Comparison of AMSR2 TPW products between JAXA and RSS

Keiichi Ohara[1)], Takuji Kubota[1)], Misako Kachi[1)], and Masahiro Kazumori[2)]

1)Japan Aerospace Exploration Agency, Japan, 2) Japan Meteorological Agency, Japan

Introduction

Water vapor is a key parameter to elucidate the mechanism of global climate and water cycle changes, because of ...

- The important greenhouse effect.
- The positive feedback on global warming
- The absorption and release of latent heat related to Earth's energy budget and other climate systems. (such as clouds and precipitation)

It is very important to observe and analyze water vapor globally, homogeneously, and continuously for a long period of time

AMSR-E and AMSR2 are spaceborne passive microwave radiometers, called the Advanced Microwave Scanning Radiometer (AMSR) series, aboard the Aqua satellite and the Global Change Observation Mission-Water (GCOM-W) "SHIZUKU", respectively. They …

- can estimate total columnar water vapor values, referred to as total precipitable water (TPW), over the ocean.
- can observe more than 99% of the Earth's surface in two days in all sky.
- have almost same observation orbits and similar sensor specifications
- have been observing the Earth for more than 19 years, from June 2002 to the present, except for a gap of about 10 months between the two observation periods.
- the GOSAT-GW satellite equipped with AMSR3, the successor to AMSR2, is scheduled for launch in Japanese Fiscal Year (JFY) 2023.

In the future, the importance of Climate Data Record (CDR) of water vapor observed by AMSR series, including observations by AMSR3, will become increasingly important.

In this study, we mainly compares AMSR2 TPW products estimated by Japan Aerospace Exploration Agency (JAXA), Remote Sensing Systems (RSS), and National Oceanic and Atmospheric Administration (NOAA). In particular, we investigate the time series, location and seasonal dependence of the differences of TPW between JAXA and RSS.

Data

Table 1. Data used in this work.

Data	Institution	Spatial Resolution	Range of data used in this work
AMSR2 TPW Level3 ver.2	JAXA	0.25×0.25 degree grid	July 2012 to December 2020
AMSR2 TPW Level3 ver.8.2	RSS	0.25×0.25 degree grid	July 2012 to December 2020
AMSR2 TPW Level2 ver.2	NOAA	converted to 0.25×0.25 degree grid	January 2013 to December 2018
GANAL	JMA	0.5×0.5 degree grid	August 2018
MGDSST	JMA	0.25×0.25 degree grid	August 2018

JAXA products were provided by G-Portal (https://gportal.jaxa.jp/gpr/). RSS products were provided by RSS Inc. website (http://www.remss.com/missions/amsr/). NOAA products were provided by Dr. Alsweiss of NOAA.

Result 1: Time Series Analysis

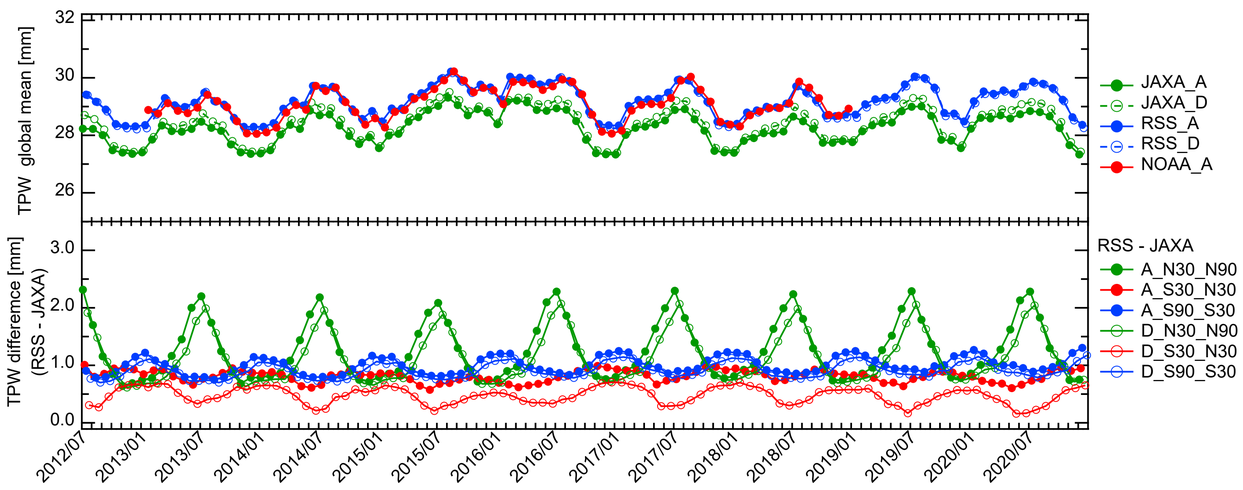

Fig. 1. Time series of AMSR2 TPW from July 2012 to December 2020

The global monthly mean values of …

- ✓ RSS and NOAA TPW products show almost same behaviors.
- ✓ JAXA TPW product is about 1mm smaller than the others.

The zonal mean of TPW differences (RSS - JAXA) are …

- ✓ over 2mm in every summer at 30° N -90° N (green).
- ✓ relatively small (about 1mm) and seasonal variations are also small at 30° S-30° N (red) and 30° S -90° S (blue).

Result 2: Horizontal distribution

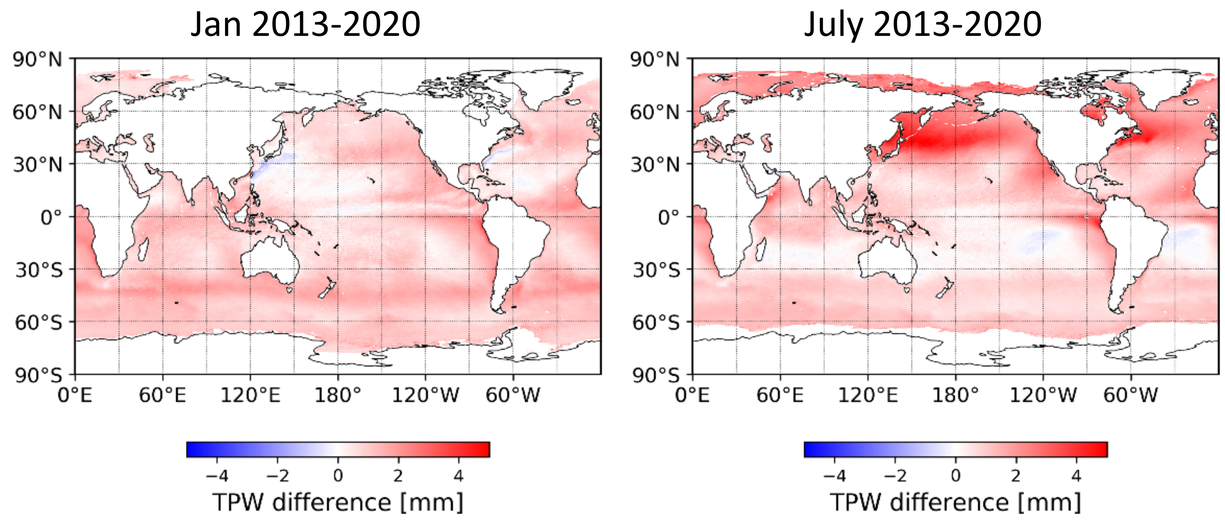

Fig. 2. Differences in TPW (RSS - JAXA) average of January (left) and July (right) during 2013 and 2020.

- ✓ In the northwest Pacific and Atlantic Oceans at 30-60° N, large TPW differences of nearly 4 mm (RSS - JAXA) are found only in August. The Similar differences were found in other months of the summer (June, August, and September).
- ✓ In the other areas, the differences in horizontal distribution are relatively small and the TPW differences are about 1mm.

Result 3: Correlation of TPW differences with other geophysical quantities

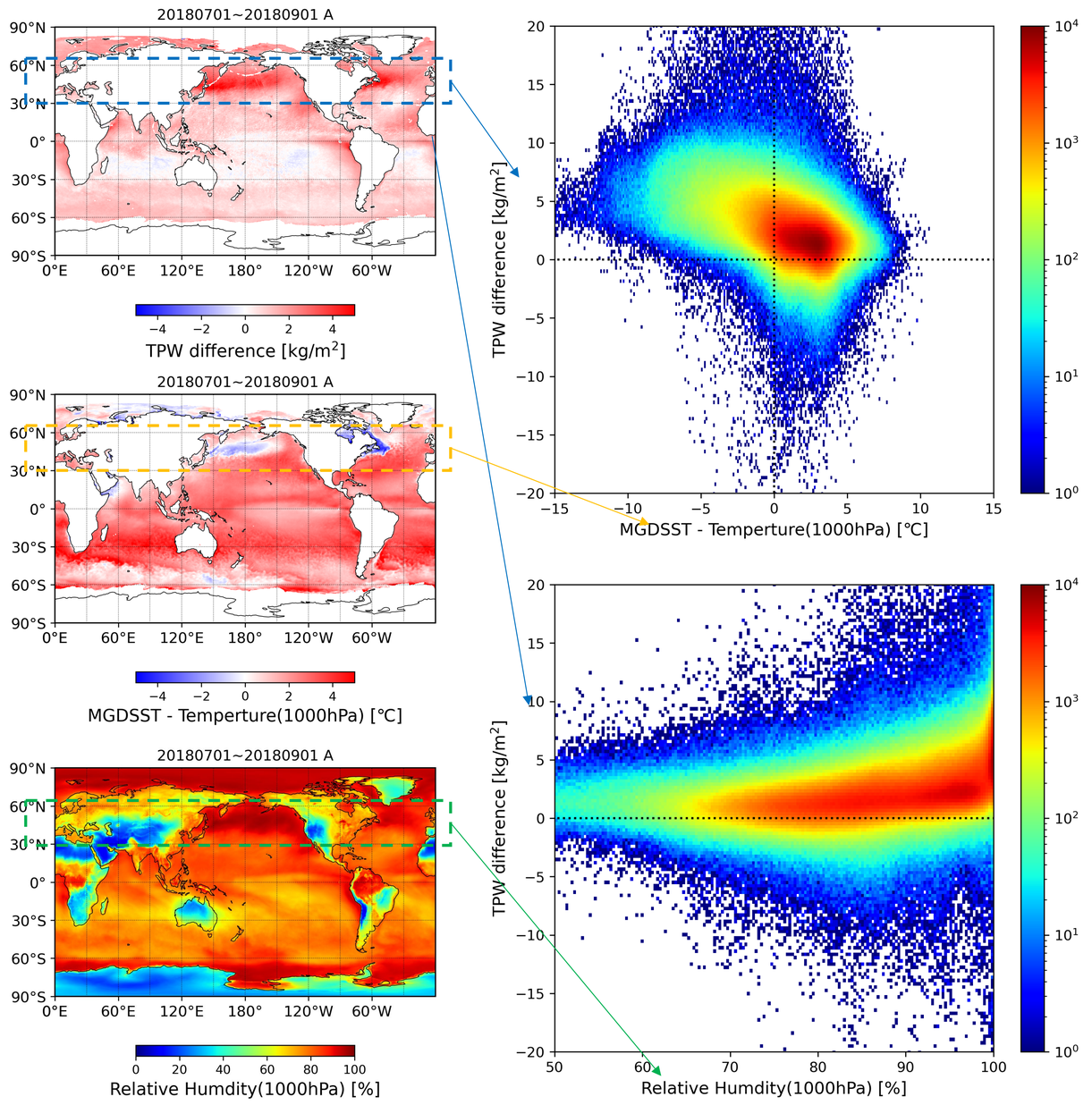

Fig. 3. Relationship between the TPW difference (RSS - JAXA) and the other geophysical parameters (difference between SST and surface air temperature and surface relative humidity) at 30-60° N from July to August 2018.

- ✓ The relationship between the TPW difference (RSS - JAXA) and the other geophysical parameters (SST, SSW, difference between SST and surface air temperature, and surface relative humidity) are investigated.
- ✓ The TPW difference (RSS-JAXA) is larger when SST is lower than the surface air temperature and the relative humidity is close to 100%.

Summary

- ✓ There are two types of TPW differences; a small difference of about 1 mm, which does not depend on season or region; and a large difference of more than 2 mm, which is observed at 30-60° N every summer.
- ✓ The large TPW difference (RSS – JAXA) was found to appear more frequently where SST was lower than the air temperature just above the sea surface and the relative humidity just above the sea surface was close to 100 %.