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Analysis of ECC dual flights at various sites: Correcting the KI-Concentration and sonde Manufacturer influences

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Abstract Different stations around the world have launched balloons carrying multiple ECC sondes to measure the systematic differences observed for sondes from different providers and using different sensing solutions. To synthesize the results of these campaigns conducted at 6 different sites, a dataset of more than 200 ECC sondes pairs comparison has been created. The different combinations of ozonesonde providers (e.g. ENSCI vs. SPC) and sensing solutions (e.g. 0.5% vs. 1.0%) are analyzed separately. The present analysis is complementary to the experiments performed in the Jülich atmospheric simulator (JOSIE[1]) and the field campaign at Laramie (BESOS[2]).

Data from six sites / stations

The table summarizes the **data providers** used in the analysis:

Institution / abbr.	Site of experiment	Type of flight
Univ. of Wyoming / UWY	McMurdo, Antarctica	Dual
Finish Meteo. Institute / FMI	Sodankylä, Finland	Dual / multiple
Goddard Space Flight Center / NASA	Wallops Island, VA, US	Dual
Environment Canada / EC	Vanscoy, Canada	Successive
NOAA-Boulder / ESRL	Laramie, WY, US	Multiple
MeteoSwiss / MCH	Payerne, Switzerland	Dual
International Project BESOS	Laramie, WY, US	Multiple

Different sensing solutions are used today in the global network of sounding stations and the solution composition has changed along the 40 years of ECC sounding. These change can introduce artificial trends in the series and in-homogeneities in the networks

Results: Sensing Solution Change

The results of the analysis are the mean ozone differences profiles from the different sites and for different sondes configurations. In **Figure. 1**, ENSCI sondes with 1.0% and 0.5% KI concentration are compared. Similar results for SPC sondes are shown in **Figure 2**.

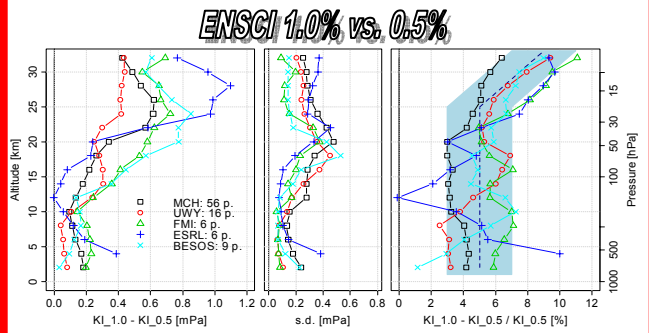

Figure 1: Difference profiles for ENSCI ozonesondes operated with 0.5% and 1.0% KI concentration. The 0.5% solution is obtained from dilution of the 1.0%.

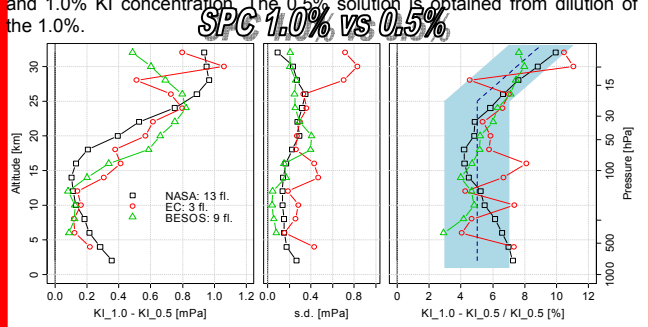

Figure 2: Difference profiles for SPC ozonesondes operated with 0.5% and 1.0% KI concentration. The 0.5% solution is obtained from dilution of the 1.0%.

Results: ECC Sondes Provider Change

The provider sensitivity test consists in having the sondes from different providers with the same or a different sensing solution. In **Figure 3**, the difference profiles from "ENSCI-0.5%" compared to "SPC-1%" are shown. **Figure 4** illustrates the provider differences.

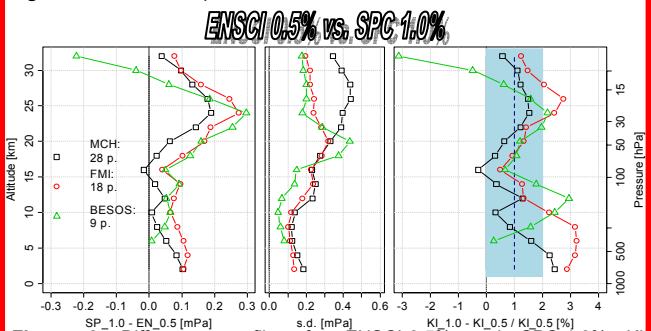

Figure 3: Difference profiles for ENSCI-0.5% and SPC-1.0% KI concentration. These solutions are recommended by the providers.

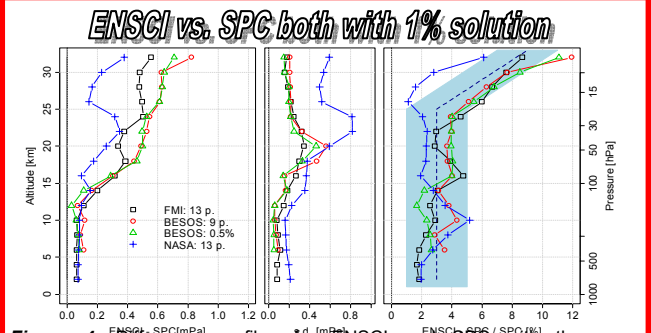

Figure 4: Difference profiles for ENSCI and SPC with the same concentration. BESOS data with 0.5% is also reported.

~~**First order transfer functions** are given to help correcting for changes in~~ the instruments settings used in the data acquisition:

- Difference 0.5 % => 1.0 %: 5% up to 25 km + add 1% / 2km above
- Difference SPC-1% and ENSCI-0.5%: not significant
- Difference ENSCI => SPC with same sensing solution: 3% till 25 km + add 1.5% / 2 km above.

Summary

The large data sets of ECC sonde pairs comparison from different stations and campaigns allows to conclude that:

- Similar results are found at stations with very different ozone profiles,
- The sensitivity of the sondes to the KI concentration is marked and a correction is needed for sondes data used in trend analysis,
- Correction is needed if a station has switched for SPC to ENSCI or vice versa without adapting the concentration accordingly,
- Alternatively, the normalization of the profiles with an independent total ozone column removes the constant factor bias,
- The back-ground current and to the pump corrections are certainly other important factors to consider.