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On the relationship between synoptic events and ozone changes in the Arctic using observations from satellite instruments and the MOSAiC ship campaign

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Although cyclones and anticyclones, referred to as synoptic events, strongly influence weather predictability, they are not well characterized or predicted in the Arctic region because of the sparse coverage of relevant meteorological measurements. As synoptic events at high latitudes influence the atmospheric dynamics in the region of the lower stratosphere and upper troposphere (UTLS) and the lower stratospheric ozone via tropopause changes, a potential approach to characterize these events is the use of space-borne measurements of ozone vertical distributions and total columns. The final goal is to assess whether the satellite ozone data can be used to obtain information about synoptic events and provide herewith an additional value in the assimilation by numerical weather prediction models. In this talk, we report our investigations of the link between synoptic events and changes in UTLS ozone by using the unique combination of ozonesonde measurements during the MOSAiC ship expedition, OMPS-LP ozone profiles, and ERA-5 data. Ozone contour levels follow changes in the tropopause height. The negative correlation between ERA5 tropopause height and ozone total columns or sub columns, retrieved from OMPS-LP observations and MOSAiC ozonesonde data can be used as an indicator for cyclonic activity. An approach to automatically identify and track cyclones with OMPS-LP ozone observations, using the lowering of the 250 ppb ozone contour level below 9 km, is proposed and discussed. The correlation between the magnitude of (anti)cyclones and the strength of the ozone change was validated using OMPS-LP data and a historical analysis of this relationship was performed using ERA5 ozone data.