Contributions: Iceland (Arni Sigurdsson, Vedurstofa Islands), Norway (Georg H. Hansen, NILU), Sweden (Thomas Carlund, SMHI), Finland (Rigel Kivi, FMI) and Denmark/Greenland (Nis Jepsen, DMI)
Ozone measured in Reykjavik in 2020 using a Dobson. The gap in the data series from April 17th to June 9th is due to calibration work in Hohenpeissenberg. The ozone depletion observed in the Arctic is not observed here.
Ozone measured in Reykjavik in 2021 (until July 1st).
Ozone Time Series for Reykjavik 1958-2020. Blue line is average from individual years. Grey line is the 5 year moving average.
Norwegian ozone and UV monitoring network

Recent changes in Norwegian network:

- Ozone monitoring site at Blindern/University of Oslo moved to Kjeller/NILU (18 km east of Oslo) after retirement of key personnel in 2019
- Ny-Ålesund:
  - cooperation with National Research Council of Italy (CNR) on use of Italian-owned Brewer instrument
  - Installation of a Pandora spectrometer capable of monitoring $\text{O}_3$, $\text{NO}_2$ with sun and moon as light sources in March 2020; part of the SIOS research infrastructure network
Funding situation

• Funding of the Norwegian monitoring programme of the atmospheric ozone layer and natural UV radiation by the Norwegian Environment Agency since 1990;
• NILU in charge of total ozone measurements at 3 stations and UV measurements at these stations; remaining UV monitoring sites and calibration activities performed by the Norwegian Radiation and Nuclear Safety Authority
• Funding level is continued at the same level as in recent years; no major changes are expected in the next 2-3 years
Total ozone observations 2020 in Norway

- Strong signature of winter 2019/2020 Arctic ozone depletion at northern sites (Andøya, Ny-Ålesund), less pronounced at South-Norwegian station (Kjeller)
- Total ozone reduction of up to 170 DU compared to long-term mean mostly in April, but also severe reduction in preceding months at Ny-Ålesund
- Strong ozone mini-hole over Southern Norway in late January 2020 (210 DU)
- Marked ozone ridge in September at Ny-Ålesund: 80 DU above long-term mean over a 3-week period
UV observations and trends

UV dose rates 2020:
Marked spring «hump» at all 3 stations in April due to reduced ozone layer thickness

Trends 1996 - 2020
Oslo/Kjeller:
+0.8% / decade

Tromsø/Andøya:
+2.5% / decade

Ny-Ålesund:
-1.6 ± 2.7% / decade

None of trends significant at a 2-σ confidence level; single-year outliers have changed sign of trends in Oslo and Andøya compared to 2015
Swedish ozone and UV stations

- **Vindeln (64.24°N, 19.77°E, 225 m.a.s.l.)**
  Dobson ozone spectrophotometer #30 (Total ozone)
  Brewer spectrophotometer #6 (Total ozone, some UV spectra)
  (The Brewer calibrated by IOS August 2019)

  Operated by SLU (Swedish University of Agricultural Sciences)
  (Pernilla and Mikael)

- **Norrköping (58.58°N, 16.15°E, 50 m.a.s.l.)**
  Brewer spectrophotometer #128 (Total ozone)
  SL-501 UV biometer (Broadband CIE-weighted UV irradiance)
  K&Z SUV-E UVE radiometer (Broadband CIE-weighted UV irradiance)

  Operated by SMHI (Swedish Meteorological and Hydrological Institute)
  (Thomas)

Funded by Swedish Environmental Protection Agency, Swedish Radiation Safety Authority (SSM) and SMHI.
• Episodes with low TOZ over Sweden/Scandinavia in January, April and June

• **Record low** monthly mean TOZ in **April** at both sites.

• **Record low** monthly mean TOZ in **June** in **Vindeln**, next lowest in Norrköping.

• No unusually high daily TOZ
PSC (polar stratospheric clouds) in Northern Sweden, December 2019
Some monitoring results – Total ozone

- Annual mean TOZ in Norrköping 2020 lowest since the 1990’s
- The TOZ seem not to decrease after 1990’s
- No significant positive trends either
Record high measured monthly accumulated UVE radiation in April and June 2020 in Norrköping.

Reason: Thin ozone layer and high or record high solar radiation due to low cloudiness.

Taking measurement uncertainties into account, values in 2020 not significantly higher than earlier high values of UVE.

Positive trends in solar radiation since 1983.
FMI ozone observations

- Brewer instruments in Sodankylä and in Helsinki.
- SAOZ instrument is hosted in Sodankylä.
- Ozonesondes in Sodankylä and in Jokioinen.
- Ozonesondes in Marambio (Antarctica) in collaboration with SMN Argentina.
An example of ozone profiles measurements in Sodankylä.
DMI ozone observations

• Copenhagen, Brewer#082 and Brewer#228, YES UVI-instrument
• Kangerlussuaq (Sondre Stromfjord), Brewer#053 and Brewer#202, SAOZ spectrometer
• Ittoqqortoormiit (Scoresbysund), EnSci ozonesondes, SAOZ spectrometer (LATMOS)
• Hosting Aeronet Photometers (NASA) in Kangerlussuaq, Narsarsuaq & Ittoqqortoormiit
Season time series Copenhagen

Ozone measurements with Brewer#082 and Brewer#228 in Copenhagen. The year is divided into seasons, such as Dec, Jan and Feb is winter season. Data from before 1991 are from the NASA TOMS instrument on Nimbus7.
Ozone measurements with Brewer#082 and Brewer#228 in Copenhagen. The year is divided into seasons, such as Mar, April and May is the spring season. Data from before 1991 are from the NASA TOMS instrument on Nimbus7.