

Interactive comment on “Hydration of the lower stratosphere by ice crystal geysers over land convective systems” by S. Khaykin et al.

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The authors thank the reviewer for his useful remarks.

1. Some of the observed water vapor enhancements are rather small but yet obvious and are found related to overshoots upwind. Ice particles in subsaturated environment, coinciding with the water vapour enhancement of 7 ppmv, were observed during high local convective activity on 23 August; they are most likely originating from a very fresh overshoot, which made it possible to detect them before sublimation. The indirect evidence that these particles are composed of ice is coming from the BKS color index, which also allows to estimate their size (0.5 - 10 microns). The case of 23 August provides an experimental illustration of the mechanism by which moisture could penetrate the stratosphere. The consequences of such hydration, i.e. enhanced water vapour layers observed in all present water vapor profiles. The discussion of particles

occurrence and their relation to the water vapour enhancements has been improved.

2. From the observations we conclude that ice geysers hydration may be an important factor controlling water vapour in the stratosphere on a global scale. The quantification of the amount of moisture transported by this process at global scale is highly dependent on the frequency of overshooting events, which is still little known. It is clear that such quantification falls beyond the scope of the paper, limited to the provision of an experimental evidence of the existence of such hydration process. The paper shows that deep overshooting convection occurring above continents does have significant potential to hydrate lower stratosphere and hence can be an important contributor to the stratospheric water budget. Indeed, hydration mechanism is required to explain the hygropause located 3.5 km above the tropopause, the gradual decrease of water vapour from the cold point to the hygropause and the summer seasonal increase of water vapour in the lower stratosphere. Though the latter is known from satellite observations, the new information from high-resolution balloon measurements is the highly structured profile in the lower stratosphere, suggesting that the geyser hydration process could be an important contributor.

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