Reviewer 1 comments (Blue Italics) and Authors Responses (“AR” Black Regular)

The manuscript by Petropavlovskikh et al. provides an overview of the current status, recent achievements and future outlook of the Network for the Detection of Atmospheric Composition Change (NDACC). About six years after the last comprehensive review of NDACC by De Maziere et al., the manuscript is a useful reference for the more recent developments, current challenges and future directions. I recommend publication in Atmos. Chem. Phys. after consideration of the following specific – mostly minor – comments.

I was surprised that the manuscript does not include a figure or table of the NDACC stations. I would encourage the authors to consider a world map with NDACC and Cooperative Networks stations included.

AR: We appreciate Reviewer 1 comments and understand the value of map for the reader. However, when considering a combined map of NDACC stations and Cooperating Network (CN) sites we found its design prohibitively complicated. Instead, we added the following sentence to the beginning of Section 2. “For an interactive map of NDACC stations see https://www.ndacc.org”. We also added the following sentence to the discussion of cooperating networks in Section 2. “A list showing colocation of NDACC long-term measurement stations with those of Cooperating Networks (referenced in the table) is available in the ‘Site List’ of the ‘Measurements and Analyses Directory’ in the DATA Tab of the NDACC website.”

I didn’t see in the manuscript any reference to the special issue. Maybe it would make sense to point to the special issue, if this paper is meant as an introduction?

AR: We modified the sentence in line 116 to

This paper reviews NDACC achievements since the publication of De Mazière et al. (2018) and serves as an introduction to the special issue "Achievements and perspectives of the Network for the Detection of Atmospheric Composition Change after 35 years of operation”.

Specific comments:

p2, l49: “11” -> “eleven”

AR: made change

p2, l56: “most of” -> “large parts of”?

AR: made change

p5, l155: reference to Appendix A either here or in line 144, but not needed twice

AR: removed the second reference in L155

p10, l254-263: I am not convinced about the information content of the introductory paragraph. The most useful information in this paragraph is that in total nearly 500 papers since 2018 have been published – clearly an important achievement. I suggest shortening the introductory paragraph to Sec. 4.

AR: "Recent achievements, described in this section, include discoveries related to both stratosphere and troposphere, synergistic collaboration with satellite observations, and advances in network infrastructure. In all endeavors, NDACC's temporal coverage and emphasis on standardized instruments, data-processing methods and protocols, have been essential in creating the high-quality data required for quantifying chemical composition changes. Nearly 500 publications since 2018 attest to NDACC's scientific contribution, e.g,, https://ndacc.org/publications. Highlights of stratospheric and tropospheric research appear in Sections 4.1 and Section 4.2 respectively. Although not exhaustive, the examples feature a range of scientific issues and perspectives. Section 4.3 discusses satellite collaborations and NDACC contributions to validation. Section 4.4 illustrates NDACC's advances in instrumentation, technology and archiving infrastructure, i.e., those capabilities and practices that make NDACC a uniquely valuable resource for the global atmospheric research community."

Revised to:

"Selected recent achievements are described in this section. These include discoveries related to both stratosphere and troposphere, synergistic collaboration with satellite observations, and advances in network infrastructure. In all endeavors, NDACC's temporal coverage and adherence to standardized instruments, data-processing methods and protocols, have been essential in creating the high-quality data required for quantifying chemical composition changes and achieving network science goals. Nearly 500 publications since 2018 attest to NDACC's scientific contribution, (https://ndacc.org/publications). Highlights of stratospheric and tropospheric research appear in Sections 4.1 and Section 4.2 respectively. Section 4.3 discusses satellite collaborations. Section 4.4 illustrates NDACC's advances in instrumentation, technology and archiving infrastructure."

p12, l304/305: "trends…compared well": can this statement be made stronger? E.g. "NDACC data provided support for the trend detection", or "NDACC data confirmed the in-situ trends"?

AR: "In the Ozone Assessment trends in the Jungfraujoch FTIR time series of CFC-11, CFC-12, HCFC-22, HCFC-142b, CCl4, CF4 and SF6 compared well with those derived from satellite and in situ surface data (Laube et al., 2022; Chapter 1 in WMO 2022)."

Revised to:

“In the 2022 Ozone Assessment, trends in the Jungfraujoch FTIR total column time series of CFC-11, CFC-12, HCFC-22, HCFC-142b, CCl_4, CF_4 and SF_6 support and bridge the high precision in situ data and upper troposphere observations from satellites where available (Laube et al., 2022; Chapter 1 in WMO 2022).”

p12, l313: 10°S-60°N: typo? the figure says 60°S-60°N!

AR: Changed to 60ºS - 60ºN

p14, l345: “20S”-> “20°S”

AR Changed to “20ºS”

p16, l394: “affiliated networks” -> “Cooperative Networks”?

“records from NDACC and affiliated networks for four instruments”

AR: changed to “records from NDACC and other atmospheric measurement networks”

Fig.10: Text in the figure too small to read!

AR: We increased the text in figures

p16, l411: “The HEGIFTOM-derived trends mark a turning point for the tropospheric ozone community.” How? What exactly does this mean?

p17, l420: You may add, that OCS is also a tracer for CO2 uptake by the biosphere?

AR: “Carbonyl sulfide (OCS), the reservoir sulfur species in the free troposphere, is a product of anthropogenic, biogenic and oceanic emissions and the largest source of sulfur transported to the stratosphere during periods of low volcanic emissions, helping maintain the lower stratospheric sulfate aerosol layer.”

Revised to:

“Carbonyl sulfide (OCS), the reservoir sulfur species in the free troposphere, is a product of anthropogenic, biogenic and oceanic emissions, a tracer for CO_2 uptake by the biosphere and the largest source of sulfur transported to the stratosphere during periods of low volcanic emissions, helping maintain the lower stratospheric sulfate aerosol layer.”

Fig. 11: Please provide the station names (and maybe latitudes?) in the caption. What does the explained variance quantify? What exactly is correlated here? Please give a few more details.

AR: Caption “Fit of the annual anthropogenic emissions inventory from Zumkehr et al. (2018) to annually averaged FTIR OCS data from stations with the longest running data records. The emissions inventory is interpolated to the station location. From Hannigan et al. (2022).”

Revised to:

“Fit of the annual anthropogenic emissions inventory from Zumkehr et al. (2018) to annually averaged FTIR OCS data from stations with the longest running data records. The emissions inventory is interpolated to the station location. From Hannigan et al. (2022). TAB: Thule Air Base 76ºN, KIR: Kiruna 67ºN, ZUG: Zugspitze 47ºN, JFJ: Jungfraujoch 46ºN, IZA: Izana 28ºN, WLG: Wollongong 34ºS, LDR: Lauder 45ºS, AHS: Arrival Heights 79ºS.”

L425: “Regression models and available proxies of varying time periods, attribute the varying trends in Fig. 11 are due primarily to anthropogenic emissions.”

Revised to:

“They showed that regression models using available geophysical proxies of varying time periods could not adequately explain the multi-decadal OCS variability. For the longest time series through to 2012 the highest correlations to the free tropospheric NDACC time series was with the gridded, bottom up anthropogenic emissions from Zumkehr et. al., 2018. Shown in Fig. 11, between 46% to 77% of the variability can be attributed to anthropogenic sources at stations between 76ºN and 80ºS.”

p17, l434: “dynamics” is jargon here. While aerosols, clouds and ozone directly affect UV radiation, it is not immediately clear how “dynamics” affect UV. Please explain or remove “dynamics”.

AR: replaced “dynamics” with “other atmospheric composition changes driven by natural and anthropogenic sources, transport and atmospheric mixing”

p21, l517: “See Table A1 (Appendix B)”: do you mean Table C1 in Appendix C?

AR: “ changed to “Table C1 in Appendix C”

p22, l549: “The Global Lidar Analysis Software Suite (GLASS).” should be part of the previous sentence(?)

AR: The NDACC Lidar Working Group recently built its initial centralized lidar data processor: the Global Lidar Analysis Software Suite (GLASS).

Revised to:

The NDACC Lidar Working Group recently built its initial centralized lidar data processor: the Global Lidar Analysis Software Suite (GLASS).

p22, l561: "Like the FTIR CDPS (see below)…": Text would flow better if this statement is moved after the CDPS discussion.

AR: "Like the FTIR CDPS (see below) this system is also integrated within the ACTRIS Centre for Reactive Trace Remote Sensing Central Facility."

To avoid confusion, we revised paragraph to:

AR: "The NDACC Lidar Working Group recently made significant efforts towards the development of centralized lidar data processing. The Global Lidar Analysis Software Suite (GLASS) was initially developed to retrieve stratospheric ozone, temperature, aerosol, tropospheric ozone, and water vapor for the four NASA/JPL lidars. It was then expanded to process the raw data of more than a dozen lidar instruments contributing to NDACC, TOLNet and GRUAN (GCOS reference Upper Air Network). GLASS is used to support several NDACC-contributing stations on a routine basis and has served as a transfer standard during campaigns (e.g., the SCOOP and STOIC campaigns in 2016 and 2024 respectively). Another centralized lidar data processor was also installed at ACTRIS for the analysis of several European NDACC lidars. is integrated within the ACTRIS Centre for Reactive Trace Remote Sensing Central Facility."

p23, l604-611: in this section on the Data Handling Facility (DHF), it is not clear if CLaMS model data (and which) are available through the DHF

AR: We removed text discussing CLaMS model data as these are not provided on the DHF website.

Section 4.4.3: Suggestion: say something about mirroring of NDACC data at other data centers

AR: We added this statement "NILU provides a mirror of the NDACC DHF and a backup of the website content."

Table C1: Please use subscripts in chemical formulas

AR: we applied the requested appropriate formatting