Report from the 10th SPARC data assimilation workshop and the 2014 SPARC Reanalysis Intercomparison Project (S-RIP) workshop in Washington DC, USA

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The 10th SPARC Data Assimilation (SPARC DA) workshop and the 2014 SPARC Reanalysis Intercomparison Project (S-RIP) workshop were held together at the National Oceanographic and Atmospheric Administration (NOAA) Center for Weather and Climate Prediction (NCWCP) in College Park (Maryland, USA), close to Washington DC, from 8-12 September 2014. Days one and two were dedicated to scientific presentations and discussion related to SPARC DA activities, days four and five were dedicated to discussion on the progress of S-RIP and on day three a joint session between both activities was held. The 10th SPARC-DA workshop was one of a regular series (see **http://www.sparc-climate.org/activities/data-assimilation/**) that started in 2002 and had around 25 participants, while the 2014 S-RIP workshop was the first ever after a 2013 planning meeting (Fujiwara and Jackson, 2013) and also had around 30 participants. About 45 participants attended the joint workshop on day three.

The S-RIP activity emerged after discussions held at the 8th and 9th SPARC DA workshops and therefore it is only natural to have a shared location and week with workshops for both activities. Moreover, many people involved in one of the two activities were happy to participate in a one-day joint meeting with scientific talks about using and creating reanalysis data products.

Observation requirements and exploitation of new observations for stratosphere-troposphere data assimilation

Pawan Bhartia (invited) presented the capabilities and potential applications of the Ozone Mapping and Profiler Suite (OMPS) Limb Profiler (LP) launched in October 2011 for the study of atmospheric chemistry and dynamics. The OMPS LP measures limb scattered radiances and solar irradiances from 275-1050nm. The sensor employs three horizontally separated vertical slits to provide wider cross-track coverage. Ozone profiles are retrieved from cloud top altitude to 60km from 84°N-84°S during daylight hours with a vertical resolution of around 2km. The instrument also provides profiles of aerosols extinction at five wavelengths from cloud top altitude to 35km. OMPS LP version 2 Ozone data agree well with observations from Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS), Microwave Limb Sounder (MLS), and ozonesondes. The version 2.5 data, to be released in 2015, are supposed to show even better agreement. The end of the presentation highlighted the potential use of data assimilation of LP data along with total ozone provided by the Nadir Mapper (NM) and Cross-track Infrared Sounder (CrIS), also onboard OMPS. This would allow getting a good ozone analysis thanks to the good vertical resolution of LP in the stratosphere, the sensitivity of NM in the troposphere and the sensitivity of CrIS in the Upper Troposphere and Lower Stratosphere (UTLS).

Lawrence Coy discussed several improvements realized in the second release (planned for early 2015) of the Modern Era Retrospective analysis for Research and Applications (MERRA-2), a reanalysis covering the period 1979-2015. The tuning of the gravity wave parameterization has been improved and allows a much better model representation of the Quasi Biennial Oscillation (QBO) than in the model used in the first MERRA release. MERRA-2 also benefits from an upgrade of the orographic gravity wave scheme to better represent gravity waves over Southern Hemisphere islands. Other improvements come from new assimilated observations. Temperature profiles measured by MLS are now assimilated from 2004 onwards, reducing the high temperature bias in the mesosphere seen in MERRA. For example, during the period of the

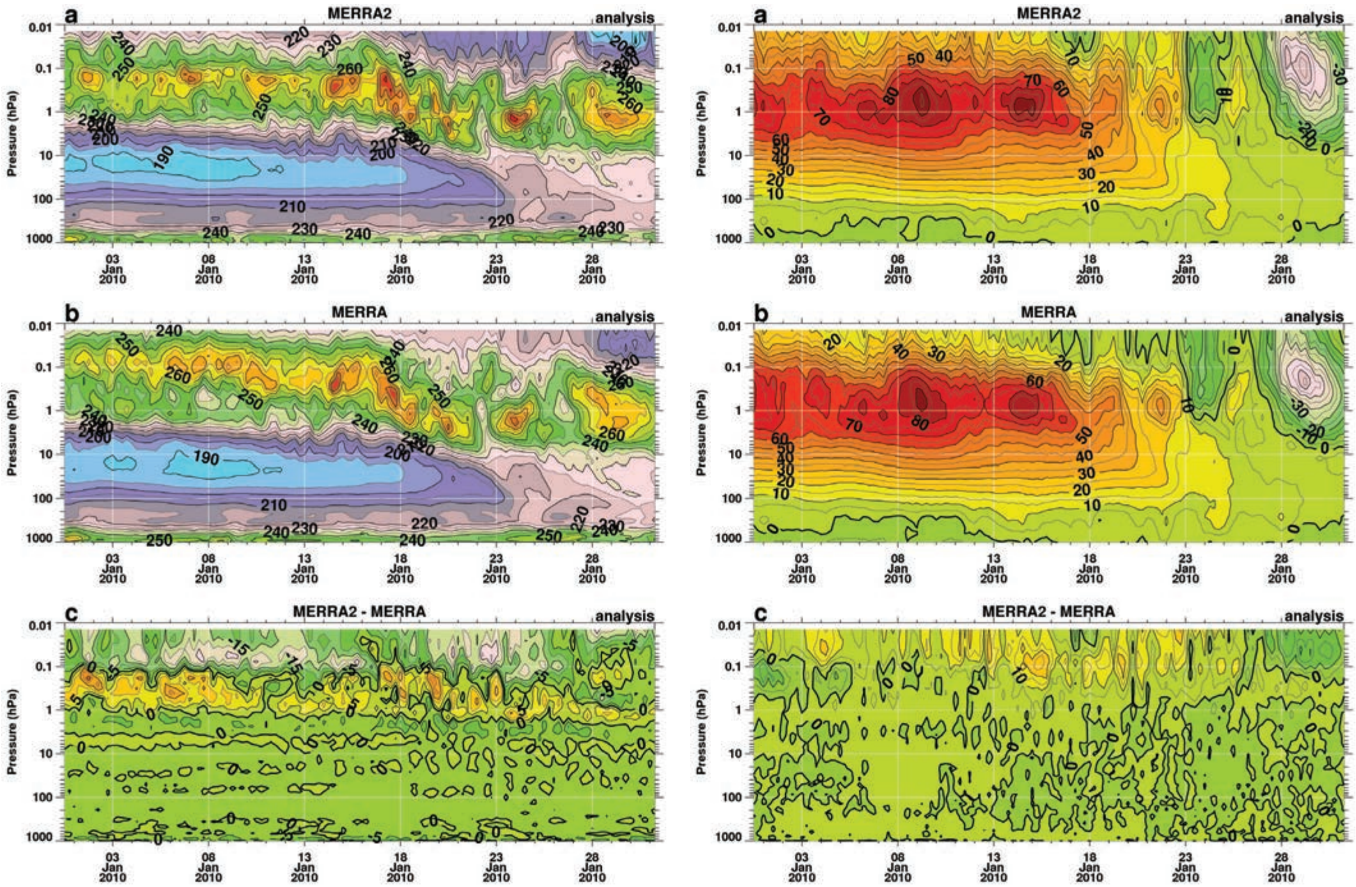

Figure 7: Time series of temperature averaged from 60°N-90°N (left) and zonal wind at 60°N (right) from MERRA-2 (top), MERRA-1 (middle), and their differences (bottom), for January 2010 when a stratospheric sudden warming occurred. (Provided by Lawrence Coy).

Stratospheric Sudden Warming in 2010 (see **Figure 7**), MERRA-2 shows a lower stratopause and cooler mesosphere than MERRA. Interestingly though, mesospheric zonal wind is stronger in MERRA-2 than in MERRA.

Troposphere/stratosphere/ mesosphere interactions: Stratosphere & Troposphere

Andrea Lang (invited) presented an overview and the current status of the SPARC Stratosphere Network for the Assessment of Predictability (SNAP) activity (Charlton-Perez and Jackson, 2012). The goal of SNAP is to understand the role of the stratosphere in numerical weather predictions. Several case studies have been defined and are being analysed with the different Numerical Weather Prediction (NWP) systems participating in SNAP. She showed results of predictability for the northern hemisphere sudden stratospheric warming (SSW) in early 2013. All the models failed to predict the warming 15 days in advance, and had a huge spread of zonal wind predictions at 10hPa and 60°N (60m.s^{-1} after 15 days). However, all models can essentially simulate the SSW if initialized 10 days in advance. By focusing on the 'best' and 'worst' ensemble members, she showed that all models struggle to simulate the amplification of wave-2 structure in the stratosphere, while amplification of wave-2 in the troposphere as well as amplification of wave-1 in both regions was relatively well resolved by the models.

Gloria Manney studied the effect of SSWs on the composition of the UTLS using meteorological analyses and satellite data. Six SSWs have occurred in the past decade and it was shown that during SSW years disturbances of the polar vortex lead to very early chlorine activation and substantial ozone loss in December and January. These disturbances were accompanied by changes in the patterns of upper tropospheric jets and the increased occurrence of multiple tropopauses. **Jean de Grandpré** evaluated the ozone predictability of the operational Environment Canada Chemical Data Assimilation (EC-CDA) system. Several numerical experiments were conducted using different ozone datasets, namely, data from MLS, Global Ozone Monitoring Experiment-2 (GOME 2) and Solar Backscatter Ultraviolet Radiometer (SBUV) instruments.

The experiments were evaluated in terms of their skill in forecasting ozone anomaly correlations. When coupling between the modelled ozone and radiation is considered, the system showed better stratospheric temperature forecasts when assimilating MLS ozone data. When assimilating GOME-2 instead of MLS, the gain in predictability is half a day after ten days of prediction. In the case of assimilating SBUV observations instead of GOME-2, the loss in predictability is greater than one day. Finally, removing the a priori ozone profile from the SBUV retrieval using averaging kernels did not significantly improve the forecast skill.

Using the coupled whole-atmosphere/ionosphere model of NOAA's Integrated Dynamics in Earth's Atmosphere (IDEA), **Houjun Wang** made the first 'weather forecast' (with this kind of model) of the January 2009 SSW. He used data assimilation up to 80km (the model upper boundary is at around 600km), with incremental analysis update, and no digital filtering to ensure accurate representation of tides. IDEA successfully predicts both the time and amplitude of peak warming in the polar cap region, with the 10-day forecast being superior to the standard NOAA NWP model (GFS). The observed impact of this SSW on the ionosphere includes enhanced (reduced) vertical drift velocity from the product of the electric and magnetic fields around 08-10Z (10-14Z), and IDEA seems to represent this well. The drift velocity changes and associated changes in ionospheric total electron content are related to changes in lower thermospheric tides. The forecast of the semi-diurnal, westward-propagating zonal wave number 2 (SW2) tide in zonal wind also shows an increase in amplitude and a phase shift to earlier hours in the equatorial dynamo region during and after the peak warming, before recovering to prior values about 15 days later. The SW2 amplitude and phase changes were shown to likely be due to changes in stratospheric circulation and associated stratospheric ozone changes.

Richard Ménard presented results from a study group looking at the added value of upper-tropospheric and stratospheric chemical data assimilation. While chemical data assimilation systems are more and more mature and despite the high number of observations available in these regions, few applications of these analyses have been found. This group, supported by the International Space Science Institute (ISSI) in Bern, Switzerland, is based on assimilators and potential users. Potential products are a reanalysis of methane and CFCs to make a linearized chemical scheme to be used in climate models (see also the summary of Quentin Errera's talk below).

Troposphere/stratosphere/ mesosphere interactions: Upper Atmosphere

John McCormack (invited) discussed the recent progress of the Naval Research Laboratory (NRL) NWP systems at high altitude. He showed that assimilation of radiances from SSMIS (Special Sensor Microwave Imager/ Sounder) was able to constrain mesospheric temperature nearly as well as profile assimilation of MLS and SABER (Sounding of the Atmosphere using Broadband Emission Radiometry). John also showed how a new linearized water vapour photochemical scheme significantly improved the water vapour analysis in the stratosphere and mesosphere, reducing model temperature biases through a better representation of infrared radiation and enabling assimilation of additional radiance observations from IASI (Infrared Atmospheric Sounding Interferometer). Last but not least, he noted that many scientists are concerned by the lack of plans for new limb sounders, but also mentioned the lack of plans for future upper atmospheric radiance sounders like SSMIS.

David Jackson presented an extension of the UK Met Office Unified Model (UM) to the thermosphere, which is aimed at improving space weather forecasts in the long term. Development of the UM is focused on two areas. One concerns lifting the model lid up to 120-140km to allow better coupling between the lower and upper atmosphere and to enable assessment of the UM tidal climatology against meteor radar and other observations. Initial UM simulations with UM lids at 100km and 120km are promising, but there are issues regarding tuning of the model non-orographic gravity waves scheme and with model stability. The second area focuses on improvement of the dynamical core of UM above 120km. Idealized tests show that the representation of acoustic waves are challenging in this region.

Valery Yudin discussed data analysis and whole atmosphere predictions calculated with the chemistry-climate model WACCM. He highlighted the need for profile assimilation to reproduce vertical structures of observed ozone laminas and severe ozone losses as, for example, during the 2011 Arctic winter. Valery also presented results from a new version of WACCM with the lid extended from 140km to 500km. Using observations from the TIMED (Thermosphere Ionosphere Mesosphere Energetics and Dynamics) and GPS (Global Positioning System) TEC (Total Electron Content), he evaluated WACCM simulations where the dynamics was specified by meteorological analysis in the lower atmosphere. This simulation was able to reproduce several observed features like tidal variability in the ionosphere-thermosphere during various SSW events between 2006 and 2013.

DA Methods

Karl Hoppel explored the background forecast error covariances of the middle atmosphere as simulated by the NRL NWP system. Forecast error covariances were estimated using two methods: (1) forecast field differences at 24 and 48 hours and (2) a random observation denial method. A rapid increase in error variance in the mesosphere was observed, along with unexpectedly large horizontal correlation patterns. The breakdown of geostrophic correlation at small scales (<1000km) was also observed in the mesosphere. By performing a spectral decomposition of analysis errors, the predictability limit as a function of resolution was inferred (**Figure 8**). The skill-resolution was found to decrease with increasing altitude, reaching values of around six degrees (wavenumber 30) in the upper mesosphere for temperature, and similar values for vorticity and divergence.

Data assimilation products in support of SPARC activities

Michaela Hegglin (invited) discussed the value of data assimilation products for the IGAC/SPARC Chemistry Climate Model Initiative (CCMI). Two examples using the Canadian Middle Atmosphere Model (CMAM) nudged to ERA-Interim reanalysis were discussed. The first presented a study of stratospheric ozone between 1960 and 2010 (Shepherd *et al.*, 2014). Thanks to model simulations using evolving and fixed amounts of ozone depleting substances, several remaining questions about observed ozone trends could be answered and the onset of ozone recovery identified. In the second example (Hegglin *et al.*, 2014), a CMAM simulation was used as a transfer function between different satellite water vapour datasets in order to remove biases between instruments and to create a long-term (mid-1980 to 2010) water vapour record for the stratosphere. A negative trend is found in lower/mid-stratospheric water vapour, implying that the positive trend observed in balloon observations over Boulder (USA) is not globally representative. In the upper stratosphere, the water vapour trend is positive. The difference in sign between the trend in the lower and upper stratosphere was attributed to changes in the Brewer Dobson circulation (BDC). Together, these two examples highlighted not only the high quality of the ERA-Interim reanalysis, but also revealed an inhomogeneity where GPS Radio Occultation observations started to be fed into the assimilation system.

Simon Chabrillat presented the Near Real Time (NRT) ozone analyses delivered by the European

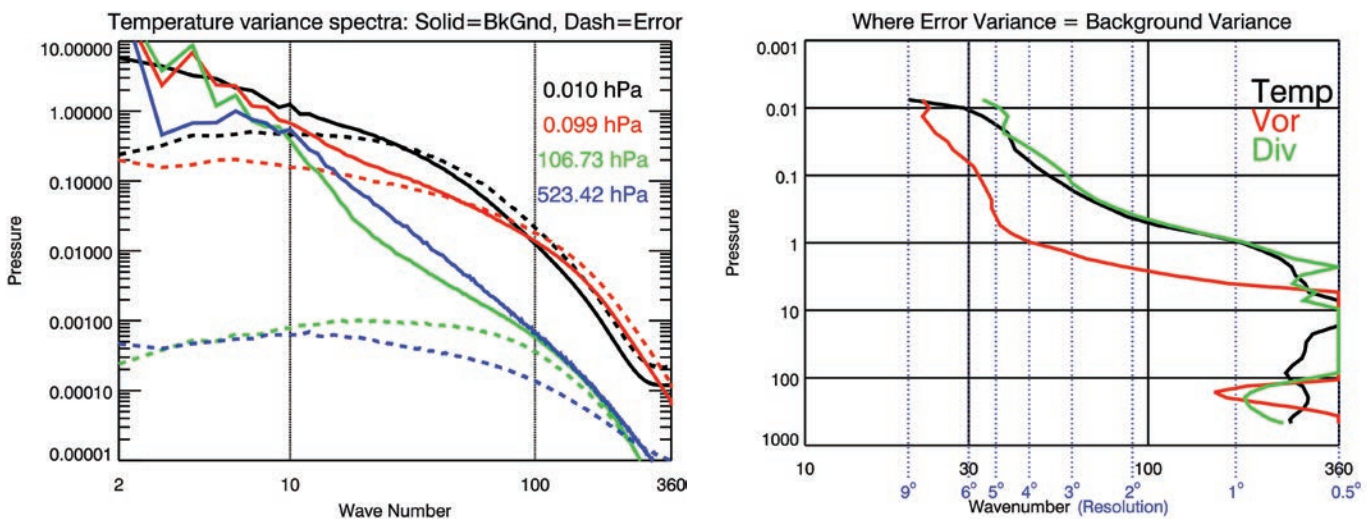

Figure 8: (left) Average power spectra for temperature forecast (solid line) and temperature analysis error (dashed lines) for several pressure levels. (right) Limit of predictability, defined as the wavenumber where the error variance exceeds the forecast variance. Analysis errors for temperature (black), vorticity (red), and divergence (green) were estimated as the difference between two December 2011 analyses produced from a random-observation denial experiment. (Provided by Karl Hoppel).

project MACC (Monitoring Atmospheric Composition and Climate). Due to NRT constraints, the system assimilates the NRT MLS ozone observations delivered three hours after measuring time and not the scientific MLS ozone data delivered around four days later. Due to the differences between these MLS datasets, the latter providing a better product, ozone fields from MACC are found to be of lower quality than those expected if the system could afford a four day delay (Lefever *et al.*, 2014).

Kris Wargan investigated the occurrence of Tropopause Inversion Layer (TIL) in the Goddard Earth Observing System version 5 (GEOS-5). Past studies have shown that the TIL is well represented in models but is erased in meteorological analysis by coarse assimilated data. GEOS-5 and more recent NWP systems exhibit the TIL correctly and numerical experiments performed with GEOS-5 demonstrate that the TIL is indeed erased if low spectral resolution data, such as from the Advanced Microwave Sounding Unit A (AMSU-A), are assimilated exclusively. It was shown that the use of hyperspectral radiance data and conventional observations in GEOS-5 is critical for reproducing the feature. In fact, full data assimilation with GEOS-5 leads to a TIL that is sharper (and closer to radiosonde observations) than the model-only simulation.

Using different NWP reanalyses, **Jianjun Xu** compared stratospheric temperature trends for the 1979-2005 period from radiosondes, satellite microwave radiances, and model simulations of the Coupled Model Intercomparison Project (CMIP) phase 3 and 5. He also compared the spread of trends based on the variability in the different datasets. His analysis revealed that reanalyses overestimate tropospheric warming and underestimate stratospheric cooling compared to that observed by radiosondes. Variability between the different reanalyses is also much higher than that present in the different radiosonde datasets.

Another trend evaluation using different reanalyses was done by **Toshiki Iwasaki**, who compared the evolution of the polar cold air mass (PCAM) in the troposphere. PCAM is defined as the quantity of air with a potential temperature below 280K and is a good indicator of the life cycle of polar cold air, from generation to disappearance. In the northern hemisphere winter, all reanalyses show a negative PCAM trend, on average decreasing by 5% over the past 50 years. This quantity seems to be sensitive to climate change. In the southern hemisphere winter, the PCAM trend is less consistent between different reanalyses, probably because of sparse surface and radiosonde data available for the assimilation procedure.

Craig Long presented preliminary test results from assimilation of Stratospheric Sounding Unit (SSU) and AMSU radiances into the National Center for Environmental Prediction (NCEP) Global Forecast System (GFS). The tests were being conducted to address issues in the Climate Forecast System Reanalysis (CFSR) during the transition from the SSU to the AMSU radiances in October 1998. Issues with the CFSR associated with radiance assimilation in the stratosphere included: breaking up the reanalysis into six streams, bias correction of SSU Channel 3, and not assimilating AMSU Channel 14. Other reanalyses handled this transition in different ways, switching immediately over from the SSU to AMSU in 1998 or assimilating both for an extended period of time. The greatest temperature impacts from this transition occurred above 10hPa. The test runs showed that transitioning immediately from the SSU to the AMSU resulted in warmer temperatures above 2hPa and cooler temperatures from 10-2hPa. Assimilating both SSU and AMSU radiances reduced the respective warming and cooling by about 50%.

Joint SPARC-DA/S-RIP workshop

Quentin Errera presented a first effort in producing a chemical reanalysis of stratospheric composition based on assimilation of MLS and MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) observations for the period between 2007 and 2012. This study uses the Belgian Assimilation System for Chemical ObsErvations (BASCOE) where 13 chemical species are assimilated: O_3, H_2O, CH_4, N_2O, HNO_3, NO_2, N_2O_5, $ClONO_2$, HCl, ClO CFC-11, and CFC-12. While the reanalysis agrees relatively well with independent observations, several issues were pointed out, in particular 'zigzags' in the CH_4 profile in the lower tropical stratosphere coming from the observations as well as temporal inconsistencies resulting from temporal inconsistencies in the observing systems.

Chiaki Kobayashi evaluated the BDC in the Japanese 55-year Reanalysis (JRA-55) family, *i.e.*, JRA-55, JRA-55C (which assimilated conventional observations only; Kobayashi *et al.*, 2014), and JRA-55AMIP (with the same forecast model as JRA-55 and JRA-55C but without data assimilation). She showed that seasonal variations of the JRA-55 BDC compare well with those from ERA-Interim, which was not the case with the previous JRA-25 product. However, the time series of troposphere-stratosphere mass exchange is different; over time the mass exchange increased in JRA-55 and decreased in ERA-Interim. The BDC in the JRA-55AMIP data was found to be weaker than that in either the JRA-55 or the JRA-55C data. Model experiments suggested that improving the gravity wave parameterization so that the forecast model would spontaneously produce a QBO may result in strengthening the BDC.

Zac Lawrence showed a comparison between MERRA and ERA-Interim based on diagnostics related to the formation of polar stratospheric clouds, chlorine activation, and the destruction of stratospheric ozone. Temperature in the winter polar vortex is usually lower in MERRA than in ERA-Interim prior to 2002 and *vice versa* thereafter. This is due to differences in the assimilated observing systems used in both reanalyses. MERRA also exhibits larger regions of cold air, while ERA-Interim exhibits more cold days and larger polar vortices. Will the choice of MERRA or ERA-Interim strongly influence polar processing studies? In the early years (prior to 2002), the answer is yes.

Siddarth Das presented a comparison of *in situ* radiosonde and rocketsonde observations with different reanalyses (MERRA, ERA-40, ERA-Interim, and NCEP-II) over Thumba, India (8.5°N, 76.5°E). Features like the QBO and tropical easterly jet compared well between reanalyses and observations. The zonal winds also agree well up to 30km, however, for the meridional wind agreement is only good below the tropopause. Also comparing several reanalyses (ERA-Interim, MERRA, and JRA-55), **Bernard Legras** focused on the BDC based on age-of-air calculations. Compared to previous generations of reanalyses *(e.g.* ERA-40), agreement with observations is much better. However, in the northern hemisphere reanalyses still disagree and it is not clear how to reduce these differences.

Representing the SPARC temperature trend activity, **Dian Seidel** discussed satellite observations of stratospheric temperature and presented preliminary results of an intercomparison of climate data records (CDRs) from meteorological sounders including MSU (Microwave Sounding Unit) channel-4, three channels of SSU, and four channels of AMSU spanning 1979-present. Despite recent revisions of SSU CDRs motivated by an earlier study (Thompson *et al.*, 2012), differences remain between two versions of the SSU data and among the three versions of MSU data. Empirical orthogonal function analyses revealed significant vertical and latitudinal structure in the main patterns of stratospheric temperature variability, with the polar regions accounting for a very high fraction of interannual variability. For some channels, volcanic signals were also evident and interestingly, long-term trends did not appear to account for much of the variability. Also motivated by the Thompson *et al.* (2012) study, **Cheng-Zhi Zou** presented a recalibration and re-adjustment of the level 1c SSU data, which were affected by a space view anomaly. These revised SSU temperature trends are shown in **Figure 9.**

The end of the session saw four presentations about recent updates being carried out by the different reanalysis centres. **Steven Pawson** discussed the status of MERRA-2 at NASA, which is in production phase and is expected to be released in February 2015. Compared to MERRA, the new version will benefit from modern radiance data types, an update of the SSU data used, the inclusion of temperature and ozone profiles from MLS (from 2004 onwards), as well as various model improvements (see also the contribution of Lawrence Coy above). **David Tan** discussed the future ECMWF reanalysis which will replace ERA-Interim. This reanalysis will benefit from reprocessed observations and an improved model version, both of which are expected to deliver, amongst many things, a better representation of SSWs. **Craig Long** discussed the status of the four NOAA reanalysis efforts: NCEP/NCAR, NCEP/DOE, NCEP/CFSR, and ESRL/20CR. NOAA has also just begun plans to create a new reanalysis as part of its next version of the Climate Forecast System. This reanalysis would be generated in the 2018-2020 timeframe. A new version of 20CR and updates of other the NCEP/NCAR reanalyses are also in the early planning stage. **Yayoi Harada** presented some aspects of the new JRA-55 reanalysis with respect to the older JRA-25 reanalysis. In particular, he showed that JRA-55 reduced the cold bias in the stratosphere and significantly improved temporal consistency compared to JRA-25. The consistency of atmospheric flow in the stratosphere is also improved in terms of the momentum budget. As discussed above, the Japanese Meteorological Agency has also produced two other reanalyses, JRA-55C and JRA-55AMIP, whose data will also soon be available for scientific use.

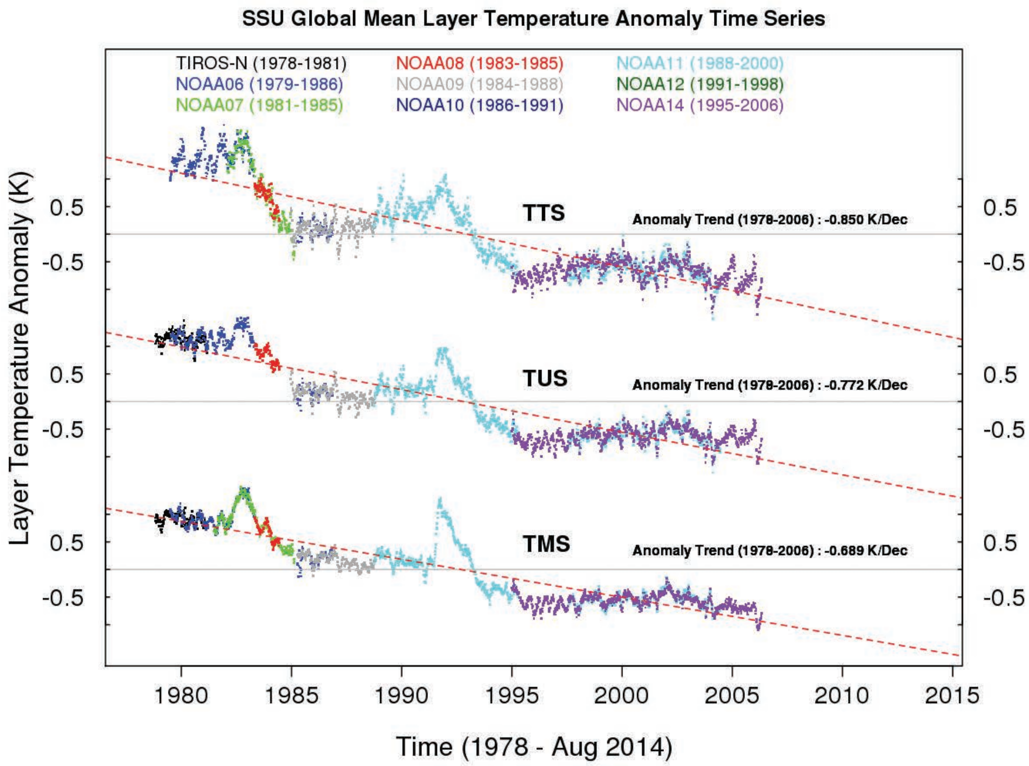

Figure 9: SSU global mean anomaly time series and trends for layer temperatures of mid-stratosphere (channel 1), upper-stratosphere (channel 2), and top-stratosphere (channel 3) after recalibration and adjustment of multiple instrument drifting effects of the level 1c radiances. (Provided by Cheng-Zhi Zou).

Seven posters were also presented during the workshop. **Simon Chabrillat** compared Chemistry Transport Model (CTM) simulations driven by two different reanalyses: MERRA and ERA-Interim. **Young-Ha Kim** compared equatorial stratospheric waves and the QBO momentum budgets of ERA-Interim, MERRA, JRA-55, and CFSR. **Craig Long** displayed two posters comparing these same four reanalyses focused on temperature and zonal wind in the stratosphere. **Takatoshi Sakazaki** compared stratospheric temperature tides between the same four reanalyses as well as NOAA 20CR. In addition to the four above-mentioned reanalyses, **Seok-Woo Son** also considered NCEP-NCAR, NCEP-DOE, JRA-25, and ERA-40, and evaluated their consistency in terms of momentum diagnostics. Finally, **Masakazu Taguchi** compared the interannual variability in northern stratospheric winter using the same eight reanalyses as well as NCEP 20CR.

Report from the S-RIP workshop

At the S-RIP planning meeting held in 2013 (Fujiwara and Jackson, 2013), it was decided that annual S-RIP workshops would be held until 2018, when the final full report is planned for publication. The main purpose of these annual workshops is to discuss progress and current issues facing each chapter of the planned S-RIP report. On day three, **Masatomo Fujiwara** presented an overview of S-RIP and chapter 1 (Introduction) and **David Tan** presented the progress of chapter 2 (Description of the Reanalysis Systems). On day four, **Craig Long** discussed chapter 3 (Climatology and Interannual Variability of Dynamical Variables), **Sean Davis** and **Michaela Hegglin** discussed chapter 4 (Climatology and Interannual Variability of Ozone and Water Vapour), **Thomas Birner** and **Beatriz Monge-Sanz** discussed chapter 5 (Brewer-Dobson Circulation), **Edwin Gerber** discussed chapter 6 (Stratosphere-Troposphere Coupling), **Gloria Manney** and **Cameron Homeyer** discussed chapter 7 (Extra-tropical Upper Troposphere and Lower Stratosphere), and **Jonathon Wright,** on behalf of the chapter leads Susann Tegtmeier and Kirstin Krüger, discussed chapter 8 (Tropical Tropopause Layer). On day five, **James Anstey** discussed chapter 9 (Quasi-Biennial Oscillation and Tropical Variability), **Michelle Santee** discussed chapter 10 (Polar Processes), and **Diane Pendlebury** and **Lynn Harvey** discussed chapter 11 (Upper Stratosphere and Lower Mesosphere). Rapporteurs were assigned for each chapter and they made brief summary presentations at the end of the workshop.

The S-RIP 'Interim' Report, covering the 'basic' chapters (1-4) will be completed and published in 2015. Discussion also focused on the actual procedures in terms of producing the report. It was also agreed that by mid-2015 a zeroth-order draft would be prepared for the 'advanced' chapters (5-11).

Discussion and next workshop

David Jackson officially stepped down as chair of the SPARC DA activity and co-lead of S-RIP in April 2014. Quentin Errera has replaced him as SPARC DA lead while David Tan was approved as new S-RIP co-lead at the workshop (prior to the workshop, Masatomo Fujiwara, the other S-RIP co-lead, had proposed him as candidate). It was also agreed that the next SPARC DA workshop would again be held jointly with the next S-RIP workshop in fall 2015, in coordination with other SPARC-related workshops.

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Vladimir Ryabinin – SPARC liaison at WCRP Joint Planning Staff: 2002-2015

Vladimir joined the WCRP Joint Planning Staff (JPS) in November 2001 with the primary responsibility of taking care of polar and cryospheric research, in particular the Climate and Cryosphere (CliC) core project that had just been established in 2000. When Roger Newson retired in 2002, Vladimir took over the responsibility of SPARC at the WCRP. Since then, Vladimir has been a vital supporter of SPARC and was integral in helping SPARC evolve into an even better project during his tenure. His warm smile, approachability, and great wisdom, will be missed by the many who had the wonderful opportunity of interacting with him.

Vladimir will be taking up a new position as executive secretary at the UNESCO Intergovernmental Oceanic Commission in Paris as of March 2015. The entire SPARC community thanks Vladimir for all his hard work and friendship and wishes him every success in his new position!

Boram Lee, who before joining the WCRP worked for the Marine Meteorology and Oceanography Programme of the WMO, is the new SPARC liaison. We all look very much forward to working with Boram and wish her all the best for the new beginnings at WCRP!

by Fiona Tummon, SPARC Director