

Second review for tc-2021-240 "Modeling enhanced firn densification due to strain softening" by Oraschewski and Grinsted

I would first like to thank the authors for their careful reply to all the comments made during the first round of review. I think the paper has significantly been improved but there are still a number of points regarding the model development that are a bit obscure. They are listed below by order of appearance in the manuscript, as well as some minor remarks.

- lines 54, 261: I don't think there is the need of a capital letter after a colon.
- line 98: you should start to give the exact definition $\frac{1}{\rho} \frac{\partial \rho}{\partial t} = \text{tr}(\dot{\epsilon})$
- Equation (5): the way Eq. (5) is obtained looks like a magic trick! Why not just saying that you are making the assumption that $\dot{\epsilon}_h = \dot{\epsilon}_{xx} + \dot{\epsilon}_{yy} = 0$ instead of adding it to one term to subtract it right after? This part is a bit confusing and it is difficult to get a correct meaning of all these different terms introduced for $\dot{\epsilon}_{zz}$.
- line 118: I am not sure that phase is adapted here! The constitutive relation is given on the form of a tensorial relation between Cauchy stress and strain rate, which can be decomposed in two sets of relation: one tensorial between deviatoric stress and deviatoric strain-rate and one scalar relation between isotropic pressure and rate of change in volume. Phase in a classical meaning is more referring to ice and air for example for snow, which is not the meaning here I guess?
- line 125: it should be mentioned that the two factors a and b are function of the density. The way it written here using "factor" makes think there are constants.
- line 170 k_1 and k_2 are not written the same way as in (10) and (11).
- line 172: not clear what you mean by the two versions of Eq. (12)?
- line 189: the fact that it is difficult to estimate the strain-rate components should be emphasized. Instead of *In summary, all components of* could be *In summary, if all components of* for example.
- lines 303, 342: I think there is a confusion about temperature, which is taken constant and uniform. If I understand that seasonal variation of temperature can be neglected, changes in temperature with depth should be accounted for, which seems not the case here? In the CFM paper, it is mentioned that T is the temperature of a specific parcel of firn and thus is not uniform (function of depth and eventually of horizontal coordinates also). Is there an existing temperature profile at EGRIP that could confirm that the temperature is uniform in the firn?
- line 355: why not 295 kg m^{-3} as mentioned above?
- line 387: indicated
- Figure 5: I don't understand why all the density measurements in Greenland and Antarctica (the red dots in Fig. 5) are not compared with the model results for this last application?