NASA/GSFC/Atmospheric Chemistry and Dynamics

Newsletter No. 11 2010

SHADOZ Notes

Southern Hemisphere Additional Ozonesondes

A NASA public archive of tropical ozonesonde profile data for remote sensing research, model studies and education

SHADOZ is a NASA project to augment and archive balloon-borne ozonesonde launches and to archive data from tropical and sub-tropical operational sites. The project was initiated in 1998 by NASA/Goddard Space Flight Center with other US and international co-investigators. There are currently thirteen stations launching ozonesondes in the SHADOZ network; Irene, Malindi, Cotonou, and Tahiti have stopped operations. The collective data set provides the first climatology of tropical ozone in the equatorial region, enhances validation studies aimed at improving satellite remote sensing techniques for tropical ozone estimations, and serves as an educational tool to students, especially in participating countries.

Data are public <http://croc.gsfc.nasa.gov/shadoz>

SHADOZ CD-ROM

To increase access to SHADOZ data beyond the internet, a cd-rom is available that mimics the website providing the bulk of the archival data from 1998 to 2008. Campaigns data are also included. Contact SHADOZ PI Anne M. Thompson at anne@met.psu.edu for a copy.

SHADOZ Participates in NDACC

One component of the Network for the Detection of Atmospheric Composition Chance (NDACC) is maintaining a high-quality global network of ozonesonde data for long-term trend studies and establishing a coherent set of standard operating procedures for ozonesondes. SHADOZ has been designated as a "Cooperating Network" under NDACC to foster greater collaborative measurement and analyses activities through mutual data access and representation.

For more information go to the NDACC website: http://www.ndsc.ncep.noaa.gov/

SHADOZ Contributes to the Validation of Japan's Space-borne Instrument SMILES

By Masatomo Fujiwara (Hokkaido University, Japan; fuji@ees.hokudai.ac.jp),
Françoise Posny (University of La Réunion, France) ,
and Masato Shiotani (Kyoto University, Japan)

On 11 September, 2009, a Japanese H-IIB rocket carrying the H-II Transfer Vehicle (HTV) was launched to transport a middle atmosphere instrument called SMILES to the International Space Station (ISS). SMILES stands for the Superconducting Submillimeter-Wave Limb Emission Sounder and was developed by the Japan Aerospace Exploration Agency (JAXA) and the National Institute of Information and Communications Technology (NICT) to make high sensitivity measurements of stratospheric constituents, such as ozone. SMILES was installed on the Japanese Experiment Module (JEM) of the ISS and started taking measurements on 12 October, 2009. Figure 1 shows a photograph of the SMILES taken from the ISS on 23 November 2009. More details of the SMILES can be found at http://smiles.tksc.jaxa.jp/indexe.shtml and Kikuchi et al. (2010).

SHADOZ has been supporting the SMILES validation by providing ozonesonde data. The SHADOZ station at La Réunion has been providing profile data within a few days of launching, allowing for quick internal checks of the data processing algorithm during the first half year of its operation. Figure 2 shows some examples of profile comparisons between SMILES and La Réunion between December 2009 and March 2010. It is shown that both measurements agree within ~10% between ~20 km and 28 km. The SMILES team is now working on a new data processing algorithm by considering the water vapor continuum more seriously, expecting better agreement below 20 km as well (Takahashi et al., 2010)

Kikuchi, K., et al. (2010), Overview and early results of the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES), *Journal of Geophysical Research*, submitted.

Takahashi, C., S. Ochiai, and M. Suzuki (2010), Operational retrieval algorithms for JEM/SMILES level 2 data processing system, *Journal of Quantitative Spectroscopy & Radiative Transfer*, 111, 160-173.

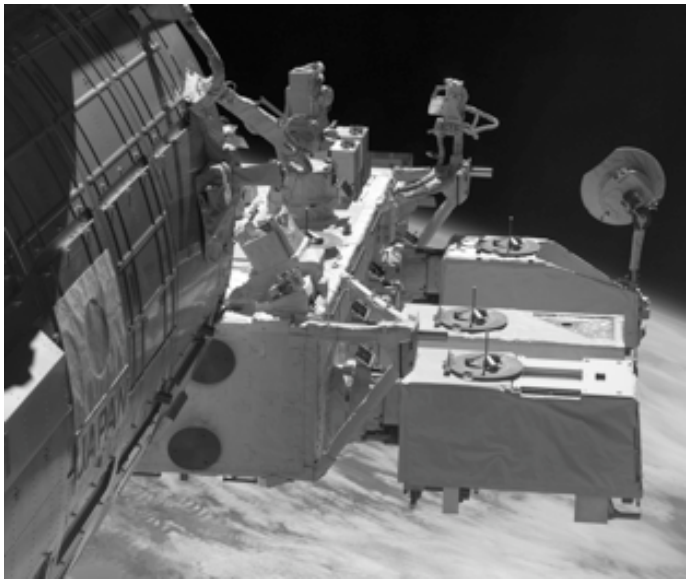

Figure 1. The SMILES instrument (the middle box to the right) aboard the JEM/ISS. Copyright NASA.

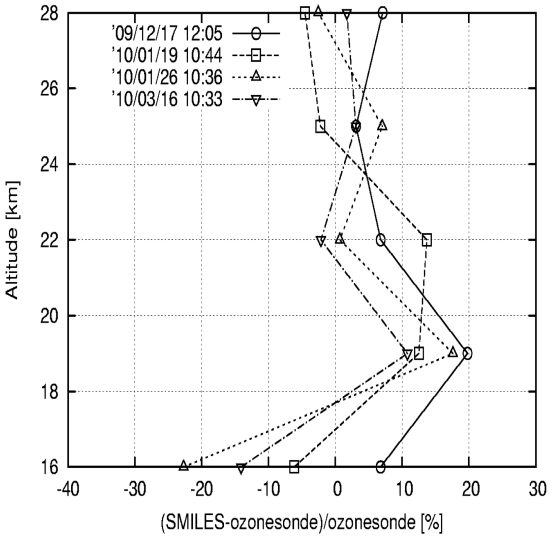

Figure 2. Comparison of 4 overpass ozone profiles between ozonesonde and the SMILES at/around La Réunion between December 2009 and March 2010. The overpass criteria are within 500 km and within 24 hours. The SMILES data used here are Level-2 Version 005-06-0032 data. The La Réunion ozonesonde data have been validated with the Aura Ozone Monitoring Instrument (OMI) total column ozone measurements

A Successful Change At La Réunion Island Station (21°S, 55.5°E)

By Françoise Posny (posny@univ-reunion.fr)) , Jean-Marc Metzger, and Jean-Luc Baray
(University of La Réunion, France)

Until September 2007, the meteorological radiosondes used at La Réunion station were RS80 Vaisala sondes (P,T,U measurements). Since then, they have been replaced by M2K2-DC Modem sondes (T,U,3D GPS position). Since 2008, three intercomparisons have been performed on 5 November 2008, 21 August 2009, and recently on 6 April 2010 . A balloon was launched with two ECC ozonesondes, one coupled to a RS80 Vaisala sonde and the other to a M2K2-DC Modem sonde for a dual flight. An example of the profile comparisons is presented in Figure 1 and shows a good agreement between ozone partial pressure values. For the three intercomparisons the difference of the total ozone value between the two profiles is less than 2% and the agreement with the Aura/OMI total column ozone amounts vary from 2% to 9%. The main difference between the two sondes is the pressure-altitude determination. The RS80 sonde measures the pressure and the altitude using the hydrostatic equation, while the M2K2 sonde measures the GPS altitude and the pressure is calculated with the same equation. For the RS80 sonde the uncertainty on the pressure is increasing with the altitude reaching 1000 meters at 10hPa while the uncertainty of the GPS position is 10 meters and constant with altitude. Differences in pressure-altitude values have been observed in the first intercomparison but not in the third one. These differences remain however within the range of the announced 1000 meters at 10hPa. The temperature profiles are in very good agreement. The largest difference is observed at the end of the 6 April 2010 profiles and is less than 3°C (see Figure 2). The relative humidity profiles are also in very good agreement between 0 and 10 km (1600 s). Above this altitude the RS80 sonde profile shows a "memory effect" of the humidity sensor which is not present in the M2K2 sensor. Figure 3 shows the relative humidity profiles of the 5 November 2008. In addition, the 3D GPS measurement from the M2K2-DC Modem sonde gives access to wind direction and speed which are two additional useful parameters. Further intercomparisons are planned to confirm these encouraging results.

More details about the M2K2-DC Modem sonde specifications can be found at http://www.meteomodem.com/htm/radiosondes.htm

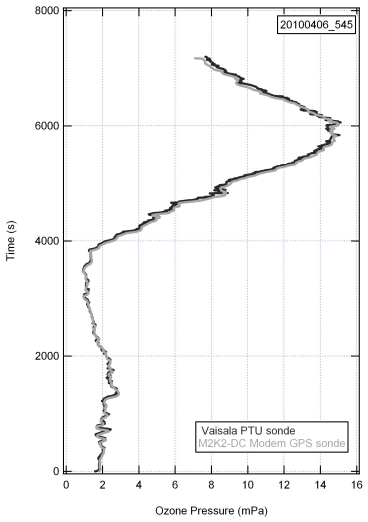

Figure 1 : Dual flight Ozone profiles of the 6 April 2010 (11:13 UT)

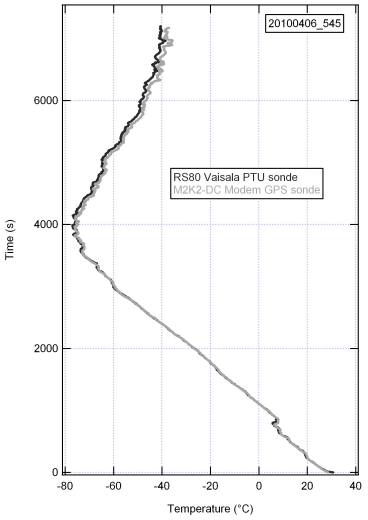

Figure 2 : Dual flight Temperature profiles of the 6 April 2010 (11:13 UT) showing the largest difference observed between the two types of sondes.

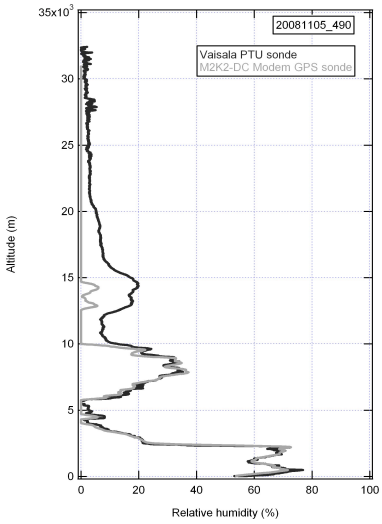

Figure 3 : Dual flight Relative Humidity profiles of the 5 November 2008 (05:48 UT)

From the PI Corner

As announced on the first page, SHADOZ has affiliated formally with the Network for the Detection of Atmospheric Composition Change, NDACC. This allows all Co-Investigators in SHADOZ access to data from the NDACC website. NDACC, an international consortium of researchers across more than a dozen nations, is charged with long-term ground-based measurements that track chlorofluorocarbons (as in AGAGE), as well as, ozone - all around the world. The NDACC affiliation is patterned after a formal agreement between SHADOZ and GCOS (Global Climate Observing System) in 2007. These linkages help maintain measurement networks that support international assessments and frameworks of WMO/GAW (World Meteorological Organization/ Global Atmospheric Watch). I was "accepted" into NDACC at its annual meeting in September 2009, hosted by NDACC Co-Chair Geir Braathen in Geneva. During the NDACC meeting, we had a field day in Payerne with our SHADOZ colleagues who work with the Nairobi station, Rene Stubi and Gilbert Levrat.

I made two other SHADOZ-related trips in the second half of 2009. In July I was hosted by Gert Coetzee of the South African Weather Service and I gave a lecture showing the importance of Irene soundings for tracking ozone pollution in the rapidly growing Gauteng-Mpumalanga region of South Africa. In late October 2009, SHADOZ was represented at the SPARC Steering Committee meeting hosted by Co-I Professor Masato Shiotani at Kyoto. I spoke about SHADOZ as a "strategic sounding network" at the SPARC Workshop that preceded the Steering Committee meeting. Thanks to Professor Shiotani and his colleagues Professors Masatomo Fujiwara and S. Hayashida for outstanding scientific exchange and hospitality.

— Anne Thompson

SHADOZ Notes is published for and about the data archive and stations. SHADOZ is supported by ACMAP an Aura NASA programs. Individual SHADOZ stations are supported by in-country agencies and universities.

The SHADOZ homepage provides technical information for each station and contact information. The station managers are responsible for the original data processing and should be consulted for details of their methods and appropriates references to their work.

SHADOZ Principal Publications

Thompson, A. M. et al., Southern Hemisphere Additional Ozonesondes (SHADOZ) 1998-2004 tropical ozone climatology. 3. Instrumentation, Station-to-station variability, evaluation with JOSIE-2000 results, J. Geophys. Res., doi:10.1029/2005JD007042, 2007.

Thompson, A. M., et al., Southern Hemisphere Additional Ozonesondes (SHADOZ) 1998-2000 tropical ozone climatology. 2. Tropospheric variability and the zonal wave-one, J. Geophys. Res., 108, 8241, doi: 10.1029/2002JD002241, 2003.

Thompson, A. M. et al., Southern Hemisphere Additional Ozonesondes (SHADOZ) 1998-2000 tropical ozone climatology. 1. Comparison with Total Ozone Mapping Spectrometer (TOMS) and ground-based measurements, J. Geophys. Res., 108, 8238, doi: 10.1029/2001JD000967, 2003.