TOAR
tropospheric
ozone
assessment
report

TOAR-II Progress Report

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CIRES, University of Colorado Boulder/NOAA CSL, USA

TOAR-II Database Status

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JÜLICH Forschungszentrum

INTERNATIONAL GLOBAL ATMOSPHERIC CHEMISTRY
IGAC

Spring 2022 Meetings of the Task Force on Hemispheric Transport of Air Pollution

TOAR-II Primary Goal and Scientific Scope

Organization: an official Activity of the International Global Atmospheric Chemistry Project (IGAC)

Final Product: An observation-based, up-to-date assessment of tropospheric ozone's distribution and trends on regional, hemispheric and global scales.

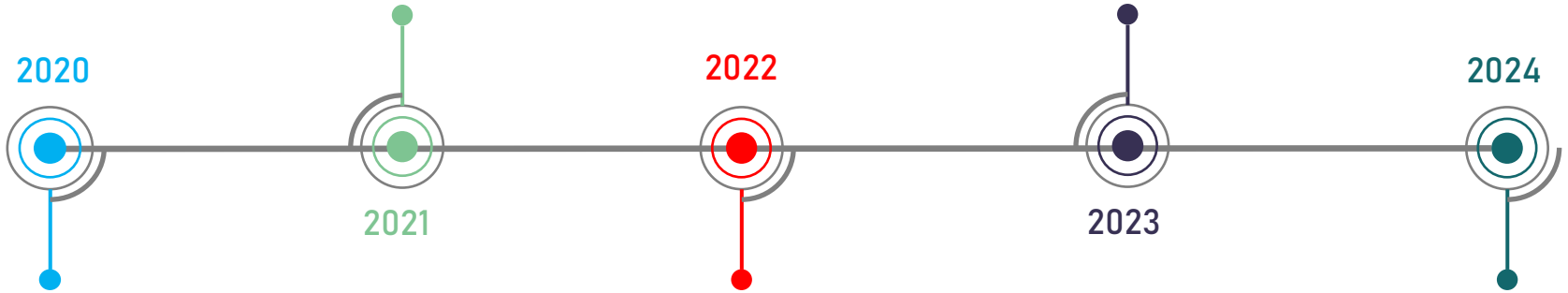
TOAR-II will assess the physical science basis for tropospheric ozone's global distribution and trends *(similar to IPCC Working Group I)*

TOAR-II will also explore and quantify the ***impacts*** of tropospheric ozone on human health, crop and ecosystem productivity and climate change *(similar to IPCC Working Group II)*

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

Manuscript Scoping Event (Nov. 2021) participants: 150 scientists from 31 nations

TOAR-II Status and roadmap



2020

Selection of new steering committee

Planning of objectives and roadmap

Development of enhanced data infrastructure

2021

First TOAR-II workshops

Formation of working groups (WGs)

Beginning of new data collection

2022

WGs: Develop manuscripts and initial data analysis

Develop new ozone metrics and populate database

2023

Finalize database

Complete data analyses

Paper submissions to the Community Special Issue

2024

Publication of TOAR-II assessment papers

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

TOAR-II Focus Working Groups

New research is being led by 14 independent Focus Working Groups:

Chemical Reanalysis Focus Working Group
East Asia Focus Working Group
Global and Regional Models Focus Working Group
HEGIFTOM Focus Working Group
Machine Learning for Tropospheric Ozone Focus Working Group
Ozone over the Oceans Focus Working Group
Ozone and Precursors in the Tropics (OPT) Focus Working Group
Radiative Forcing Focus Working Group
ROSTEES Focus Working Group
Satellite Ozone Focus Working Group
South Asia Focus Working Group
Statistics Focus Working Group
Tropospheric Ozone Precursors (TOP) Focus Working Group
Urban Ozone Focus Working Group

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

TOAR-II Community Special Issue

Focus Working Group findings submitted to the Community special issue in 2023

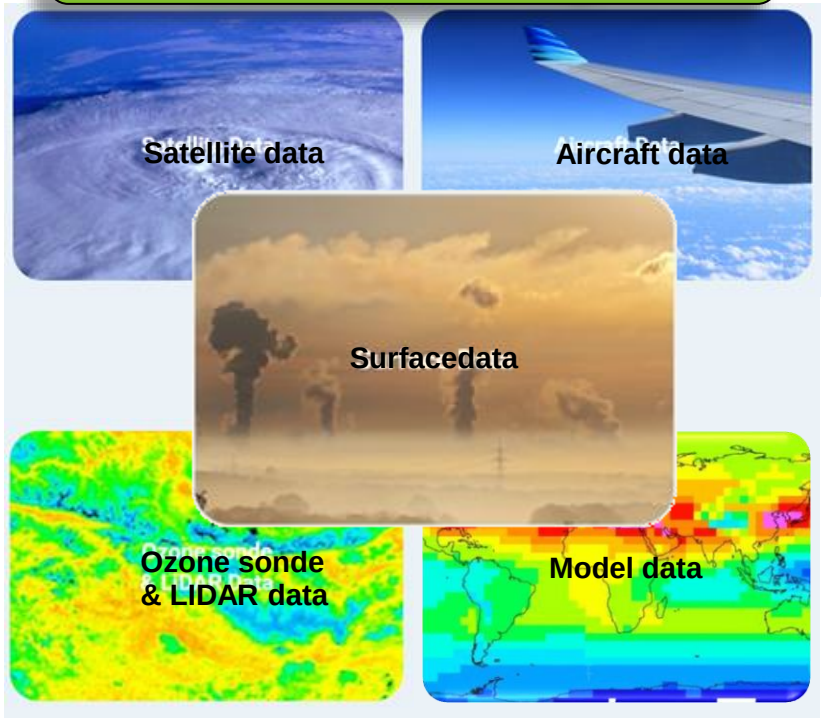
An inter-journal special issue hosted by Copernicus ***(under development)***:

TOAR-II Data

toar-data.fz-juelich.de

TOAR database

toar-data.org



TOAR data portal

Sabine Schröder @ TFHTAP: Global Modeling of Ozone and Aerosols
TOAR-II Database Status, 19 May 2022

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

TOAR tropospheric ozone assessment report Phase II

The TOAR Database in a nutshell

Contents:

- Harmonized and quality-controlled surface ozone measurements and related data from all over the world (one of the largest collections of global air quality data)
- Globally consistent metadata to describe station characteristics and aid the interpretation of ozone data

Purpose:

- To provide globally consistent metrics for analyses of health, vegetation, and climate impacts from ozone air pollution

Data sources:

- Various environmental agencies and programs
- Universities and individual researchers
- OpenAQ (in version 2)
- COSMO (version 1) and ERA-5 (version 2) reanalysis data

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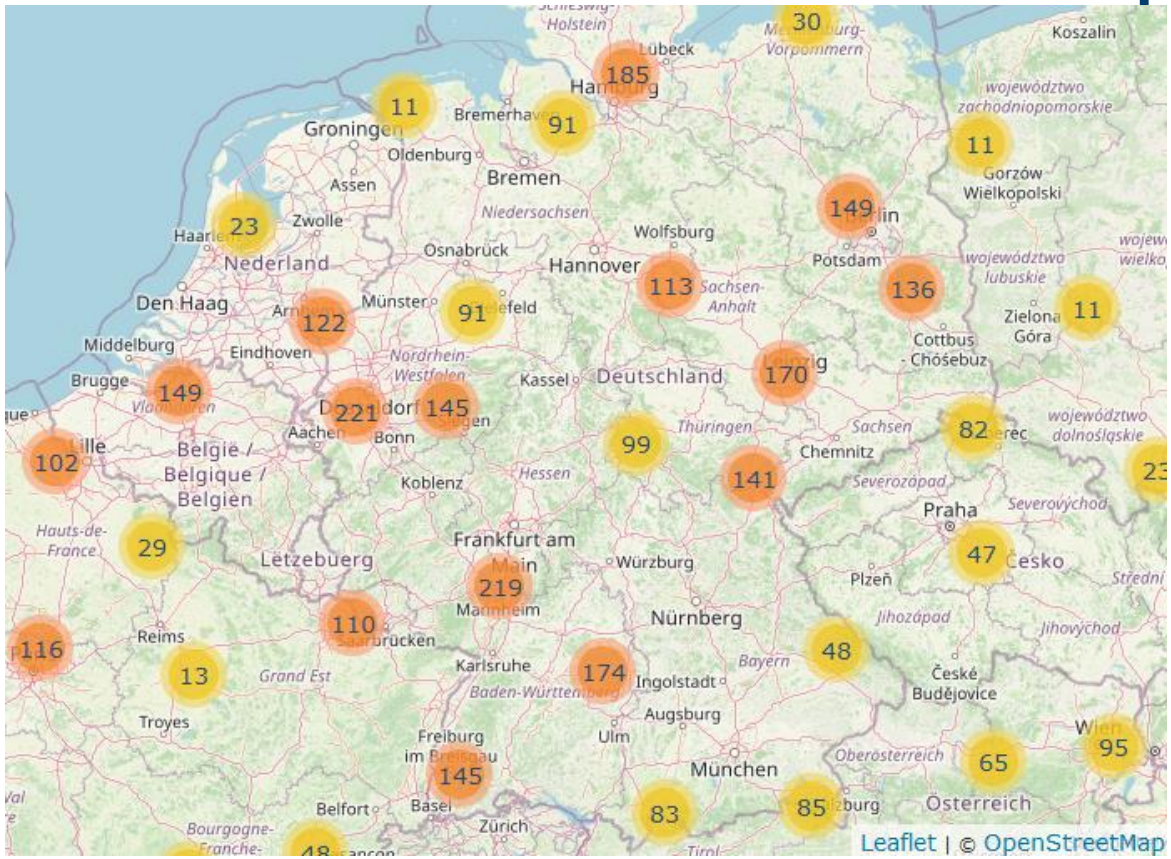
The TOAR Database

a harmonized and documented collection of global surface measurements of ozone and its precursors



TOAR-I

13,257 stations
103,735 time series
~12,000,000,000 data points

Ozone, NO, NO2, CO, PM2.5, PM10, ethane, propane, benzene, toluene, irradiance, cloud cover, T, RH, q, u, v, wdir, wspeed, Rn

~40 contributing networks and research groups

harmonized data and metadata
enhanced station metadata

1970 – 2013
some datasets extended to 2017

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

TOAR tropospheric ozone assessment report Phase II

The TOAR Database

a harmonized and documented collection of global surface measurements of ozone and its precursors

REST API

https://toar-data.fz-juelich.de/api/v2/stationmeta/?bounding_box=49,7,50,8

[{"id":975,"codes":["DERP060"],"name":"Pirmasens-Innenstadt","coordinates":{"lat":49.191996,"lng":7.614573,"alt":378.0},"coordinate_validation_status":"not checked","country":"Germany","state":"Rheinland-Pfalz","type":"background","type_of_area":"urban","timezone":"Europe/Berlin", "additional_metadata": …
"globalmeta":{"mean_srtm_alt_90m_year1994":386.0,"mean_srtm_alt_1km_year1994":306.0,"max_srtm_relative_alt_5km_year1994":80.0, …
climatic_zone_year2016":"undefined","htap_region_tier1_year2010":"4 (EUR Western + Eastern EU+Turkey (upto 66 N polar circle))“,…
mean_nightlight_1km_year2013":36.0,"mean_nightlight_5km_year2013":24.9091,"max_nightlight_25km_year2013":52.0, …
"mean_population_density_250m_year2015":1416.0,…#"omi_no2_column_years2011to2015":3.966,"toar1_category":"rural low elevation","station_id":975},"changelog": …},
{"id":4437,"codes":["openaq_3791"],"name":"FR22022",
…

GUI / Dashboard under construction

TOAR-II

19,444 stations
72,804 time series
2,645,933,824 data points

Ozone, NO, NO2, CO, PM2.5, PM10, PM1, ethane, propane, benzene, toluene, mpxylene, oxylene, SO2, Ox, NOx, CH4, bc, irradiance, cloud cover, T, RH, q, u, v, aswdir, wdir, wspeed, press, pblheight, totprecip, albedo, aswdifu, humidity

~40 contributing networks and research groups

harmonized data and metadata
enhanced station metadata
trustworthy repository

1970 – 2021

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TOAR tropospheric ozone assessment report Phase II

The TOAR II Database and FAIR data

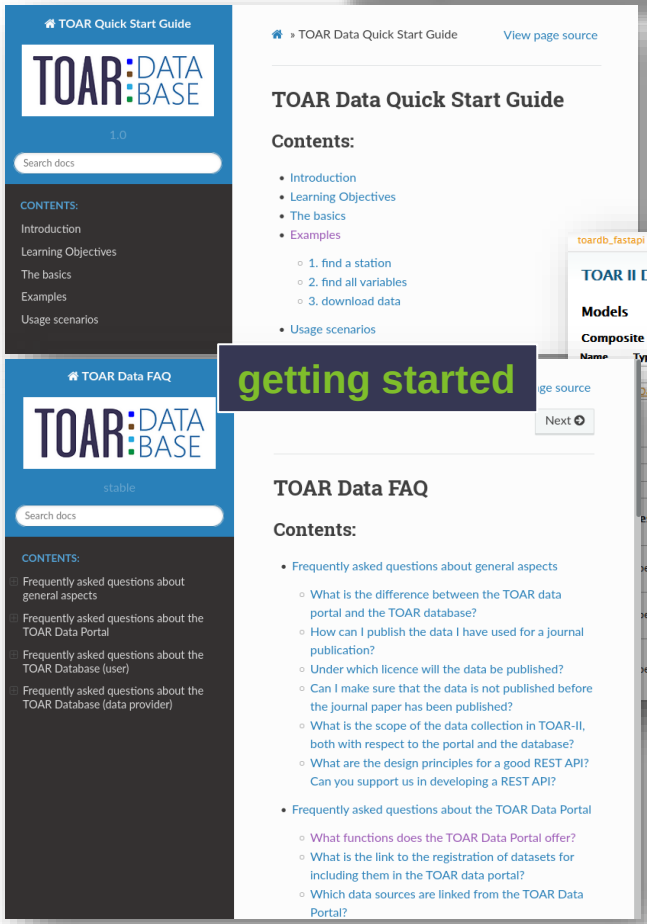
- Improved metadata schema:
  - Data versioning & documented QC
  - Better attribution to PIs, providers, etc (roles)
  - Use of controlled vocabulary and ontology
  - More flexibility to handle provider-specific metadata
  - Automated workflows including statistical QC
  - Station characterisation from higher resolution geospatial data
- Clear data license and data use policy (CC-BY 4)
- PostGIS database (standardized geographic representations)

⇨ CoreTrustSeal application pending
first positive feedback from reviewers
(answers submitted for review)

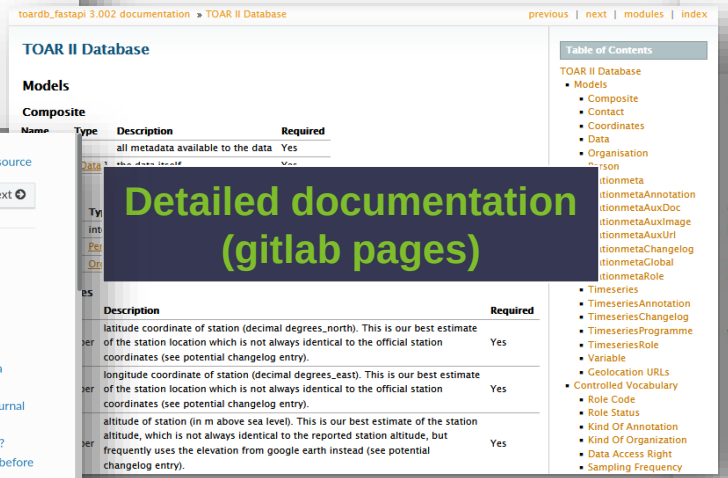
https://igacproject.org/activities/TOAR/TOAR-II

The TOAR Database documentation

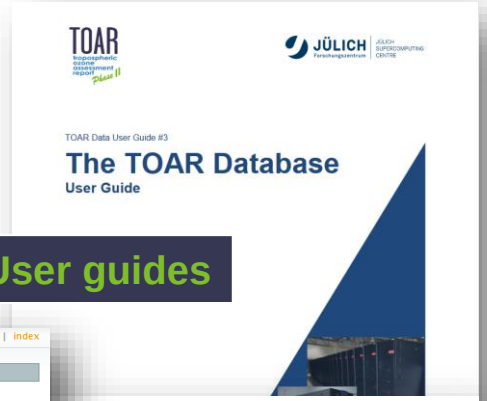
https://toar-data.fz-juelich.de



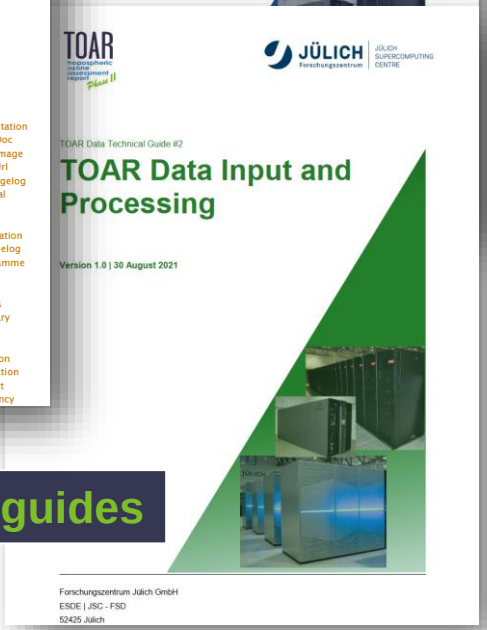
getting started



Detailed documentation (gitlab pages)



User guides



Technical guides

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TOAR-II Database Status, 19 May 2022

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TOAR tropospheric ozone assessment report Phase II

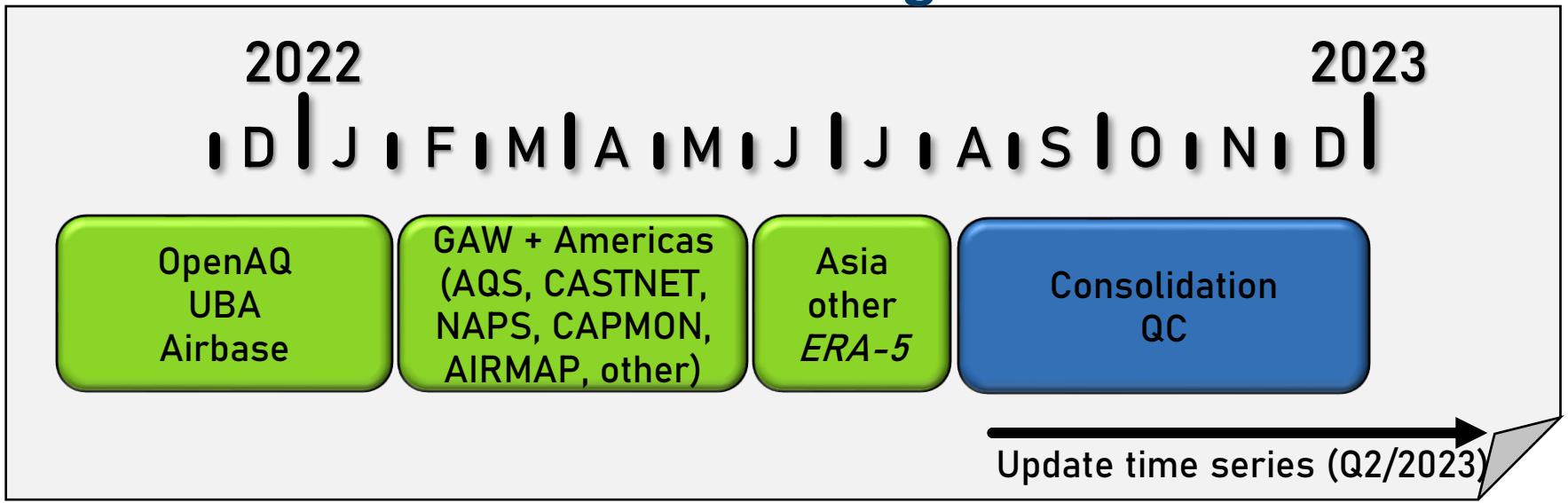
TOAR-II Database – user workshop 2022

on-site in Jülich
23 June 2022, 12:00 CEST
to **24 June 2022 15:00 CEST**

online
12 July 2022 05:00 – 10:00 UTC
13 July 2022 13:00 – 18:00 UTC

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

TOAR-II Database – data ingestion timeline



Status: 2022-01-21

TOAR data portal

https://toar-data.org

TOAR database

https://toar-data.fz-juelich.de

Thank you for your attention

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