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Surprisingly small HONO emissions from snow surfaces at Browning Pass, Antarctica

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Abstract. Measured Fluxes of nitrous acid at Browning Pass, Antarctica were very low, despite conditions that are generally understood as favorable for HONO emissions, including: acidic snow surfaces, an abundance of NO_3^- anions in the snow surface, and abundant UV light for NO_3^- photolysis. Photochemical modeling suggests noon time HONO fluxes of 5–10 nmol m^{-2} h^{-1}; the measured fluxes, however, were close to zero throughout the campaign. The location and state of NO_3^- in snow is crucial to its reactivity. The analysis of soluble mineral ions in snow reveals that the NO_3^- ion is probably present in aged snows as $NaNO_3$. This is peculiar to our study site, and we suggest that this may affect the photochemical reactivity of NO_3^-, by preventing the release of products, or providing a reactive medium for newly formed HONO. In fresh snow, the NO_3^- ion is probably present as dissolved or adsorbed HNO_3 and yet, no HONO emissions were observed. We speculate that HONO formation from NO_3^- photolysis may involve electron transfer reactions of NO_2 from photosensitized organics and that fresh snows at our site had insufficient concentrations of adequate organic compounds to favor this reaction.

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