

## ***Interactive comment on “1-D air-snowpack modeling of atmospheric nitrous acid at South Pole during ANTCI 2003” by Wei Liao and D. Tan***

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We are using the previous field observation that "HONO at 30 cm can be bigger than HONO at 10 cm in the snowpack" to reject the previously widely accepted "theory" that "photolysis of nitrate is the main reason for snowpack HONO emission". As mentioned in this paper, the nitrite can come from the source other than the photolysis of nitrate, such as the hydrolysis of NO<sub>2</sub>. Furthermore, we proposed our understanding of the physics/chemistry process and quantify the discussion with the proposed model. The aim of our model is not to prove the mentioned fact.

We don't quite agree with commenter's assumptions listed below:

"C proportional upon actinic flux" since the chemistry source and sink both involve photolysis.

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"Boundary condition of  $C=0$  at  $z=0$ " There are measurement evidence that sometimes surface HONO concentrations can be higher than snowpack HONO. If the snowpack pH is basic, the snowpack can be a HONO sink other than a source.

We can shutdown chemistry to distinguish between diffusion and chemistry.

In our proposed model (equation 3), the HONO gradient can go either way (see fig 7 on page 9759). In our analysis during ANTCI 2003, the QLL nitrite provides too much HONO and diffusion dominates chemistry. In other scenario, it is not necessarily true.

Thanks for commenting on our paper and we would welcome any further discussions!

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9731, 2008.

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