

Radical views on snow chemistry

Several years ago *Environmental Chemistry* introduced Concept articles as a means for authors to present a new way of thinking about known phenomena, or a new way of interpreting existing data. Such articles lend themselves to speculation, which tends to generate lively discussion on a topic.

This is certainly the case for the Concept article by Tkachenko and Kozachkov appearing in this issue of *Environmental Chemistry*.^[1] The paper entitled 'Possible contribution of triboelectricity to snow–air interactions' presents the view that snow–air interactions and the resultant electrification of snow can play a significant role in snow chemistry processes. In this way, Tkachenko and Kozachkov hope to better explain some important polar chemical phenomena such as ozone depletion events and their relationship to the natural release of brominated compounds.^[2–4] During the peer-review process, the Concept article attracted varied and diverse comments, two of which have been expanded and are presented here to counterbalance some of the speculative ideas of Tkachenko and Kozachkov.

Bartels-Rausch and Schneebeli^[5] are generally in support of the Tkachenko and Kozachkov hypothesis – they believe that the proposed mechanism is theoretically feasible and could assist in our understanding of chemical processes in snowpacks. They remain, however, unconvinced that triboelectricity is needed to explain the observations. Although they present no firm rebuttal of the Tkachenko and Kozachkov concept, they briefly describe two other unexplored natural processes that could equally well contribute to some of the currently unexplained observations concerning the transport of trace gases in snowpacks. Bartels-Rausch and Schneebeli end their commentary with a call for further experimentation and field analyses to fully test the novel hypothesis of Tkachenko and Kozachkov.

Van Dam and Helmig^[6] consider that the Tkachenko and Kozachkov paper is a timely presentation of new ideas about snowpack chemical mechanisms. Although research over the last 20 years has indicated that the chemistry at the snow–atmosphere interface is largely controlled by photochemical processes, the hypothesis of Tkachenko and Kozachkov might provide a more complete picture of the processes involved. A key component of the new hypothesis is that ozone concentration gradients at the atmosphere–snowpack interface are related to wind speed, and are not fully explained by the wind pumping mechanism proposed by Helmig et al.^[7] To test the possible relationship between wind speed and ozone production within the snowpack, Van Dam and Helmig^[6] re-examine their own data of year-round ozone measurements in the boundary layer and inside the snowpack at Summit, Greenland.

Their premise is that photochemistry can only occur in the summer, possibly with a contribution from triboelectricity, whereas in winter photochemistry would not occur and triboelectricity would be the important contributor. Their winter data, however, indicate that triboelectricity is not a significant factor, and Van Dam and Helmig could find no evidence to support the Tkachenko and Kozachkov hypothesis. It remains possible, however, that triboelectricity might play a role under different conditions or that its effect on other compounds might be greater than that shown for ozone.

Environmental Chemistry is pleased to publish the interesting and novel ideas put forward by Tkachenko and Kozachkov. We hope that their Concept article will lead to further discussion and experimentation into the possible role of triboelectricity in the chemical processes in snow.

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