Incorporating Snow Fences in the NSDSS Water Budget Model.

Any snow fence has a maximum snow retention capacity. The Volume of Snow that corresponds to this maximum capacity in the snow fence can be estimated based on Tabler 1980 (equations 6a, 6b and 7):

Horizontal slat fence

$V_{snow} = L^* (19.3*H^2+2.6*H^2)*K$

Vertical slat fence

$V_{snow} = L^* (14.5*H^2+2.6*H^2)*K$

H is snow fence height (meters)

L is length of the snow fence in meters

K is empirical coefficient that accounts for the fence trapping efficiency (K = 0.9)

(Note: The $19.3H^2$ and $14.5H^2$ terms in the above equations account for the leeward side of the fence. The $2.6H^2$ terms account for the windward side)

Stuefer evaluated the Tabler equations against her field data (Sturm and Stuefer 2013 (Table 2 and Table 4)):

Design	Height (m)	Volume per meter fence (m^3)		
		Calculated	Measured	Difference
Plastic Fencing (using horizontal slat formula)	2.4	114	100	88
Vertical slat	4	246	230	93
Plastic Fencing (using horizontal slat formula)	3	177	182	102

Thus, the Tabler equations were supported by the Sturm and Stuefer field data.

To convert volume of snow into volume of water use:

V_{water} = (snow density) * V_{snow} / (water density);

where snow density is assumed to be constant (450 kg/m^3), a value consistent with Tabler (1980) and Sturm and Stuefer (2013). Water density is assumed to be 1,000 kg/m^3.

V_{water} can now be inserted into the Water Balance equations 6a and 6b (White Paper, See http://nsdss.ine.uaf.edu/NaturalSystemModeling/WhitePapers/WhitePaper_NSDSS_Lake_Water_Budget_Modeling.pdf).

References:

Tabler, R.D. 1980. Geometry and density of drifts formed by snow fences. Journal of Glaciology, 26(94), 405–419.

Sturm, M. and S.L. Stuefer, 2013. Windblown flux rates derived from drifts at Arctic snow fences. Journal of Glaciology, Vol. 59, No. 213, p. 21-34, doi: 10.3189/2013JoG12J110,