

Long-range transport and deposition of current-use and legacy pesticides to ice caps on Svalbard, Norway.

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Introduction

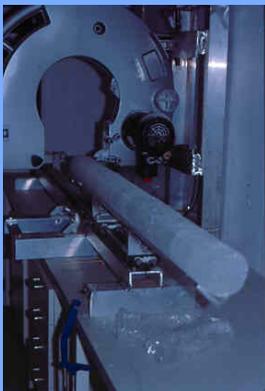
We analyzed current-use (CUPs) and legacy (LPs) pesticides from two ice cores on Svalbard, from Holtedahlfonna, elevation 1150 masl (drilled 2005) and Austfonna elevation 750 masl (drilled 1998). Both are large ice accumulations on Svalbard with long atmospheric input histories.



Above, map of the Svalbard Archipelago showing major towns and ice core drilling sites.



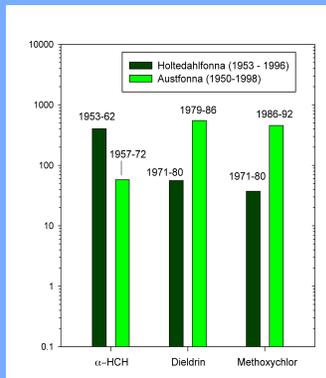
Above, the ice drilling site at Holtedahlfonna



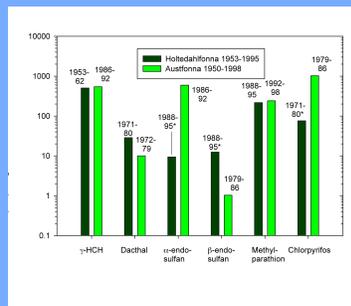
An ice core being sawed in the freezer, Norwegian Polar Institute.

Analysis

The cores were cut into segments in the field. They were melted & extracted in lab. We analyzed 64 pesticides at both sites. At Holtedahlfonna, we found 9 CUPs and 10 LPs, while at Austfonna, we found 18 CUPs and 10 LPs. We have comparable data for 3 LPs and 6 CUPs (pesticides found in each segment of both cores from ~1951 up to the late 1990s).



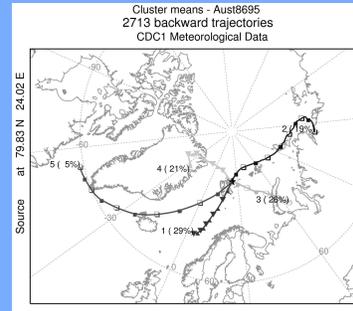
Ice core burdens in ng of comparable legacy pesticides are shown above. Dieldrin and methoxychlor are both about 10 times greater at Austfonna, with peak inputs occurring more recently.



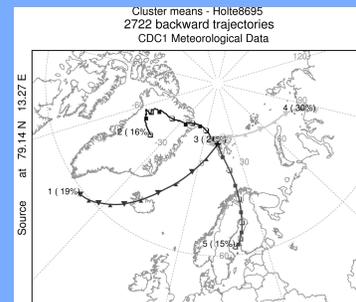
Ice core burdens in ng of comparable current-use pesticides are shown above. Burdens of older CUPs g-HCH and methyl parathion are the same. Chlorpyrifos and α-endo-sulfan are ~10 times (or more) greater at Austfonna.

Air mass source comparisons

The greater number of pesticides observed and the occasional greater burdens at Austfonna are at least partly a result of greater atmospheric flow from source regions to the south and east from Svalbard:



Above: Five-cluster averages of 2713 air mass trajectories to Austfonna from 1986 – 1995 showing 74% of flow from Eurasian sources to south and east.



Above: Five-cluster averages of 2722 air mass trajectories to Holtedahlfonna from 1986 – 1995 showing 45% of flow from Eurasian sources regions to south and east.

Conclusions

The comparison of CUP and LP burdens between the two sites shows that Austfonna receives more inputs of more pesticides than Holtedahlfonna. Ten-year cumulative 5-day air mass trajectories confirm that Austfonna has received more atmospheric flow from Eurasia than Holtedahlfonna. The result shown here is that pesticide inputs can vary significantly on scales of ~200 km within parts of the Arctic having no direct human impact.

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