



## **TOAR Workshop 1.03**

January 25-27, 2016

Xijiao Hotel, Beijing, China

## **Workshop Summary**

*Written and approved by the TOAR Steering Committee, February 15, 2016*

TOAR Workshop 1.03 (the third workshop of the first TOAR initiative) was held at the Xijiao Hotel in Beijing China, January 25-27, 2016. The workshop received logistical and financial support from the Research Center for Eco-Environmental Sciences (RCEES) at the Chinese Academy of Sciences, Nanjing University, NOAA ESRL's Chemical Sciences Division, the World Meteorological Organization and the International Global Atmospheric Chemistry (IGAC) Project. The workshop was coordinated by Owen Cooper and Christine Ennis (University of Colorado/NOAA ESRL, Boulder), Zhaozhong Feng (RCEES) and Aijun Ding (Nanjing University) and attended by 45 scientists from around the world (see attendance list at the end of this summary).

The workshop had five primary goals:

- 1) Review the first draft of the seven chapters comprising the assessment report.
- 2) Produce revised outlines of each chapter for the second-draft review scheduled for September 2016.
- 3) Update the TOAR community on the status of the TOAR database and identify new and missing datasets to be uploaded to the database by April 30, 2016.
- 4) Initiate the detailed planning of the TOAR surface ozone data analysis to inform chapters 4, 5, and 6.
- 5) Provide an opportunity to the TOAR community to learn about ozone-related research in China through a short symposium of leading Chinese scientists.

The workshop began on Monday with a plenary session in which each chapter lead author (or their representative) gave a 20-minute presentation on the first-draft contents of their chapter. The presentation was then followed by a 20-30 minute group discussion on the progress of each chapter to identify any errors or weaknesses and to flag portions of the chapters that were covering topics found in other chapters. Inconsistencies between chapters were also identified. Suggestions were made as to how the chapters can coordinate complementary or dependent analyses. Two sets of breakout sessions on Tuesday allowed the chapter authors to revise their chapter outlines and work assignments in accordance with the recommendations made during the plenary sessions and the internal review (comments posted to the TOAR wiki). Two additional sets of breakout sessions on Wednesday combined chapter teams to allow them to discuss synergies and inconsistencies between their chapters. The workshop concluded with a presentation by each chapter lead that described the chapter revisions that occurred during the workshop and presented the updated outline that will guide the writing of the second draft. The revised outlines with updated author assignments will be posted to the TOAR wiki by February 15, 2016.

All chapters greatly benefitted from the workshop comment and revision activities with 6 of the 7 chapters largely on track to fulfill their original target outline with relatively minor course corrections. Changes mainly focused on how to improve synergies and eliminate inconsistencies between chapters. The exception was Chapter 1. Discussions during the workshop and comments on the first draft posted to the TOAR wiki prior to the workshop led to a major restructuring of the chapter. The topic remains the photochemical, meteorological and depositional processes that govern the tropospheric present-day ozone budget, but the chapter has been focused to

provide the information required to assess the likely changes in the ozone budget that will occur by 2030 if the world continues to follow an increase in global ozone precursor emissions similar to RCP8.5. Guidance on this evolution is provided by the ACCMIP model ensemble projections for 2030, based on RCP8.5.

Martin Schultz (Forschungszentrum Jülich) gave an update on the TOAR database and the JOIN interface. Excellent progress has been made and by the time of the workshop the database contained time series from 8,647 stations worldwide. Several proxies for classifying sites, for example as either urban or rural, have now been implemented (gridded datasets of global population, nighttime lights of the world and climatic zones). Additional proxies to be implemented before the end of April include the HTAP 10 km global NO<sub>2</sub> emissions (year 2010), MODIS land cover (indicating vegetation type and paved areas) and rice and wheat growing regions. New features are continuing to be added to the JOIN interface including the new proxies and improvements to efficiencies, such as the preservation of filter settings when conducting data queries. Martin's team at Jülich will continue to implement the ozone metrics that are still missing, and will also continue to merge time series that were produced at the same location but over differing time periods. The database is scheduled to be frozen on April 30, 2016. After this date no new data sets will be uploaded to the database until after the TOAR data analysis is complete. To organize and facilitate the data analysis of the TOAR database, Martin will host a data analysis workshop (TOAR Workshop 1.04) in Jülich the week of April 25-29, 2016, immediately following the annual EGU meeting. The workshop is designed as a hands-on activity for no more than 20 participants and will be a drop-in affair in which participants can attend all or part of the workshop. The goal is to develop the Python code for analyzing the database; the resulting analysis and figures will feature in Chapter 4, 5 and 6. Christine Ennis at NOAA ESRL will handle the workshop registration which will close on April 1, 2016. Finally, a new database policy is being implemented to allow the embargo of certain new datasets. The embargo means that a time series can be made available for the TOAR analysis but it will not be visible to the outside world via the JOIN interface. The understanding is that the embargo on a specific data set will be lifted at an unspecified date in the future once the principal investigators who collected the data have had the opportunity to publish their own analysis of the data.

Audrey Gaudel (U. of Colorado/NOAA ESRL) reported on the progress of identifying and analyzing free tropospheric ozone data sets. This is the first time that the tropospheric ozone burden and free tropospheric ozone trends are being compared across multiple platforms. Highlights from this presentation included: 1) Free tropospheric ozone trends using in situ observations will be calculated using high mountaintop sites (beginning in the 1970s), ozonesondes and 20 years of MOZAIC/IAGOS profiles (1994-2013). Trends will also be calculated using lidar retrievals from Table Mountain, California and Observatoire Haut Provence, France. Satellite observations using the OMI/MLS tropospheric column ozone product indicate a significant increase in the tropospheric ozone burden since 2004. Other recently available satellite tropospheric ozone products will be compared to OMI/MLS to determine if the trend is robust across platforms.

The workshop hosted a short symposium on Tuesday morning that featured presentations by ten leading Chinese scientists who shared their latest findings on tropospheric ozone research within China. The talks presented new ozone data sets from urban and rural sites across the country, many of which are now long enough for assessing the existence of surface ozone trends. The talks also addressed ozone photochemical formation within China and demonstrated that the ozone distributions across the country are changing with shifting emissions, as is ozone production efficiency. The hosting of the symposium allowed the TOAR community to meet and build relationships with Chinese scientists, and TOAR was very fortunate to gain the membership of many of the presenters.

Presentations from the workshop are available from a link on the sidebar of the Beijing workshop webpage:

<http://www.esrl.noaa.gov/csd/events/TOAR/>

## **TOAR timeline:**

February 12, 2016 – End of the TOAR first-draft review process. All comments by TOAR members on the assessment report chapters must be uploaded to the TOAR wiki by this date.

February 15, 2016 – Deadline for the chapter lead authors to upload their revised chapter outlines to the TOAR wiki, with author assignments for each section. Chapters 4, 5 and 6 need to list the figures they need to have produced during the Jülich data workshop.

April 25-29, 2016 – TOAR Workshop 1.04 will be held in Jülich, Germany. The purpose of the workshop is to conduct the Big Data analysis of the TOAR database to supply the figures and analysis for Chapter 4, 5 and 6. The workshop is designed to be small (no more than 20 participants) and is focused on writing the Python code to analyze the ozone metrics in the TOAR database.

April 30, 2016 - On this date the TOAR database will be frozen and no additional ozone datasets will be made available for the TOAR data analysis.

April 1-May 27, 2016 – Time frame for lead authors to upload to the TOAR wiki the interim draft of their chapter's second draft. The exact upload date is up to the lead author and the interim drafts will only be available for internal review.

September 9, 2016 – Deadline for lead authors to submit their chapters for the TOAR second-draft open review.

September 10 – October 10, 2016 – Second-draft open review period.

September 26-30, 2016 – IGAC meeting in Breckenridge, Colorado. TOAR Steering Committee and chapter lead authors will meet to discuss the second draft.

November 11, 2016 – Deadline for lead authors to post the revised chapters to the TOAR wiki to allow for one more internal review prior to submission of the chapters to the host journal. The purpose of the last internal review is to confirm the papers are all consistent before they are submitted to the journal in December.

December 9, 2016 – Submission date for the chapters to the peer-reviewed journal which will host the special issue.

## **Workshop decisions, outcomes and near-term action items**

- 1) Martin Schultz: Continue to coordinate the TOAR surface ozone database development.
- 2) Owen Cooper: 1) Communicate with the TOAR community and provide the summary of the TOAR workshop and the updated TOAR timeline. 2) Communicate with the assessment report authors to provide them with updated guidelines for the writing style and layout of the chapters along with the authorship eligibility requirements, in accordance with the host journal of the special issue.
- 3) Martin Schultz/Owen Cooper: Plan for the TOAR Workshop 1.04 in Jülich, scheduled for April 25-29, 2016.
- 4) Steering Committee: 1) Quickly identify the journal to host the TOAR special issue. 2) Obtain a memorandum of understanding with the journal that describes the design of the special issue.

- 5) Steering Committee: Revise/edit/approve of the TOAR timeline proposed at the workshop.
- 6) Steering Committee: Confirm/approve the time during, or prior to, the September 26-30, 2016 IGAC Meeting when the SC and chapter lead authors can meet to discuss the assessment report second draft.
- 7) TOAR participants: Gridded datasets for use as proxies for monitoring station classification need to be identified and made available to Owen Cooper by February 28, 2016. Owen Cooper will appeal to the TOAR community to identify these data sets.
- 8) Martin Schultz/Owen Cooper: Follow up with the PIs or data managers of ozone data sets still missing from the TOAR database.
- 9) TOAR chapter authors: Revise chapters based on comments gathered in the review process (TOAR wiki) and at the Beijing Workshop. Each chapter team must report to Owen Cooper, by February 28, the date in the April-May 2016 timeframe by which the team will post to the TOAR wiki the interim version of the chapter second draft.



## List of Attendees at TOAR Workshop 1.03

Name	Institution	Country
Owen Cooper	NOAA ESRL Chemical Sciences Division and CIRES/University of Colorado	USA
Mhairi Coyle	Centre for Ecology and Hydrology	UK
Aijun Ding	Institute for Climate and Global Change Research, Nanjing University	China
Ruth Doherty	University of Edinburgh	UK
Gaëlle Dufour	Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA), UMR CNRS	France
Felix Ebojie	Institute of Environmental Physics, University of Bremen	Germany
Yasin Elshorbany	NASA Goddard Space Flight Center	USA
David W. Fahey	NOAA ESRL Chemical Sciences Division	USA
Zhaozhong Feng	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Gilles Foret	Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA), UMR CNRS	France
Ian Galbally	CSIRO Marine and Atmospheric Research	Australia
Audrey Gaudel	NOAA ESRL Chemical Sciences Division and CIRES/University of Colorado	USA
María Granados-Muñoz	NASA JPL—Table Mountain Facility	USA
Guanyu Huang	Harvard-Smithsonian Center for Astrophysics	USA
Ronan Jezequel	aqicn.org	China
Barry Latter	Rutherford Appleton Laboratory	UK
Allen Lefohn	ASL & Associates	USA
Meiyun Lin	NOAA Geophysical Fluid Dynamics Laboratory/Princeton	USA
Weili Lin	Chinese Meteorological Agency—Meteorological Observation Center	China
Jianzhong Ma	Chinese Academy of Meteorological Sciences	China
Chris Malley	Stockholm Environment Institute (SEI), York University	UK
Raeesa Moolla	University of the Witwatersrand	South Africa
Vaishali Naik	NOAA Geophysical Fluid Dynamics Laboratory	USA
Jessica Neu	NASA Jet Propulsion Laboratory	USA
David Parrish	NOAA ESRL Chemical Sciences Division and CIRES/University of Colorado	USA
Hervé Petetin	CNRS — Laboratoire d'Aérodologie, Observatoire Midi-Pyrénées	France
Irina Petropavlovskikh	NOAA ESRL Global Monitoring Division and CIRES/University of Colorado	USA
Pallavi Saxena	Jawaharlal Nehru University	India
Martin Schultz	Forschungszentrum Jülich	Germany
Min Shao	Peking University	China
Lou Shengrong	Shanghai Academy of Environmental Sciences	China
Martin Steinbacher	EMPA, Swiss Federal Laboratories for Materials Science & Technology	Switzerland
Haoye Tang	Institute of Soil Science, Chinese Academy of Sciences	China
David Tarasick	Air Quality Research Division, Environment Canada	Canada
Valerie Thouret	CNRS — Laboratoire d'Aérodologie, Observatoire Midi-Pyrénées	France
Erika von Schneidmesser	Institute for Advanced Sustainability Studies	Germany
Tim Wallington	Ford Motor Company	USA
Qian Wang	Shanghai Academy of Environmental Sciences	China
Tao Wang	The Hong Kong Polytechnic University	China

Oliver Wild	Lancaster University	UK
Helen Worden	National Center for Atmospheric Research	USA
Xiaobin Xu	Institute of Atmospheric Composition, Chinese Academy of Meteorological Sciences, China Meteorological Administration	China
Likun Xue	Shandong University	China
Paul Young	Lancaster University	UK
Lin Zhang	Department of Atmospheric and Oceanic Sciences, Peking University	China
Bin Zhu	Nanjing University of Information and Science Technology	China

### Workshop Support

Christine A. Ennis	NOAA ESRL Chemical Sciences Division and CIRES/University of Colorado	USA
Pin Li	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Xiangyang Yuan	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Bo Shang	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Fang Zhong	Nanjing University	China
Lijun Jiang	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Feng Gao	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Yue Xin	Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences	China
Zheng Xu	Nanjing University	China
Zhengning Xu	Nanjing University	China
Ke Ding	Nanjing University	China