Longterm Ozonesonde Observations

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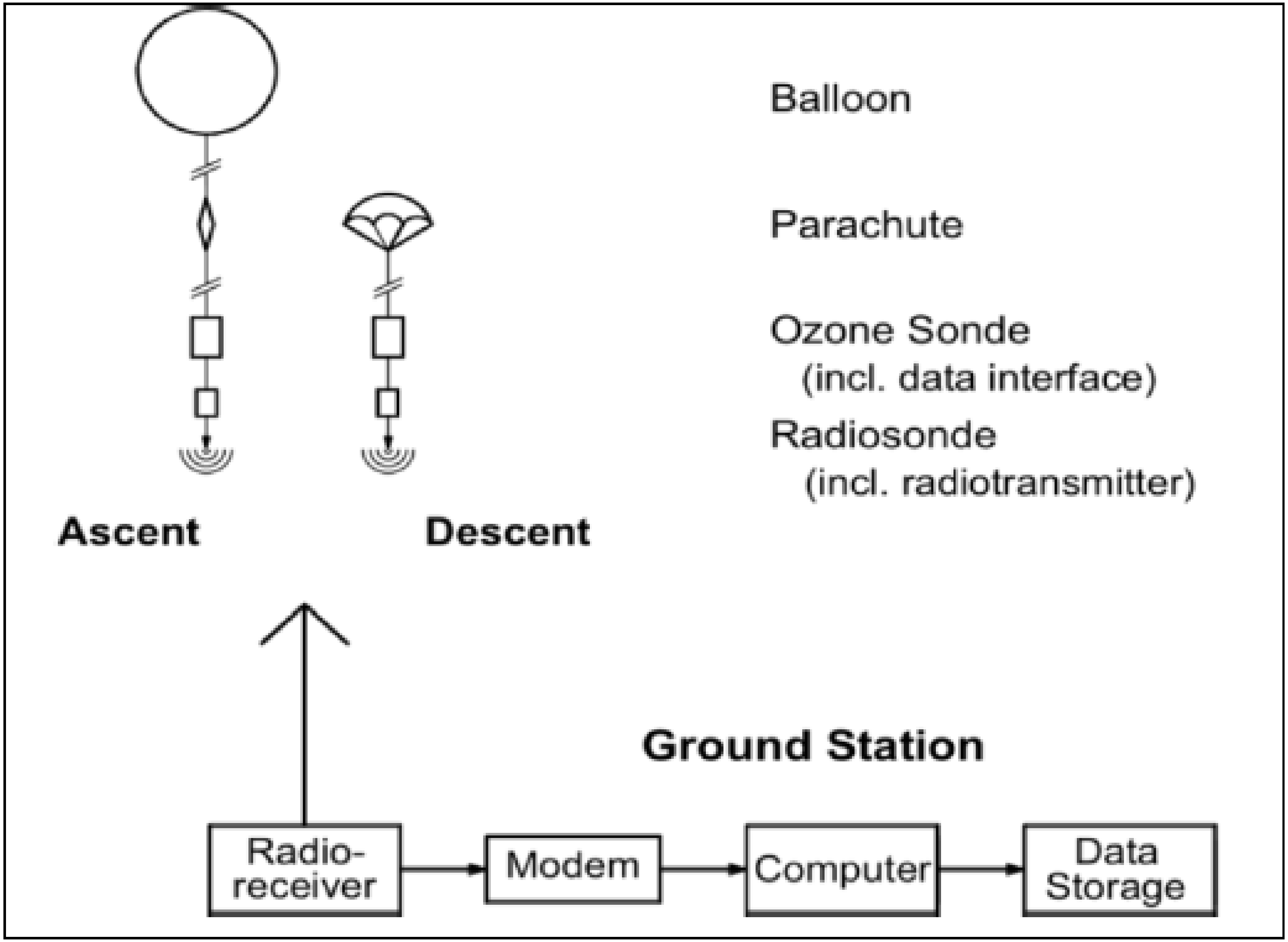
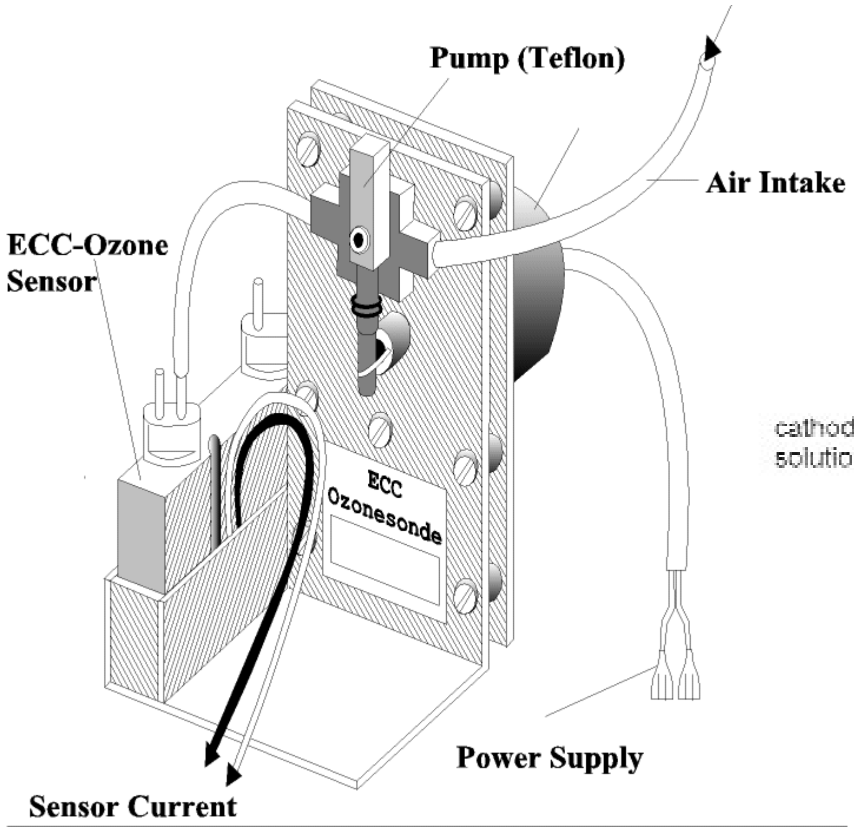
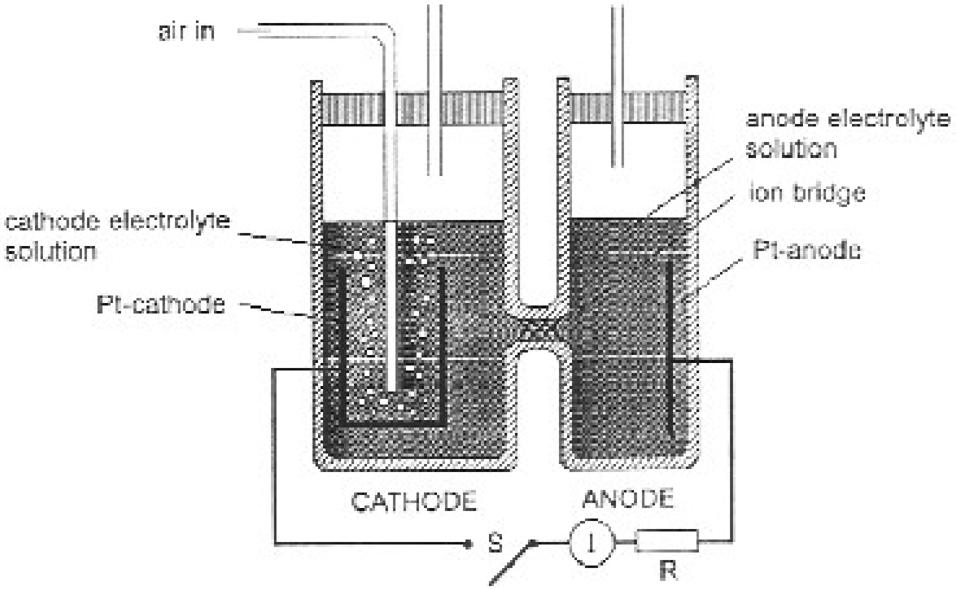


From Smit et al., 2014

Ozonesonde





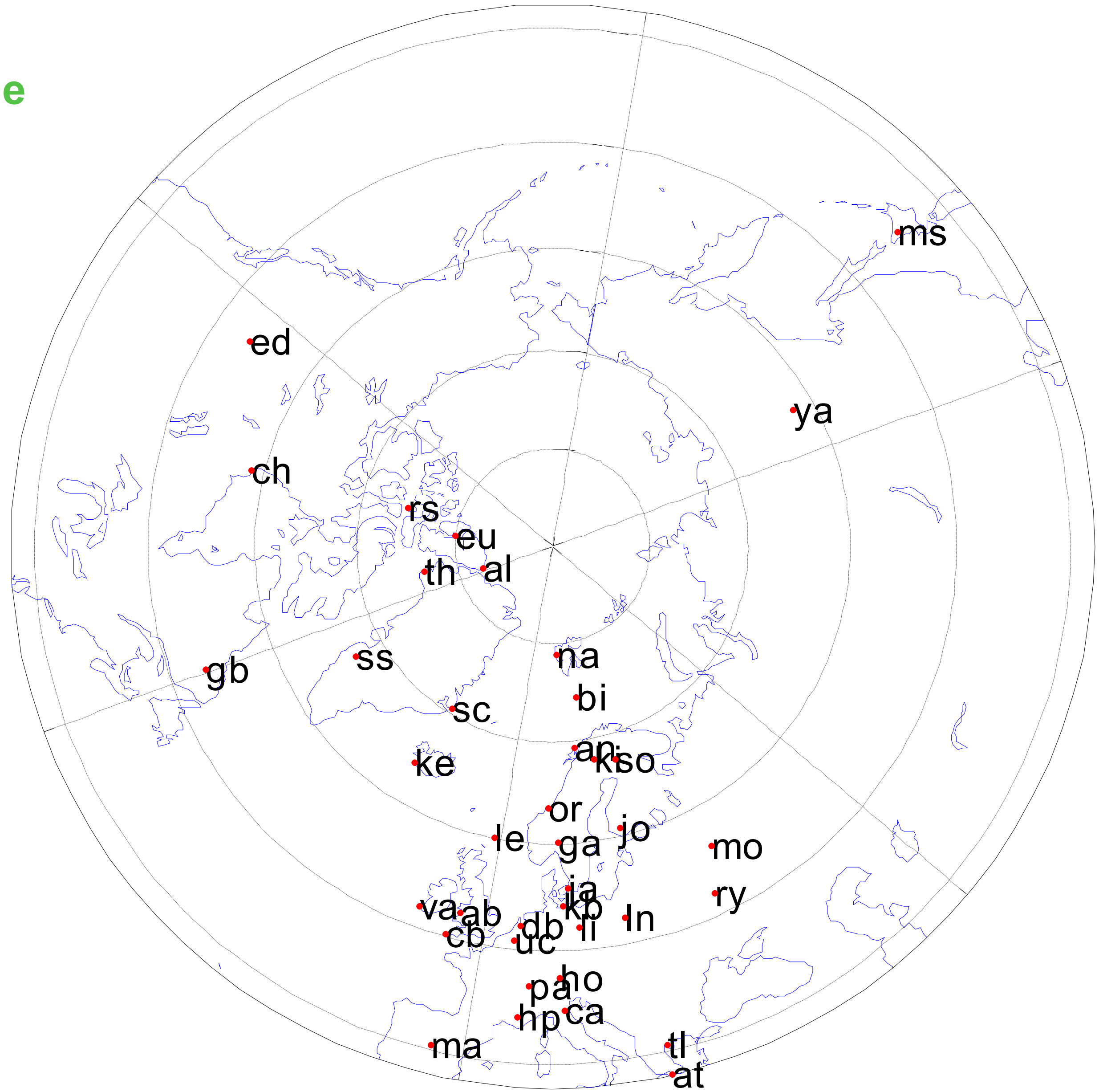
$$2KI + O_3 + H_2O \rightarrow I_2 + O_2 + 2KOH$$

An electrical current I_M [μA] generated in the external circuit of the electrochemical cell is, after correction for a background current IB [μA], directly related to the uptake rate of ozone in the sensing solution. By knowing the gas volume flow rate ΦP [cm3s-1] of the air sampling pump, its temperature TP [K] and the conversion efficiency of the ozone sensor ηC, the measured partial pressure of ozone PO3 [mPa] is determined by the relation:

[E-2-1] $$P_{O3} = 0.043085 \cdot \frac{T_P}{(\eta_C \cdot \Phi_P)} \cdot (I_M - I_B)$$

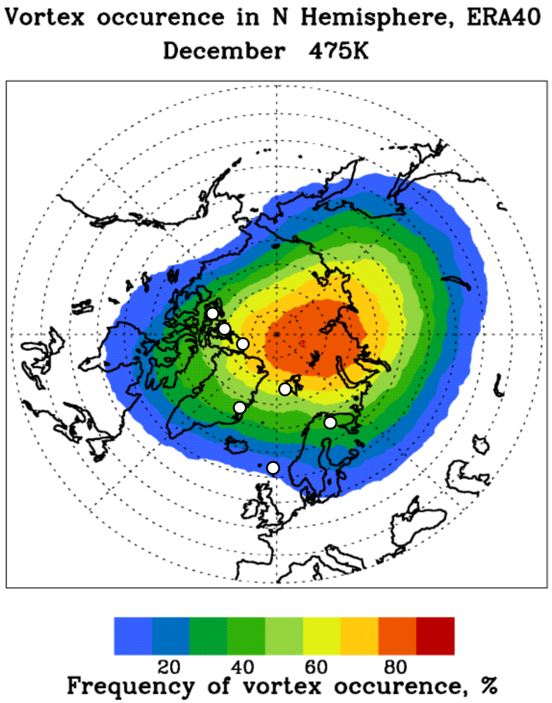
The constant 0.043085 is determined by the ratio of the gas constant, R, and the Faraday constant, F divided by 2 (the number of electrons produced in the sensor cell per ozone molecule). The electrical cell current IM and pump temperature TP are measured in-situ during the sounding. The background current IB and volumetric flow rate ΦP of the gas sampling pump of each sonde are measured in the laboratory at ambient air pressure during pre-flight preparations.

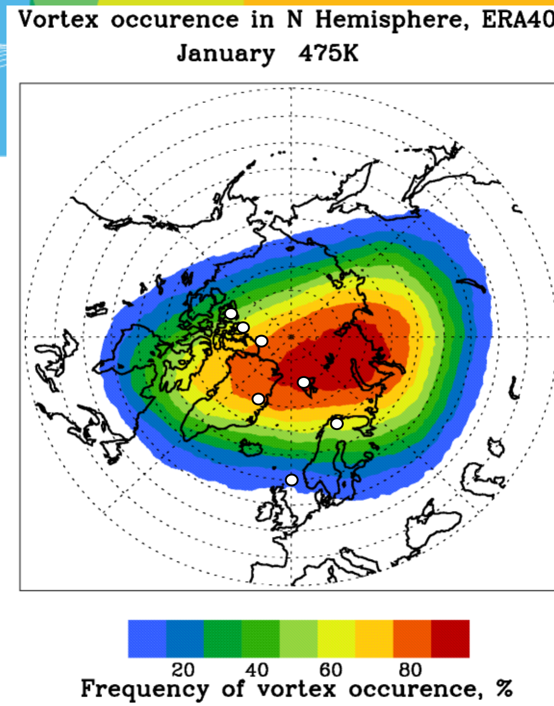
NH Ozonesonde stations

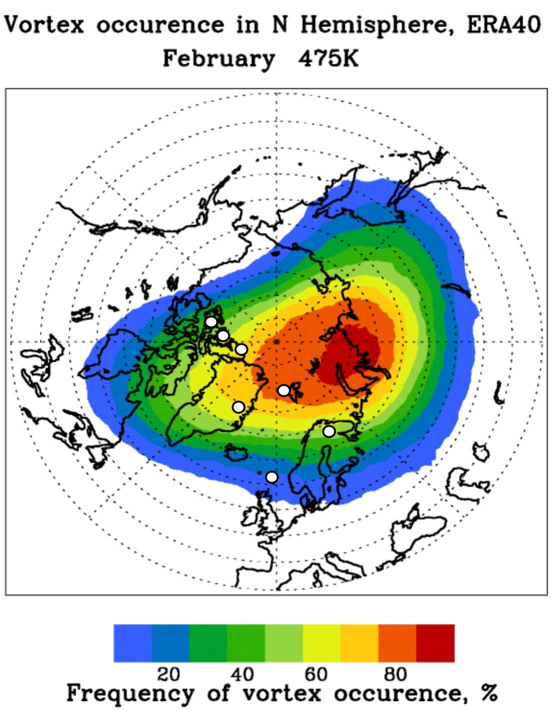


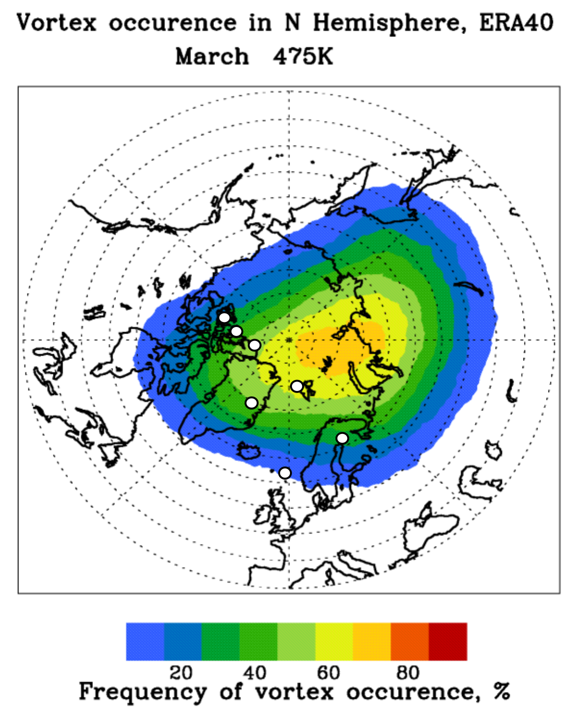
Station	Country	WMO Number	Latitude	Longitude	Data Record
Resolute	Canada	024	74.7°N	95.0°W	1979–
Alert	Canada	018	82.5°N	62.3°W	1987–
Sodankylä	Finland	262	67.4°N	26.6°E	1989–
Ny-Ålesund	Svalbard	089	78.9°N	11.9°E	1989–
Lerwick	UK	043	60.1°N	1.2°W	1992–
Eureka	Canada	315	80.0°N	85.9°W	1992–
Scoresbysund	Denmark	717	70.5°N	22.0°W	1993–[a]

[a]Additional data in February–May 1989 and November 1991 to April 1992.

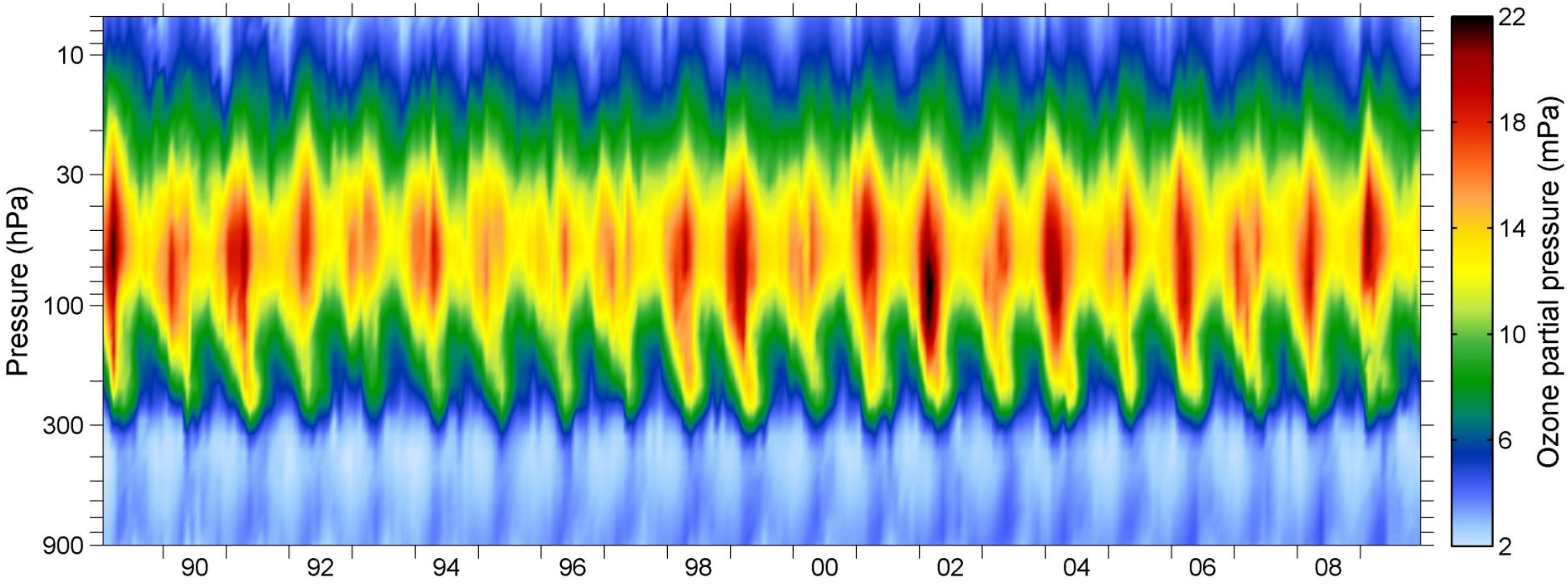

Vortex occurence in N Hemisphere, ERA40
December 475K
20 40 60 80
Frequency of vortex occurence, %


Vortex occurence in N Hemisphere, ERA40
January 475K
20 40 60 80
Frequency of vortex occurence, %


Vortex occurence in N Hemisphere, ERA40
February 475K
20 40 60 80
Frequency of vortex occurence, %


Vortex occurence in N Hemisphere, ERA40
March 475K
20 40 60 80
Frequency of vortex occurence, %

Arctic ozone inter-annual variability



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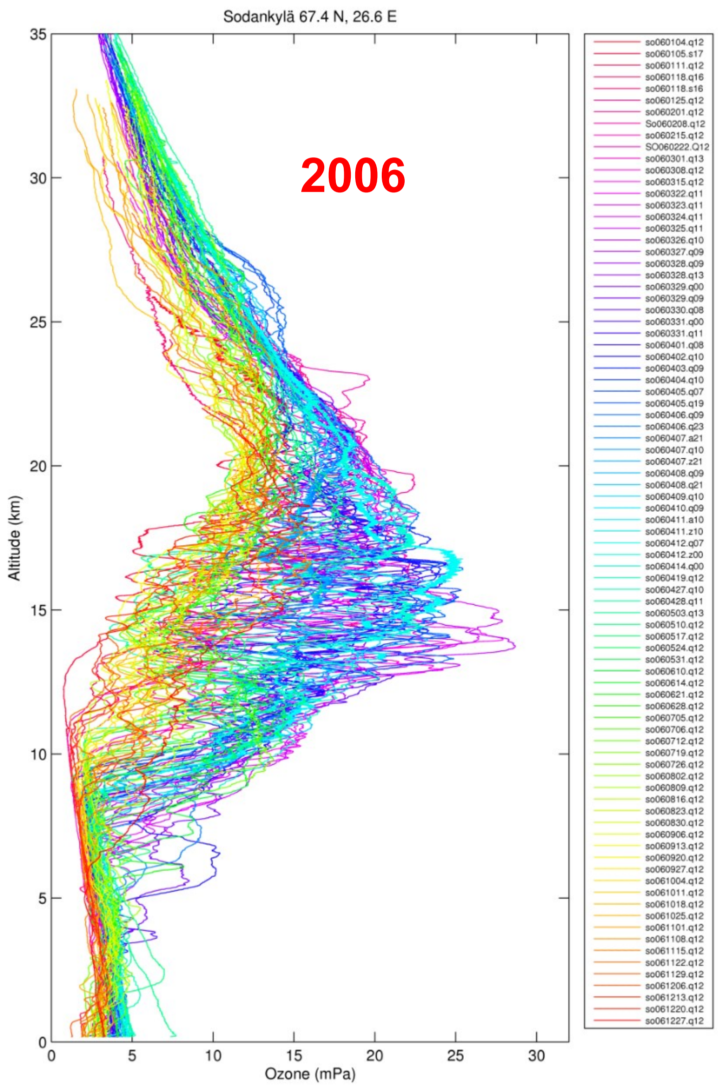

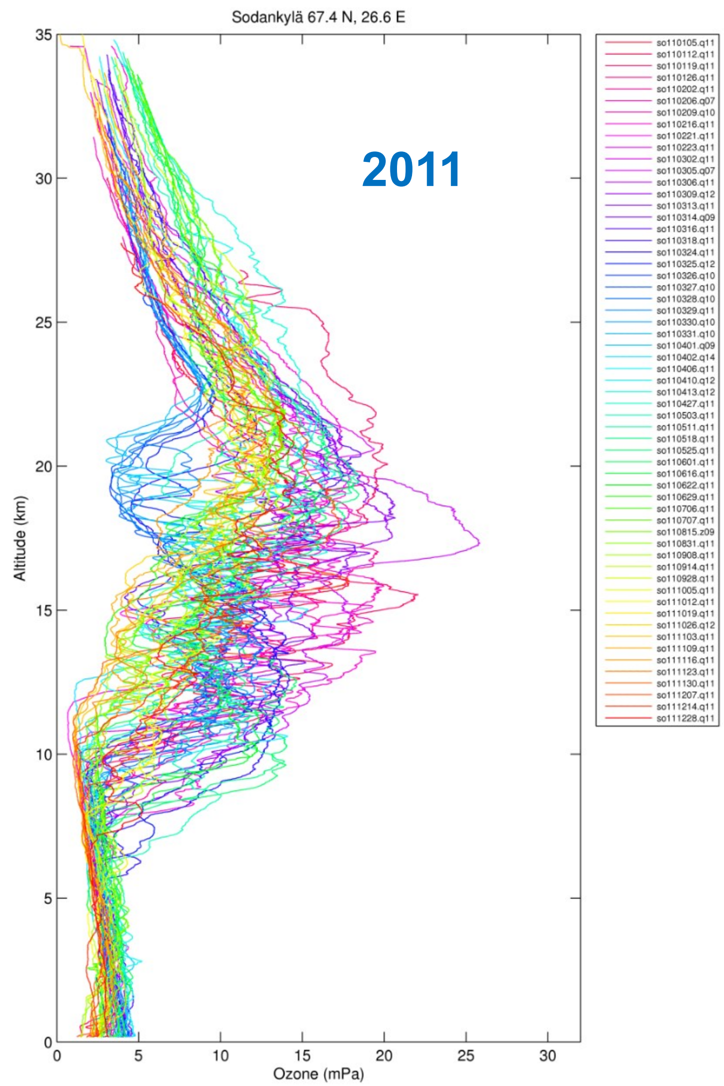

Soundings at Sodankylä start in 1988. References: Kivi et al., JGR 2007; Manney et al., Nature 2011; Kivi, 2014; Ryan et al., AMT 2016; Deshler et al., AMT 2017; Denton et al., GRL 2018; Denton et al., JASTP 2018; Christiansen et al., ACP 2017; Huan et al, AMT 2017, Thompson et al., BAMS 2019, Denton et al., JASTP 2019 etc.

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Ongoing work

Sources of possible inconsistency in the sonde data set:

- Changes in sonde type, sensing solution
- thermistor placement inside the ozone box
- pump efficiency corrections
- background current correction method