A Preliminary Evaluation of Global Elevation Dataset AW3D30 in Taiwan

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ABSTRACT: AW3D is a global topographic dataset provided by Japan Aerospace Exploration Agency (JAXA). Among products with different resolution, AW3D30 is categorized as open data and available for online download. The horizontal resolution of this dataset is approximately 30-meter (1 Arc-Second). In this study, AW3D30 of Taiwan region is comparatively evaluated with two other global elevation datasets, namely, SRTM 1 Arc-Second Global elevation data released in July 2015 and GDEM V2 released on October 17, 2011. The SRTM product is based on the data collected in February, 2000. The preliminary analysis showed that while SRTM and GDEM agree fairly well with standard deviation of 9.84m, AW3D30 has large deviation from the other two in Taiwan. The most noticeable differences appear in the East portion of Taiwan. A strip pattern across central range from north to south in the elevation differences indicates that further investigation may be required.

1. INTRODUCTION

In December 1999, the launch of American Tera satellite started the earth observation mission of ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer), which is an imaging instrument onboard Terra. The VNIR subsystem consists of two telescopes--one nadir-looking with a three-spectral-band detector, and the other backward-looking with a single-band detector (http://asterweb.jpl.nasa.gov/index.asp). These two bands, identified as 3N and 3B, facilitate stereo observation and consequently constructing digital elevation models with photogrammetric means. The first version of the ASTER GDEM, released in June 2009, coverage spans from 83 degrees north latitude to 83 degrees south. The cell resolution is 30m. GDEM V2 was released on October 17, 2011 (https://asterweb.jpl.nasa.gov/gdem.asp). The other remarkable global digital terrain product is based on the data collected in the SRTM (Shuttle Radar Topography Mission) in 2000. The data released outside the United States was with approximately 90m resolution. Followed the White House announcement on Sept. 23, 2014, the global data with original resolution 30m was released by late 2015 (http://www2.jpl.nasa.gov/srtm/).

The Japanese ALOS-2 satellite was launched on May 24, 2014. The PRISM onboard ALOS-2 is capable of stereo viewing. The full name of PRISM is “Panchromatic Remote-sensing Instrument for Stereo Mapping”. Instead of two, PRISM has three telescopes and positioned respectively in forward, nadir, and backward. The image resolution at nadir is 2.5m (http://www.eorc.jaxa.jp/ALOS/en/about/prism.htm). In May 2015, the digital terrain product AW3D was released, and global coverage was available by May 2016 (http://www.eorc.jaxa.jp/ALOS/en/aw3d30/). Together with other line of products, the 30m resolution AW3D30 is categorized as open source. Free data download is provided. Tadono, et al. (2016) and Takaku, et al. (2016) documented the production and validation of AW3D. Santillana & Makinano-Santillana (2016) reported that the accuracy of AW3D30 is higher than SRTM and GDEM with reference data from Philippine. The intention of this study is to access AW3D30 in Taiwan area.

2. THE EVALUATION

Instead of using in-site reference data, this study compared AW3D30 with the latest release of SRTM and GDEM. The AW3D30 dataset of Taiwan area was downloaded on August 7, 2016. As shown in Figure 1, while the range of elevation is quite reasonable with SRTM and GDEM, a pattern of systematic error in the central and eastern region could be observed with AW3D30. Figure 2 is the colored elevation differences between SRTM and GEDM; AW3D and GDEM; AW3D and SRTM. The systematic patterns of AW3D30 with respect to both SRTM and GDEM are similar. Several statistics, the maximum value, the minimum value, the mean, and standard deviation are derived for both the original datasets and their differences, as shown in Table 1. While SRTM and GDEM agree with standard deviation of 9.8412m, AW3D is affected likely by the systematic error observed in Figure 1 and 2.

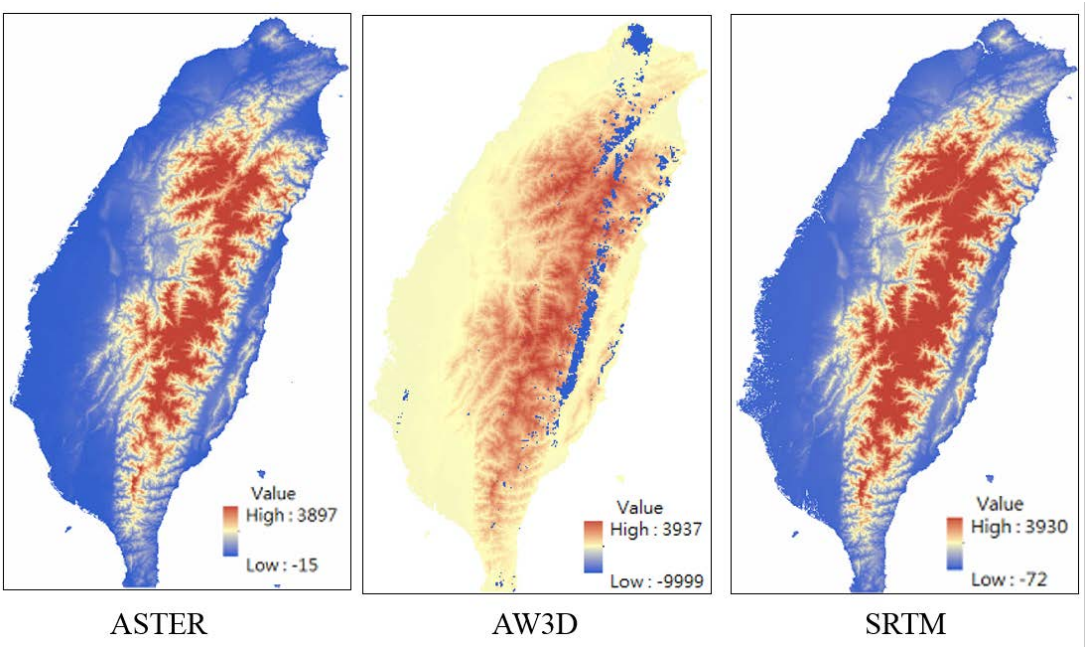

Figure 1: The Topography of Taiwan from ASTER, AW3D and SRTM dataset

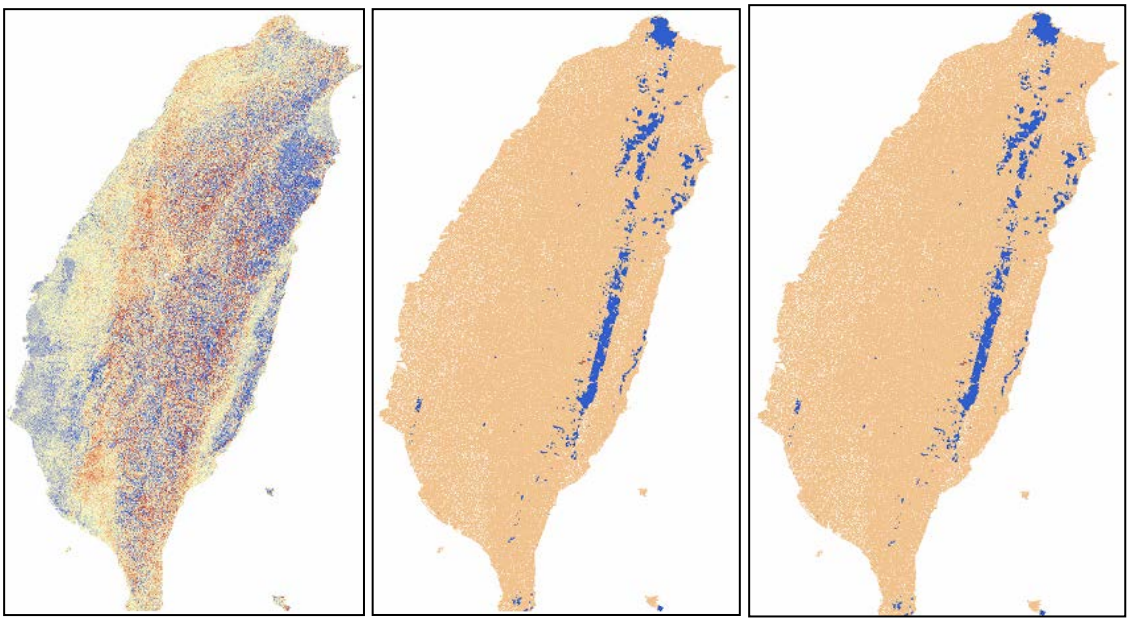
Figure 2: The Differences (from left: SRTM-ASTER; AW3D-ASTER; AW3D-SRTM)

Table 1: Statistics of Original Datasets and Differences

	Max	**Min**	**Mean**	**Std. Dev.**
SRTM DEM	3930	-72	354.8964	669.5043
ASTER GDEM	3897	-15	353.0720	671.2252
AW3D (-9999 removed)	3937	-88	340.2104	682.1557
SRTM-GDEM	281	-324	-1.4594	9.8412
AW3D-GDEM	2221	-13539	-212.4892	1506.6
AW3D-SRTM	2222	-13513	-210.9203	1506.4

3. CONCLUDING REMARKS

Global topographic data of open source is always inspiring and a real blessing. The availability of AW3D30 is expected to contribute to the science and many applications with great impact. Although this study revealed that the current content of AW3D30 for Taiwan area has significant systematic errors, it is anticipated that RESTEC and JAXA of Japan will have this fixed in near future. The production of large dataset requires tremendous work. The dedication and great contribution to the entire mankind from RESTEC and JAXA of Japan is gratefully acknowledged. The willingness of releasing data in a time effective manner also impressed this author. Meanwhile, this is also the fundamental spirit of open source. Let all the society work on the improvement and validation.

4. REFERENCES

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