

# Collection of Observational Ozone Data over the Global Oceans and Polar Regions to assess Chemistry and Temporal Evolution: Efforts of the TOAR-II Oceans Working Group

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## Abstract

Constraints from ozone ( $O_3$ ) observations over the oceans are needed in addition to those from terrestrial regions to fully understand global tropospheric chemistry and its interactions with the Earth system and climate. The TOAR-II Oceans Working Group collects such  $O_3$  observations over the oceans from 61 ship cruises, 15 drifting buoys, 47 aircraft missions, ozone sondes observations from 24 sites, and about 20 coastal sites to assess the chemistry and temporal evolution of  $O_3$  over the open oceans and polar regions, with a focus on the atmospheric boundary layer. The data set, consisting of >1M independent points, covering from the 1960s to the present, allowed analyses of diurnal/seasonal variations and long-term trends over 11 different ocean/polar regions. Backward trajectories using HYSPLIT from the observation points allowed us to extract pure oceanic data, defined as those traveling over oceans for more than 72 hours, which were tested with the coincident Radon observations. Model simulations including CHASER, UKESM1, and CAM-Chem, with and without halogen chemistry, are used to identify similarities and differences with the observations and also to fill in the spatial and temporal gaps. The analysis focuses on the geographical distribution, including latitude and longitude transects and vertical profiles in each region, and on the seasonal variability. Chemical production/loss terms from the models are also analyzed. In the Pacific, hourly medians from the Region 2 (20°S–22°N) showed a clear diurnal pattern with daytime minima, with an amplitude of 1.6 ppb (12% of the 24-h median of 13.8 ppb), requiring more  $O_3$  destruction than predicted by the CHASER model with Br/I chemistry. As a case study, the occurrence of the low ozone levels ( $\sim <10$  ppb) over the western Pacific warm pool was investigated in more detail with coincident observations of oceanic and atmospheric iodinated species.

## Early Career Scientist

NO, I am not an early career scientist.

## IGAC Activities

TOAR: Tropospheric Ozone Assessment Report

**IGAC Regional Working Groups**

Japan National Committee