Dear Perry and co-authors,

I (still) regret to say that your mass conservation given by Eq.(4) in your paper is not correct.

Let us use your notation. You must consider the relative velocities $V_r = V - \dot{S}_\Omega$ when writing mass continuity in a control volume moving at speed $\dot{S}_\Omega$ (your sketch drawn in figure 1):

$$\rho_\Phi h_\Phi V_{r,\Phi} = \rho_\Omega h_\Omega V_{r,\Omega}. \tag{1}$$

It follows:

$$\rho_\Phi h_\Phi (V_\Phi - \dot{S}_\Omega) = \rho_\Omega h_\Omega (V_\Omega - \dot{S}_\Omega). \tag{2}$$

Because the material between the wall and the discontinuity traveling at speed $\dot{S}_\Omega$ is at rest (in the domain Ω), we have $V_\Omega = 0$. This then gives:

$$\rho_\Phi h_\Phi (V_\Phi - \dot{S}_\Omega) = -\rho_\Omega h_\Omega \dot{S}_\Omega, \tag{3}$$

and:

$$\rho_\Phi h_\Phi V_\Phi = -\rho_\Omega h_\Omega \dot{S}_\Omega + \rho_\Phi h_\Phi \dot{S}_\Omega \tag{4}$$

The equation above corresponds to the correct mass conservation, and yields:

$$\dot{S}_\Omega = \frac{-V_\Phi}{\frac{\rho_\Omega h_\Omega}{\rho_\Phi h_\Phi} - 1}. \tag{5}$$

(By the way, note that your velocities $\dot{S}_\Omega$ and V_Φ, as defined in figure 1, are of opposite sign)

The calculations above (for $h_\Omega / h_\Phi > 1$) also work for the case $h_\Omega = h_\Phi$ if you would like to describe compaction against the wall without flow expansion upward ($h_\Omega = h_\Phi$ could be a reasonable assumption at the impact with the wall. However, after the initial impact of the snow avalanche with the wall this looks very unlikely to me).

Your Eq.(4) is wrong: it has to be corrected.

Regards,
Thierry FAUG