REPLY TO COMMENT 3 OF ANONYMOUS REVIEWER #2

We extend here on the "history" of the water vapor diffusion coefficient in snow in more detail. Our review showed that the definition of the fluxes and the coefficients used where often not very clear. We also observe that different concepts intermingled. This mingling stems from the fact that specific interest in snow science was always how the "grains" grow. Initially, the water vapor diffusion coefficient was thought of as a purely physical property, with a value of 0.22×10^{-5} $\mathrm{m^2 s{-}1}$. With the observation and introduction of the hand-to-hand process Yosida & Colleagues (1955) also introduced the concept of diffusion enhancement. Their measurements were taken as a reference until about 1995, and largely influenced the way of thinking. Giddings & LaChapelle (1962) developed the correct theory, and questioned the very high effective diffusion coefficients of Yosida & Colleagues (1955). However, the field experiment of Giddings & LaChapelle (1962) could not elucidate this question, and they had in fact to adjust by a free parameter the equation used to model grain growth. This is not surprising in hindsight, because instead of measuring the water vapor flux, they measured the growth in grain size. This result seemed to question the theory, and so the paper was poorly received and rarely cited. In fact, the experiments of Yosida & Colleagues (1955) were never repeated until about 1988 by Voitkovskii *et al.* (1988) (in a study not known in the international literature), and repeated by Satyawali (2000). Colbeck (1983) developed a theory to explain grain growth and morphology. Without explicit reference to Yosida et al. (1955), he developed a geometrical model and introduced a shape factor. Similarly, the papers by Gubler (1985); Sommerfeld (1983) are also considering grain growth. To explain the observed growth rate, they used an "effective" vapor diffusion coefficient, and in addition shape factors. Gubler (1985) used the standard water vapor diffusion coefficient in developing the theory, but then developed a grain growth model using a geometrical and an enhancement factor. Colbeck (1993) cautiously concluded "... at this time from physical reasoning, results from soils, results from snow experiments and the particle-to-particle model given here, is that D_{eff} in snow is above five times greater than its value in air, and decreases slowly as the average pore size increases". This value of D_{eff} was questioned by new measurements by Sokratov & Maeno (2000), and partially by Satyawali (2000).

We believe that a more complete picture results once the complete recrystallization of the structure, as shown in the supplementary movie, and in Fig. 7, is taken into account. Structural growth and vapor flux are coupled in a very complex way, and for the morphology of crystals the local environment is decisive while an effective diffusion coefficient is a macroscopically averaged quantity. The rate and location of sublimation and deposition depends possibly not only on the fluxes, but in addition on the initial and developing geometry.

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