TOAR-II Satellite O_3 Working Group (SOWG)

P. Palmer, TOAR-II Satellite O3 WG co-lead, Univ. Edinburgh, UK
J. Neu, TOAR-II Satellite O3 WG co-lead, JPL/CalTech, USA
H. Worden, TOAR-II SC, NCAR, USA

on behalf of the TOAR-II SC

HEGIFTOM KO meeting

Virtual Meeting, March 23rd, 2021

TOAR-I accomplishments

Nine highly-cited journal publications in Elementa

A database with easily accessible ozone metrics at 1000s of stations worldwide

A highly motivated community of > 240 scientists from over 35 countries

Uptake of TOAR results in impact communities (e.g. GBD)

https://igacproject.org/activities/TOAR/TOAR-II

TOAR tropospheric ozone assessment report Phase II

TOAR-II in a nutshell

TOAR-II continues the successful work of TOAR-I and lasts until 2024

TOAR-II will provide updated and extended metrics on tropospheric ozone.

TOAR-II will provide an updated state of the science estimate of ozone's global distribution and trends relevant to climate, human health and vegetation

TOAR-II will further enhance the TOAR data portal and web services

TOAR-II will extend the statistical toolbox and trend analyses

TOAR-II will maximize exploitation of the TOAR Surface Ozone Database

TOAR-II reaches out to the international scientific community

TOAR tropospheric ozone assessment report Phase II

HEGIFTOM, 25 March, 2021

https://igacproject.org/activities/TOAR/TOAR-II

TOAR-II 2020-2024, Steering Committee

Owen Cooper (co-Chair), CIRES, U. of Colorado Boulder/NOAA CSL, USA

Martin Schultz (co-Chair), Forschungszentrum Jülich, Germany

Lisa Emberson, University of York, UK

Yugo Kanaya, Japan Agency for Marine-Earth Science and Tech. (JAMSTEC)

Raeesa Moolla, University of the Witwatersrand, South Africa

Yinon Rudich, Weizmann Institute of Science, Israel

Erika von Schneidemesser, Institute for Advanced Sustainability Studies Potsdam, Germany

Rodrigo Seguel, Center for Climate and Resilience Research (CR)2 Universidad de Chile, Santiago, Chile

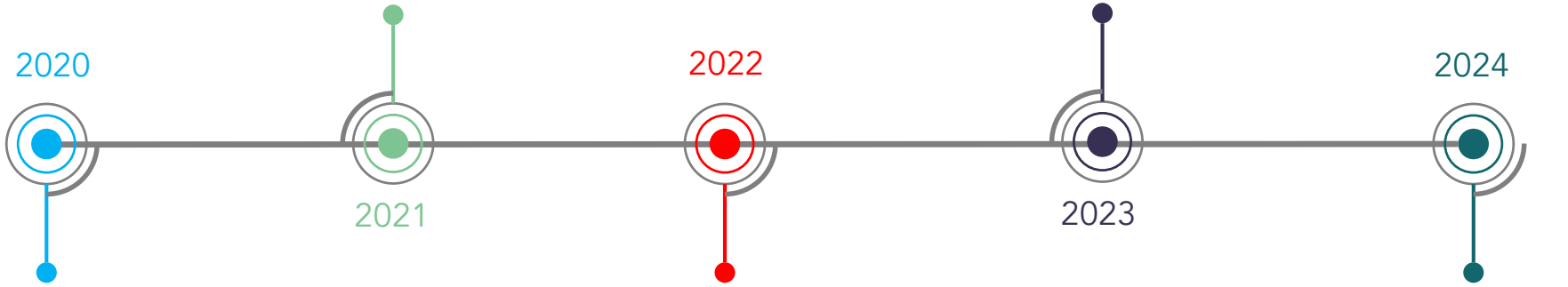
Bärbel Sinha, Indian Institute of Science Education and Research, Mohali, India

Helen Worden, National Center for Atmospheric Research, Boulder, USA

Lin Zhang, Peking University, Beijing, China

https://igacproject.org/activities/TOAR/TOAR

TOAR-II Status and roadmap



2020: Selection of new steering committee
Planning of objectives and roadmap
Formation of working groups
Development of enhanced data infrastructure

2021: First TOAR-II workshops
Beginning of new data collection
Bring data infrastructure online

2022: WGs: Preparation of analyses and planning of manuscripts
Develop new metrics and populate database

2023: Finalize data
Perform new and updated analyses
Draft manuscripts

2024: Publication of TOAR-II

HEGIFTOM, 25 March, 2021

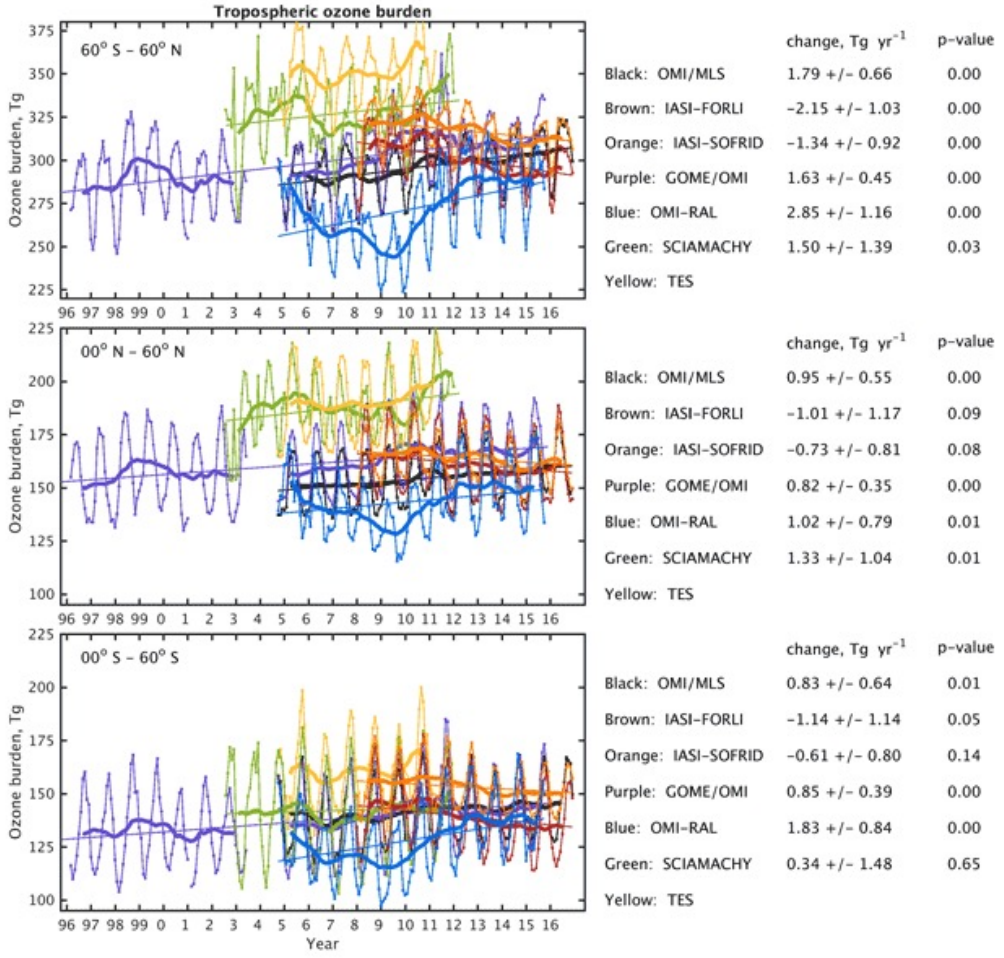
https://igacproject.org/activities/TOAR/TOAR-II

TOAR tropospheric ozone assessment report Phase II

Primary goal of the SOWG

Understand wide variety of trends and variations in tropospheric O_3 (TrO_3) reported by TOAR-I

Gaudel et al, 2018
http://doi.org/10.1525/elementa.291

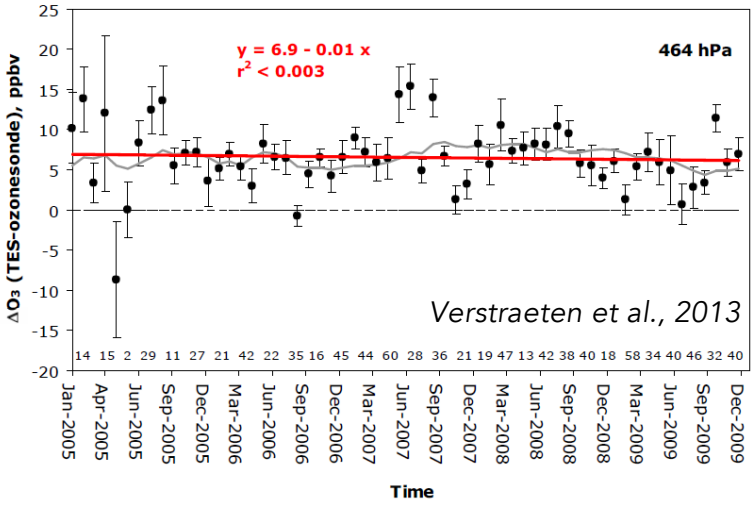


TOAR tropospheric ozone assessment report Phase II

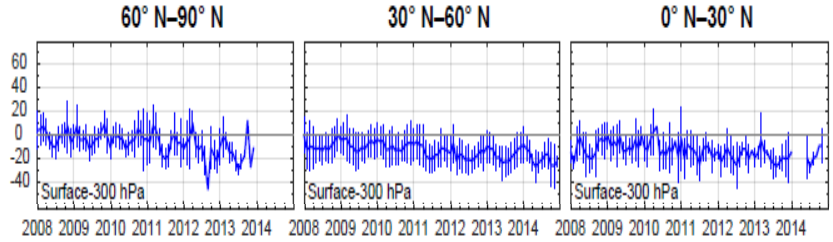
https://igacproject.org/activities/TOAR/TOAR-II

Approach 1: Time series of ozone sonde biases

TES vs Ozonesondes, 464 hPa, Northern Midlatitudes



IASI-FORLI vs Ozonesondes, Sfc-300 hPa, NH



Boynard et al., 2016

We will assess the stability of the satellite ozone measurements as a function of time.

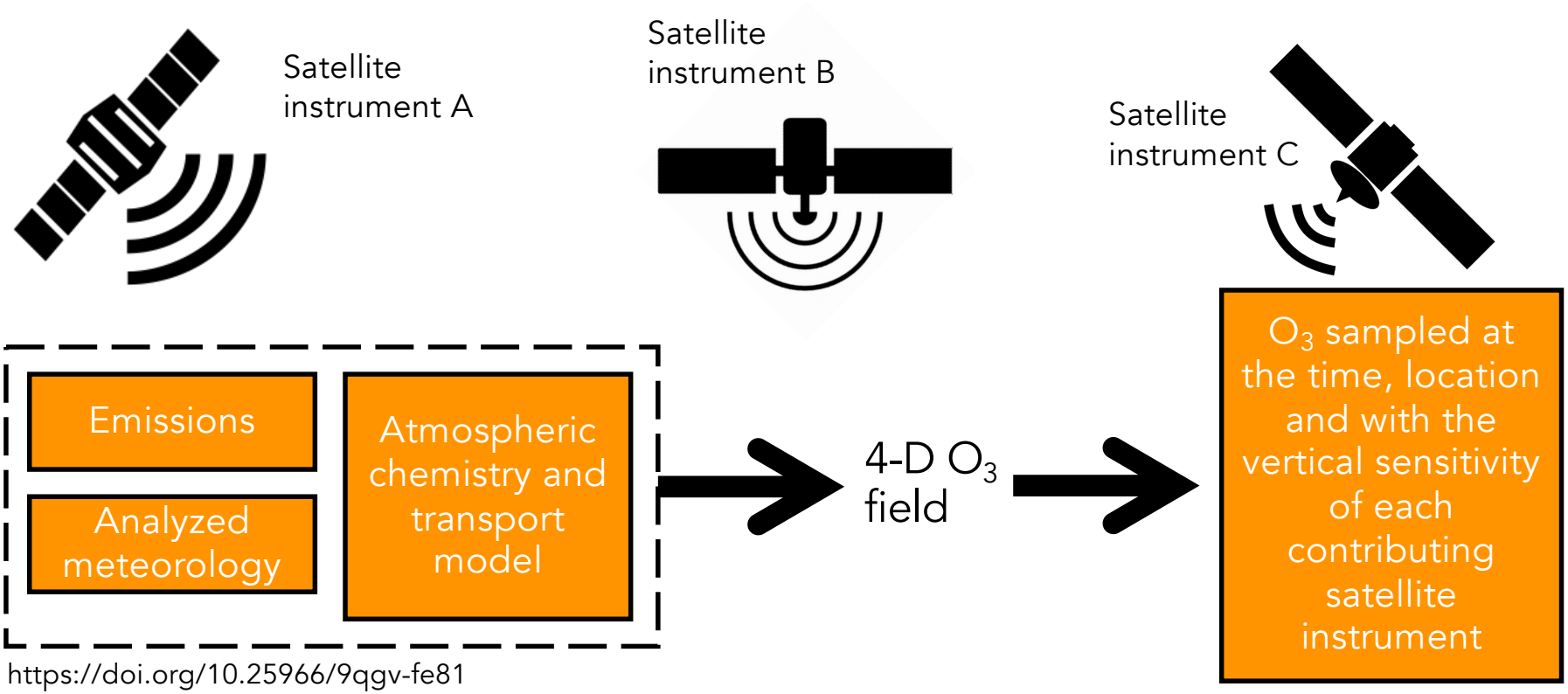
We will calculate monthly mean biases of partial column ozone from each instrument relative to ozone sonde data (using the weighting function for each profile) for 5-6 latitude bands for the entire length of each satellite record.

We will specify a format for the satellite ozone records. If the instrument groups are able to provide data to the SOWG in this format, we will assess the bias against sondes. If not, we will provide the methodology to the instrument group and ask them to do the sonde comparison.

TOAR tropospheric ozone assessment report Phase II

https://igacproject.org/activities/TOAR/TOAR-II

Approach 2: Sampling patterns and vertical sensitivity



https://doi.org/10.25966/9qgv-fe81

The model acts an intermediary to help reconcile trends reported by satellites A, B, C… and help us relate us link satellite-observed trends with other TrO_3 data.
[See Kazuyuki Miyazaki's presentation for more information]

https://igacproject.org/activities/TOAR/TOAR-II

TOAR tropospheric ozone assessment report Phase II

Statistical methods

We will use a range of methods to determine corresponding model and observed:

- Non-linear trends
- Atmospheric growth rates
- Step-wise changes, e.g., Covid-19

All taking into consideration data uncertainties so we can investigate robustness of our findings.

https://igacproject.org/activities/TOAR/TOAR-II

Study period: 2004-Spring 2021

- The broader community is central to the success of the SOWG.
- Our growing list of data groups represent all the major TrO3 instruments that cover our study period.
- Instruments that provide TrO3 data for the last few years, e.g., TROPOMI (as a follow-on to OMI) and GEMS (to provide TrO_3 diurnal cycle) will also be considered.
- We have our **KO on 31st March (1300 UT)** where we will discuss (at least):
  - Definition of commons tropopause height and prior.
  - Common file contents.
  - File format.
  - Confirmation of duration of data availability.
- We will coordinate TOAR-related studies of satellite retrievals of TrO_3.
- Data and model output will be made available for further scientific exploitation.

https://igacproject.org/activities/TOAR/TOAR-II

TOAR tropospheric ozone assessment report Phase II

Indicative timelines

Spring 2021:

- Solicit participation in working group and set up virtual meetings
  Generate methodology for direct satellite-sonde comparisons to be distributed to the various groups
- Establish common definition for the vertical extent of the measurements (e.g., tropospheric ozone column, partial column, individual pressure levels, etc).

Summer 2021: Start collating data from groups (inc. updates from TOAR-I contributors).

Summer-Winter 2021: Begin analysis using the model output to reconcile difference among the satellite trends up to 2020, and eventually up to Spring 2021.

Spring 2022: Complete analysis using the model and assess the consistency of the satellite trends with one another and with in situ data

Fall 2022-Winter 2023: Write up results of our analysis for publication

Spring 2024: submit for publication in TOAR II.

https://igacproject.org/activities/TOAR/TOAR-II

TOAR tropospheric ozone assessment report Phase II