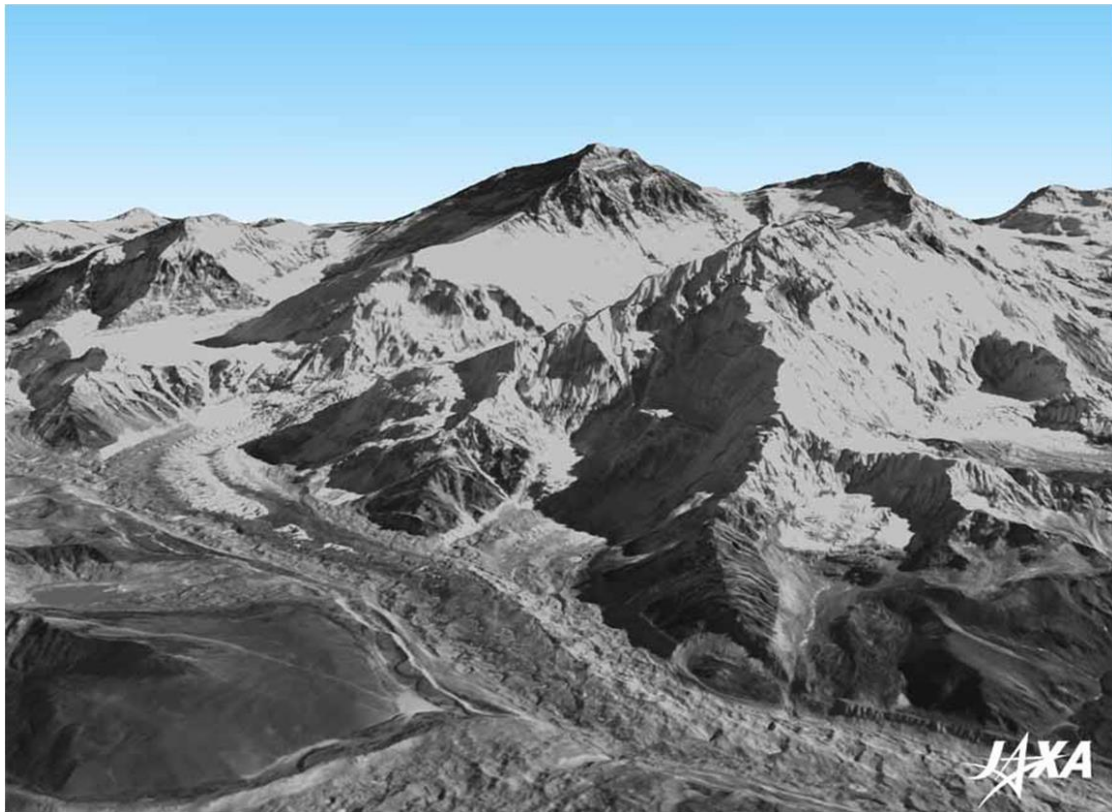# Alberta-wide ALOS DSM
"ALOS_DSM15.tif", "ALOS_DSM15_c6.tif"

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Geospatial Centre
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Contents

1. Overview

1.1. Summary

Variation in elevation is one of the primary drivers of ecosystem properties, including micro-climate and hydrological settings. This Alberta-wide raster dataset is a Digital Surface Model (DSM) at 15m pixel size circa 2010 that was generated using the *Panchromatic Remote Sensing Instrument for Stereo Mapping* (PRISM) sensor on board the Advanced Land Observing Satellite (ALOS), launched in 2006 by the Japan Aerospace Exploration Agency (JAXA) and operated until 2011.

Because this terrain model includes surface features such as trees and buildings, it was smoothed using a mean kernel filter with a search radius of 90m. The intent of this processing was to flatten surface features such as forest canopies and to reduce noise while retaining the coarser-scale topographic curvatures that determine water movement.

1.2 Description

The ALOS satellite, also known as "Daichi", carried three sensors: a *Phased-Array L-band Synthetic Aperture Radar* (PALSAR) active sensor, *Advanced Visible and Near Infrared Radiometer type 2* (AVNIR-2) optical sensor, and *Panchromatic Remote Sensing Instrument for Stereo Mapping* (PRISM), which was used for DSM generation. The PRISM consists of forward, nadir, and backward-looking radiometers that perform along-track stereoscopic observations with a spatial resolution of 2.5m. The original dataset generated by PRISM was the ALOS World 3D (AW3D) mesh at 0.15 arc seconds (~5m), with version 1 completed in March 2016.

The 5m mesh version was resampled to 30m using both an average and a median of cell values (Note: this dataset is derived from the AVERAGE version of the 5m mesh). The difference between the two is generally very subtle but the AVERAGE version was chosen because some of the original data points are ground elevations, others are top of structures. The average therefore represents an intermediate elevation while the median alternates between those elevations. The ALOS World 3D30 (AW3D30) mesh was processed at 1 arc second (~30m) and made publicly available in May 2016.

The AW3D30 data was downloaded from the JAXA website (http://www.eorc.jaxa.jp/ALOS/en/aw3d30/) in tiles measuring 1 degree by 1 degree, with rectangular pixels approximately 18m by 30m. The tiles were re-projected from geographic to UTM coordinates (25m pixel size), and mosaicked to seamless coverage of Alberta. NoData gaps between tiles (1 or 2 pixels in width) were filled using interpolation from neighbouring pixel values. The pixel type was converted from signed integer to floating-point and resampled using bilinear interpolation to 15m cell size ("*ALOS_DSM15.tif*"). Resampling to 15m matches the resolution of other Geospatial Centre's products and will enable their overlay to distinguish land surface features.

The DSM was subsequently smoothed in ArcGIS 10.1 Focal Statistics to assign each pixel the mean value of pixels within a 6-cell (90m) search radius ("*ALOS_DSM15_c6.tif*"). A Hillshade relief layer of the DSM and smoothed DSM is also provided for better visualization ("*ALOS_DSM15_h.tif*" and "*ALOS_DSM15_c6h.tif*").

Figure below shows the surface profile for a 2400m transect of the ALOS DSM (top), smoothed DSM (middle) and Bare earth LiDAR (bottom) for the scene shown below.
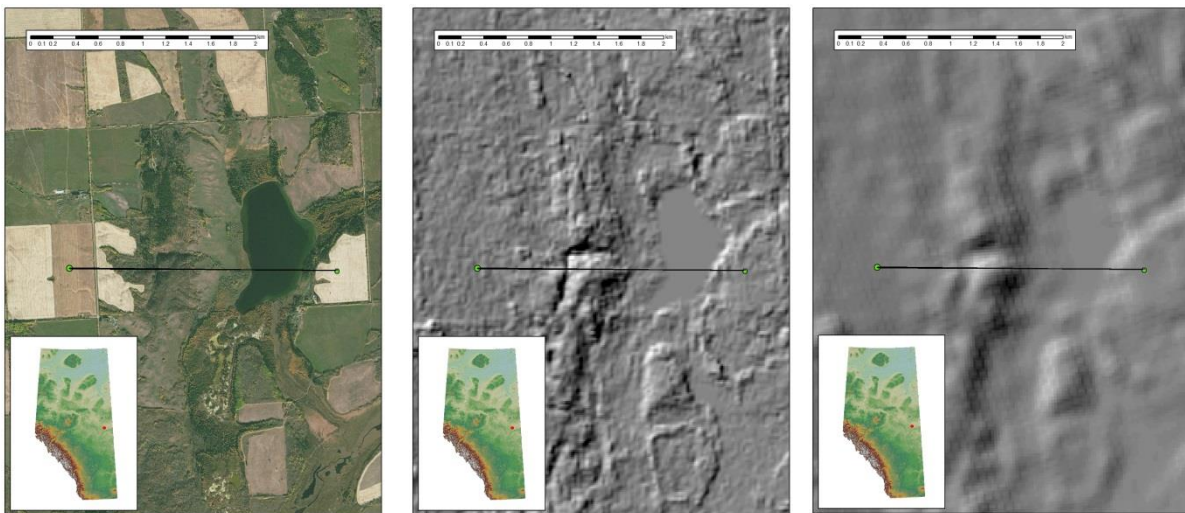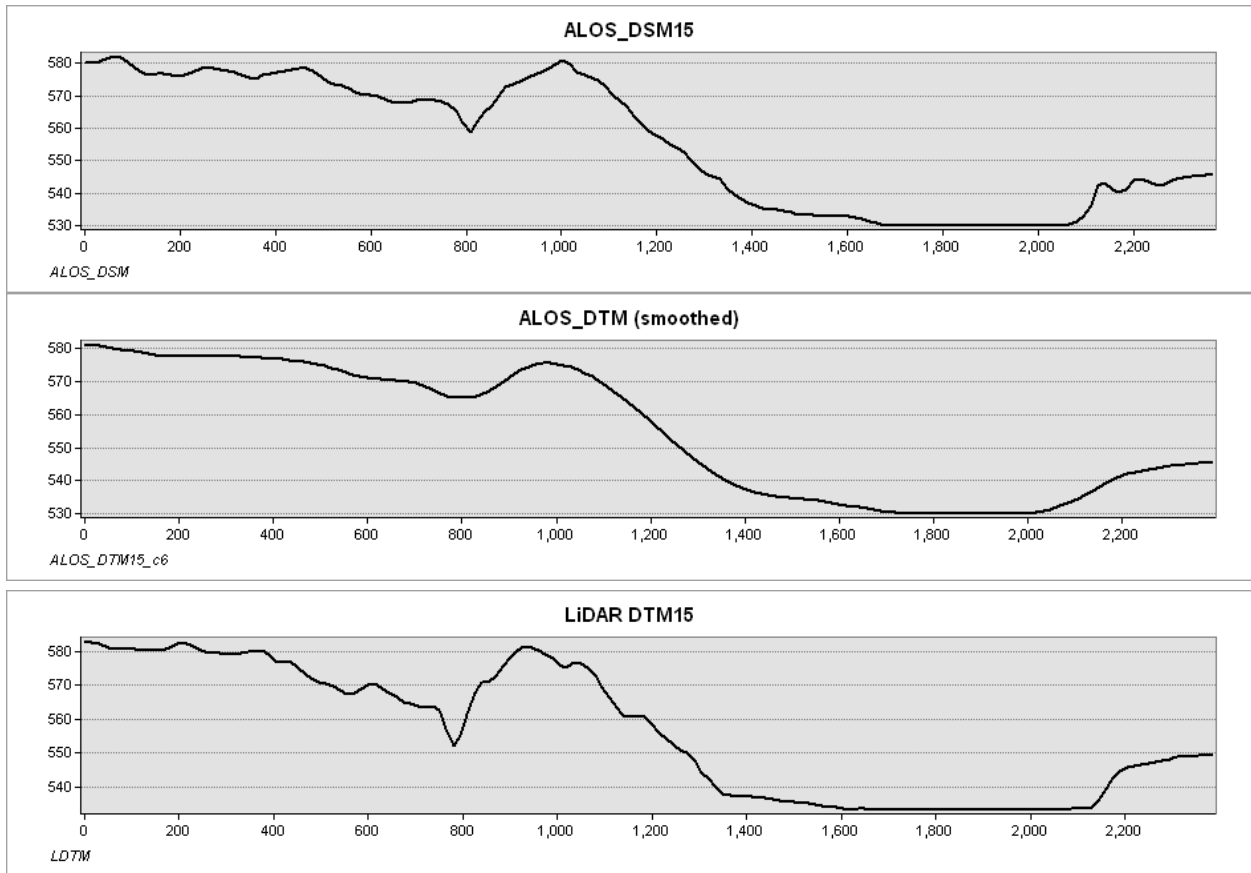

Figure 1: SPOT 2013 RGB image (left), Hillshade relief map of ALOS DSM (middle), and smoothed DSM (right).

The ALOS DSM includes above-ground features such as trees and buildings which should not be misinterpreted as landforms when using this product for hydrological modeling. Note that the DSM generated by the Shuttle Radar Topography Mission (SRTM) in 2000, which is freely available and widely used, has a lower vertical resolution than the ALOS DSM, and is therefore more likely to behave as a DTM when used for hydrological modeling.
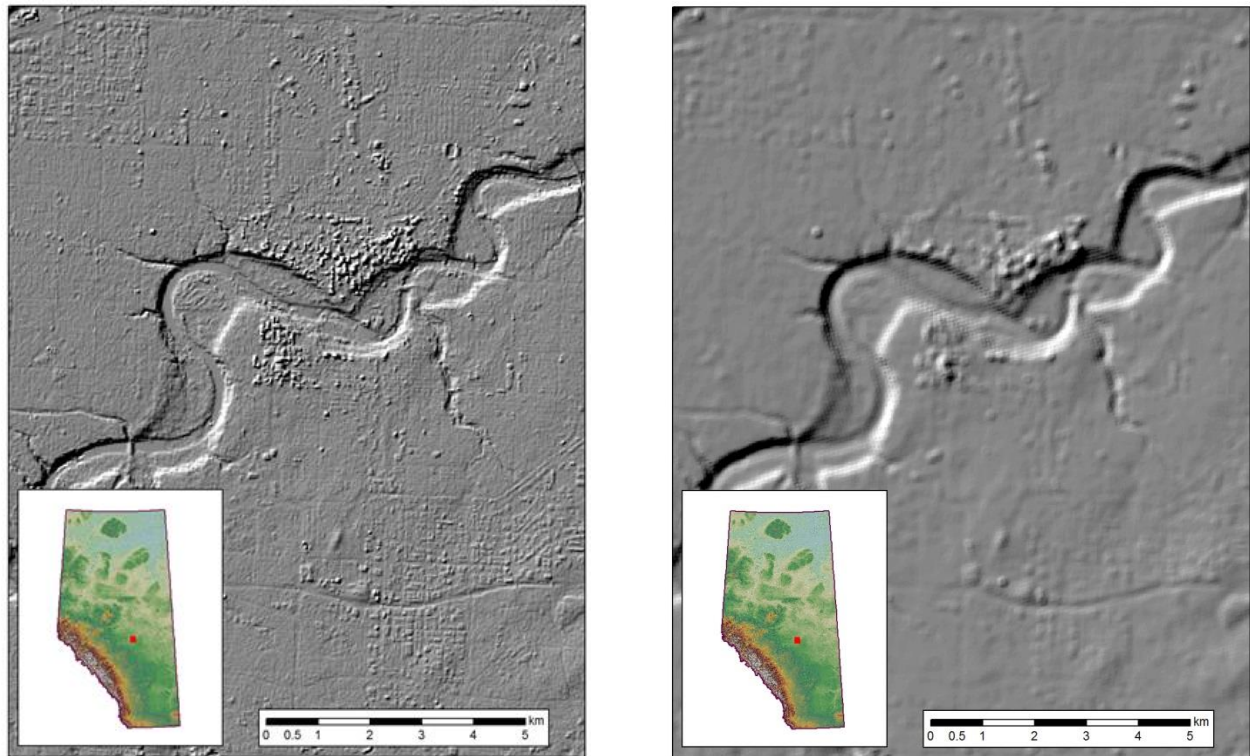

Figure 2: Hillshade relief map of ALOS DSM (left), and smoothed DSM (right).

1.3 Credits

The source data for this dataset was developed and distributed by the Japan Aerospace Exploration Agency (JAXA). The GIS post-processing and mosaicking for the province of Alberta was implemented by the ABMI's Geospatial Centre Research Team.

1.4 Citation

Two publications are listed on the JAXA website (not independent evaluations):

Generation of High Resolution Global DSM from ALOS PRISM
 J. Takaku, T. Tadono, K. Tsutsui, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2014

Precise Global DEM Generation By ALOS PRISM
T. Tadono, H. Ishida, F. Oda, S. Naito, K. Minakawa, H. Iwamoto, ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2014

1.5 Contact Information

If you have questions or concerns about the data, please contact:
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1.6 Keywords

Alberta, Digital Elevation Model, Digital Surface Model, ALOS

2. Use Limitations

This dataset is based on publicly available data from the JAXA website and may be freely used if properly cited.

Terms of use for the source data, according to JAXA website:
"This dataset is available to use with no charge under the following conditions.

- *When the user provides or publishes the products and services to a third party using this dataset, it is necessary to display that the original data is provided by JAXA.*
- *You are kindly requested to show the copyright (© JAXA) and the source of data when you publish the [data] using this dataset.*
- *JAXA does not guarantee the quality and reliability of this dataset and JAXA assume no responsibility whatsoever for any direct or indirect damage and loss caused by use of this dataset. Also, JAXA will not be responsible for any damages of users due to changing, deleting or terminating the provision of this dataset".*

(http://www.eorc.jaxa.jp/ALOS/en/aw3d30/#refer)

2.1 Open Sourced Data

This dataset contains data originating from open sources, which has subsequently been enhanced through computer processing. The open sourced data may be reproduced in whole or in part and in any form for educational, data collection or non-profit purposes without special permission from the ABMI provided acknowledgement of the source is made. No use of the open sourced data may be made for resale without prior permission in writing from the ABMI. By accessing the open sourced data, you agree to indemnify and hold harmless the ABMI and the ABMI's subsidiaries, affiliates, related parties, officers, directors, employees, agents, independent contractors, advertisers, partners, co-branders, and Open Sourced Data sources from any and all actions, proceedings, claims, demands, liabilities, losses, damages, and expenses which may be brought against or suffered by the ABMI or which it may sustain, pay or incur, arising or resulting from your violation of this clause. The Open Sourced Data is provided on an "As Is" and "As Available" basis and the ABMI does not guarantee that the Open Sourced Data will be suitable for your purposes or requirements. The ABMI further states that the Open Sourced Data is subject to change, and the ABMI gives no guarantee that the content is complete, accurate, error or virus free, or up to date. The ABMI disclaims all warranties, conditions, and other terms of any kind, whether express or implied, whether in contract, tort (including liability for negligence) or otherwise, including, but not limited to any implied term of satisfactory quality, fitness for a particular purpose, and any standard of reasonable care and skill.

2.2 Exclusive ABMI Sourced Data

N/A

3. Data Product Specifications

3.1 Spatial resolution

The original data provided by JAXA was at 1 arc-second resolution (~18m x 31m at center of province) which were mosaicked at 25m, and then resampled to 15m.

3.2 Processing Environment

Esri ArcGIS 10.1

3.3 Extents

West: -120.00˚
East: -110.00˚
North: 60. 00˚
South: 49.00˚

3.4 Resource Maintenance

The ALOS satellite was deactivated in 2011 due to a power anomaly and its successor, ALOS-2, does not have the optical capability of ALOS, so this dataset will not be updated with newer imagery.

3.5 Spatial Reference
NAD_1983_10TM_AEP_Forest
WKID: 3400 Authority: EPSG
Projection: Transverse Mercator
False Easting: 500000.0
False Northing: 0.0
Central Meridian: -115.0
Scale Factor: 0.9992
Latitude of Origin: 0.0
Linear Unit: Meter (1.0)
Geographic Coordinate System: GCS_North_American_1983
Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.0
Semiminor Axis: 6356752.314140356
Inverse Flattening: 298.257222101

4. Lineage
The derived Digital Terrain Model (DTM) should be considered preliminary as this is the first version of this dataset and methods are being developed to identify and substitute surface feature elevations with ground elevations.