m global TanDEM-X Digital Elevation Model is available for scientific users. In addition in October 2018 the open call for the 90 m global TanDEM-X DEM was launched with a fast access to the data.

TanDEM-X Products



Description

