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Aitken mode particles as CCN in aerosol- and updraft-sensitive regimes of cloud droplet formation

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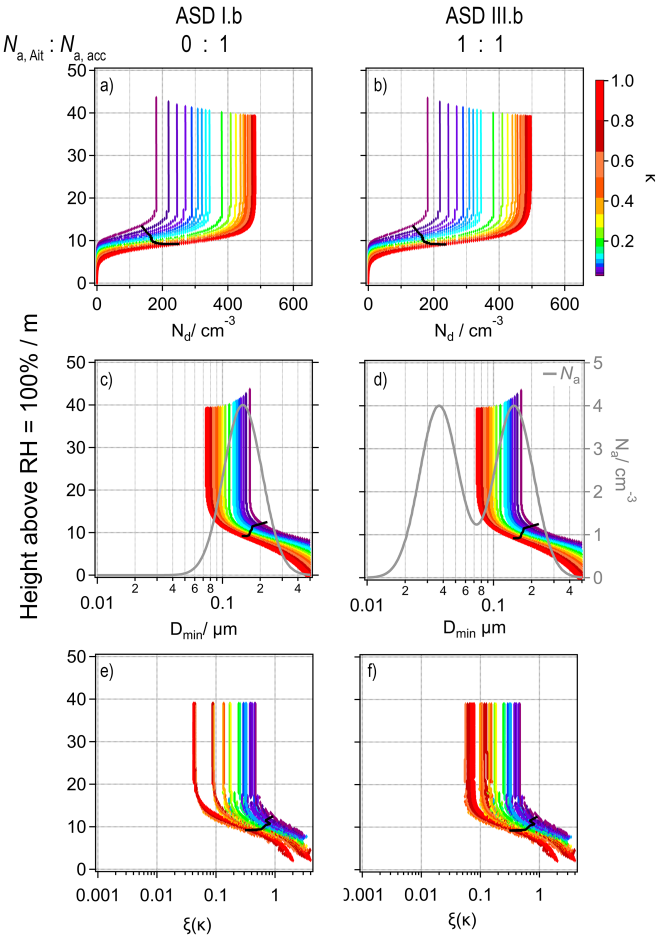

Figure S1. Vertical profiles of (a,b) droplet number concentration (N_d), (c, d) dry size of smallest particles that contribute to N_d (D_{min}), overlaid by the ASD (grey lines), and (e, f) sensitivity of N_d to κ ($\xi(\kappa)$ for an updraft velocity w = 1.0 m s^{-1}. Left and right columns show results for ASD I.b and III.b, respectively. The black lines denote the height of S_{max}.

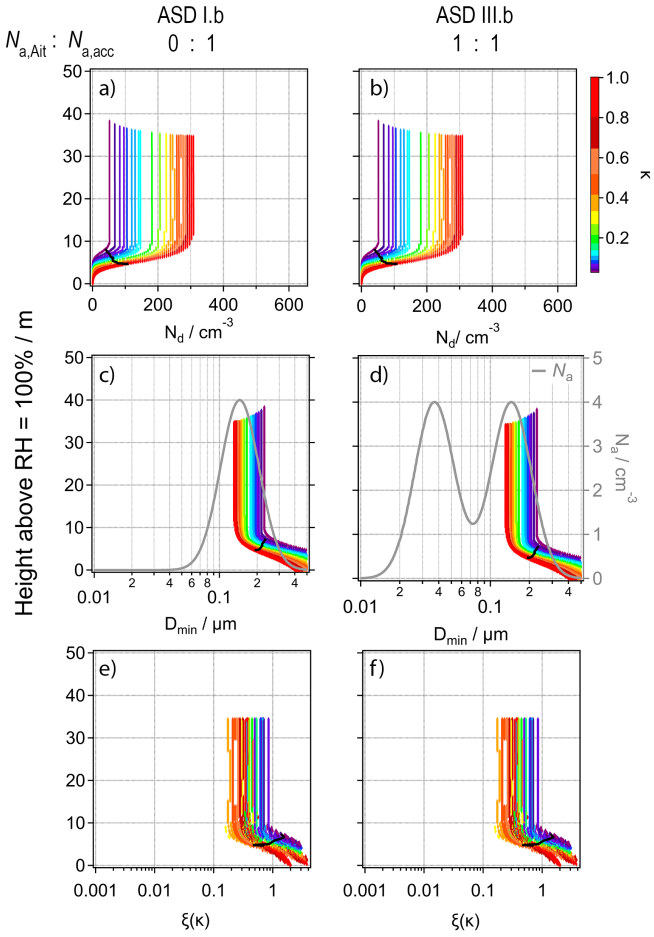

Figure S2. Vertical profiles of (a,b) droplet number concentration (N_d), (c, d) dry size of smallest particles that contribute to N_d (D_{min}), overlaid by the ASD (grey lines), and (e, f) sensitivity of N_d to κ ($\xi(\kappa)$ for an updraft velocity w = 0.2 m s^{-1}. Left and right columns show results for ASD I.b and III.b, respectively. The black lines denote the height of S_{max}.

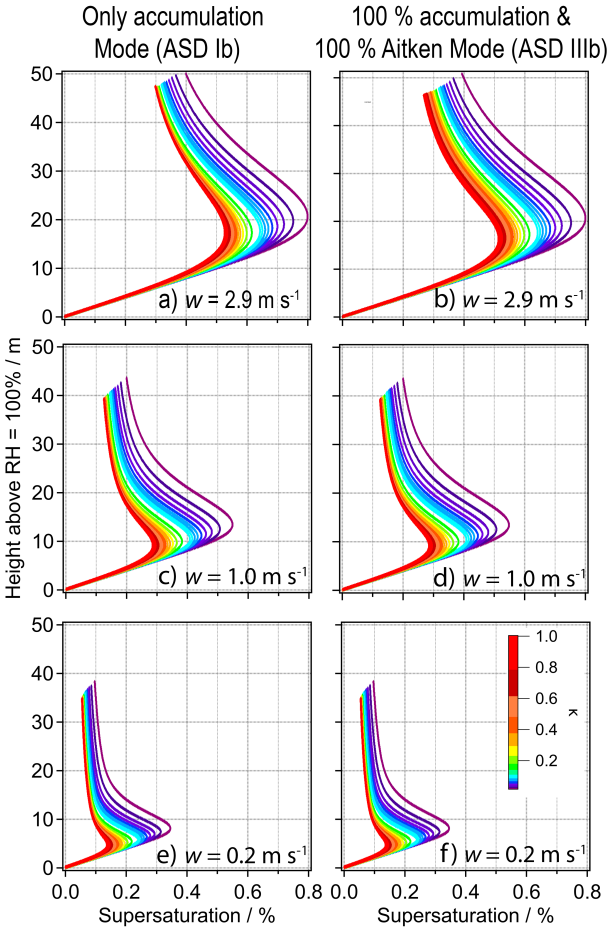

Figure S3. Left column: Supersaturation [%] for ASD I.b as a function of κ for a) w = 2.9 m s^{-1}, c) 1.0 m s^{-1}, e) 0.2 m s^{-1}; Right column: Supersaturation [%] for ASD III.b as a function of κ for b) w = 2.9 m s^{-1}, d) 1.0 m s^{-1}, f) 0.2 m s^{-1}

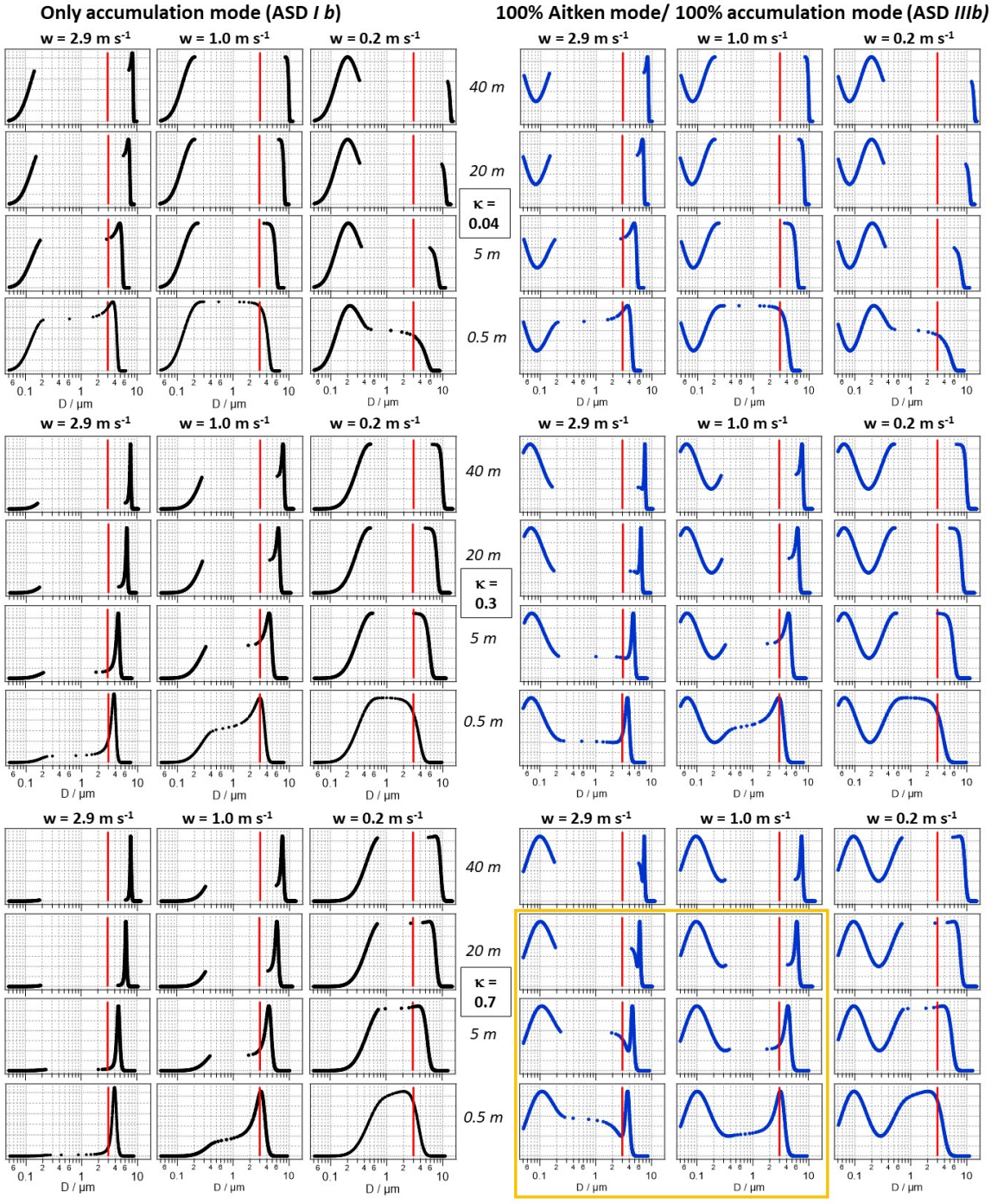

Figure S4. Size distributions of haze particles and cloud droplets as predicted for ASD I.b (black) and III.b (blue) at four heights above the level of RH = 100% (0.5 m, 5 m, 20 m, 40 m), three updraft velocities (columns) and three κ values (set of twelve panels each). The red lines mark the size threshold for cloud droplets ($D_{wet} \geq 3$ μm). The orange box indicates the conditions under which Aitken mode particles start contributing to N_d (cf 'turnover' of $\xi(\kappa)$ in Figure 2 f).

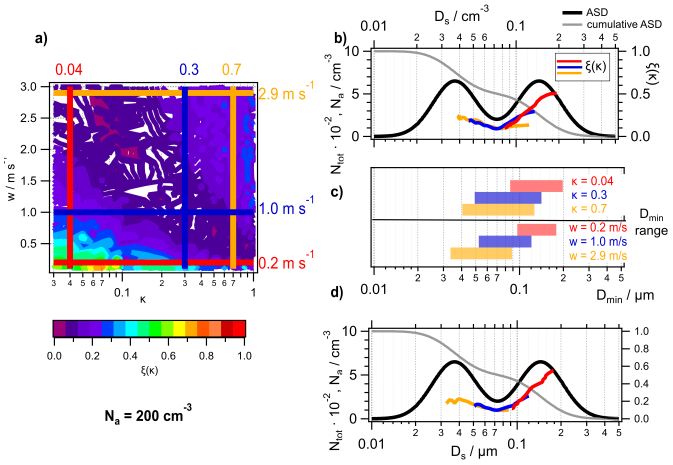

Figure S5. Same as Figure 3 but for ASD III.a (N_a = 200 cm^{-3})

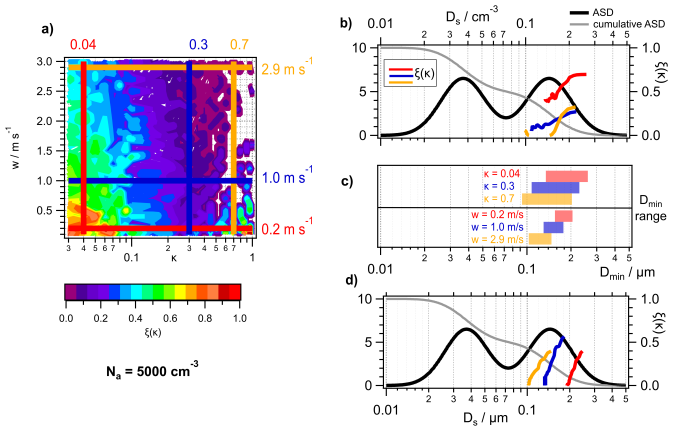

Figure S6. Same as Figure 3 but for ASD III.c (N_a = 5000 cm^{-3})

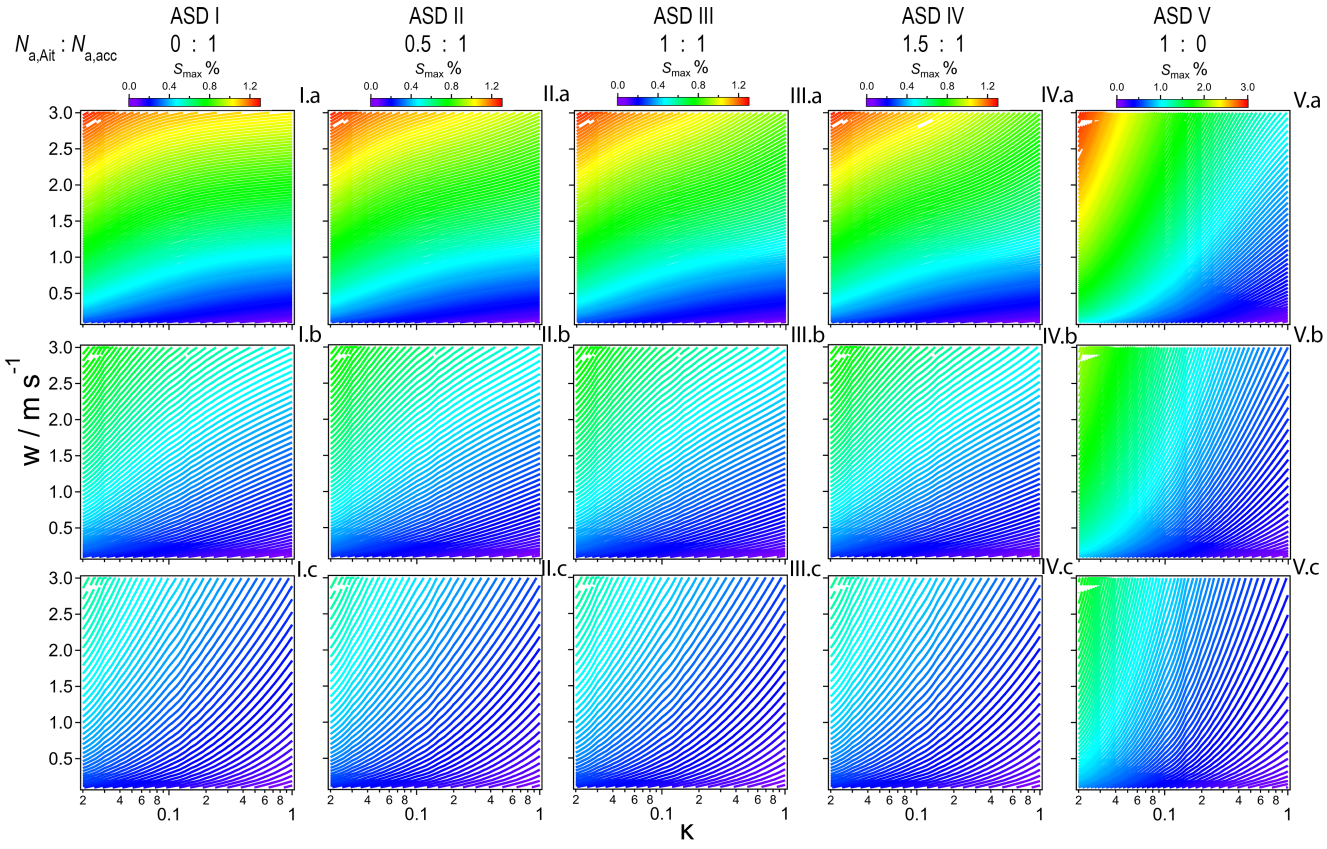

Figure S7. Supersaturation (s-1 [%]) as a function of w and κ for ASDs I.a - V.c (Figure 1). The figures are based on 810 model simulations assuming 30 different values of w and 27 different values of κ for each ASD. Note that the color scales show $S_{max} \leq 1.3\%$ for ASD I-IV and $S_{max} \leq 3\%$ for ASD V.

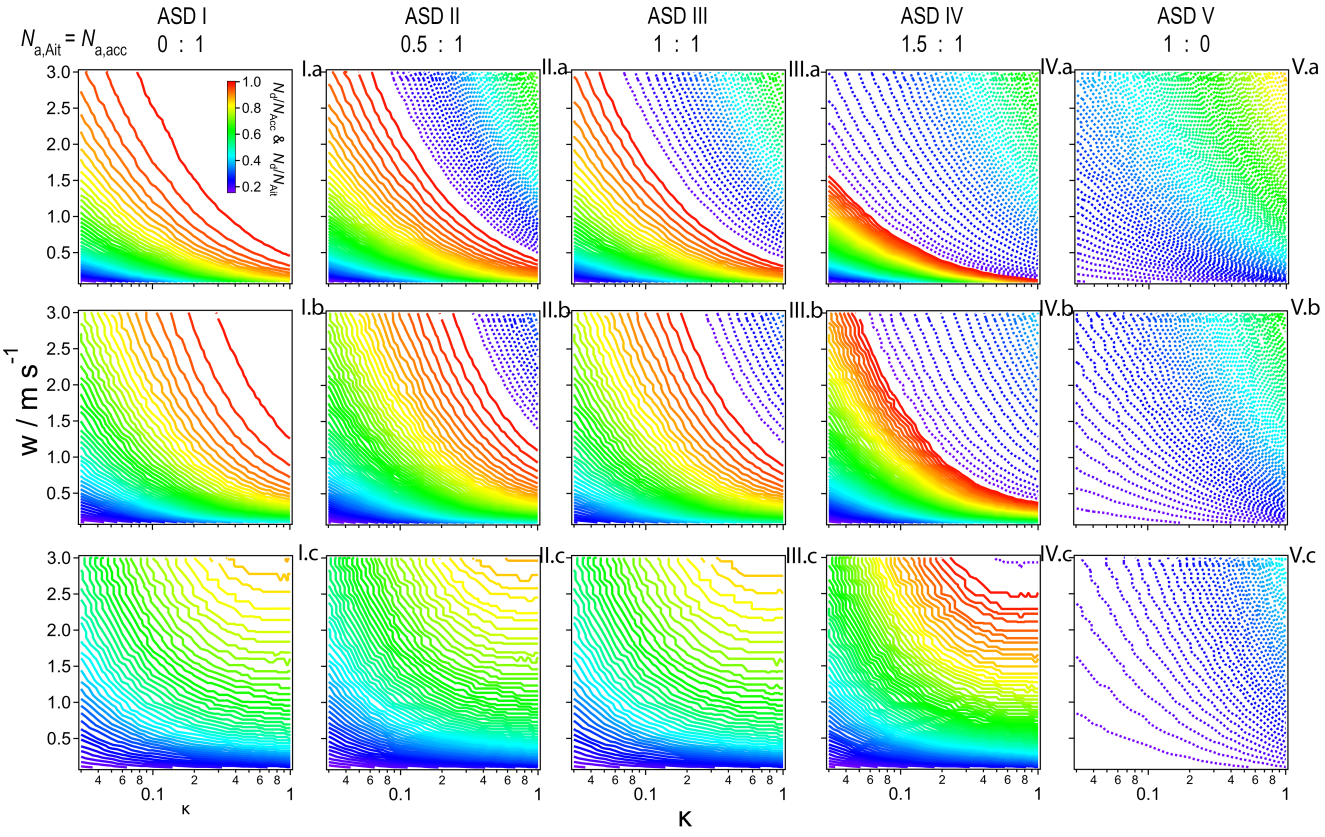

Figure S8. Activated fractions of Aitken and accumulation modes ($F_{act,Ait}$ (dotted lines), $F_{act,acc}$ (solid lines)) as a function of w and κ for ASDs I.a - V.c (Figure 1). The figures are based on 810 model simulations assuming 30 different values of w and 27 different values of κ for each ASD.

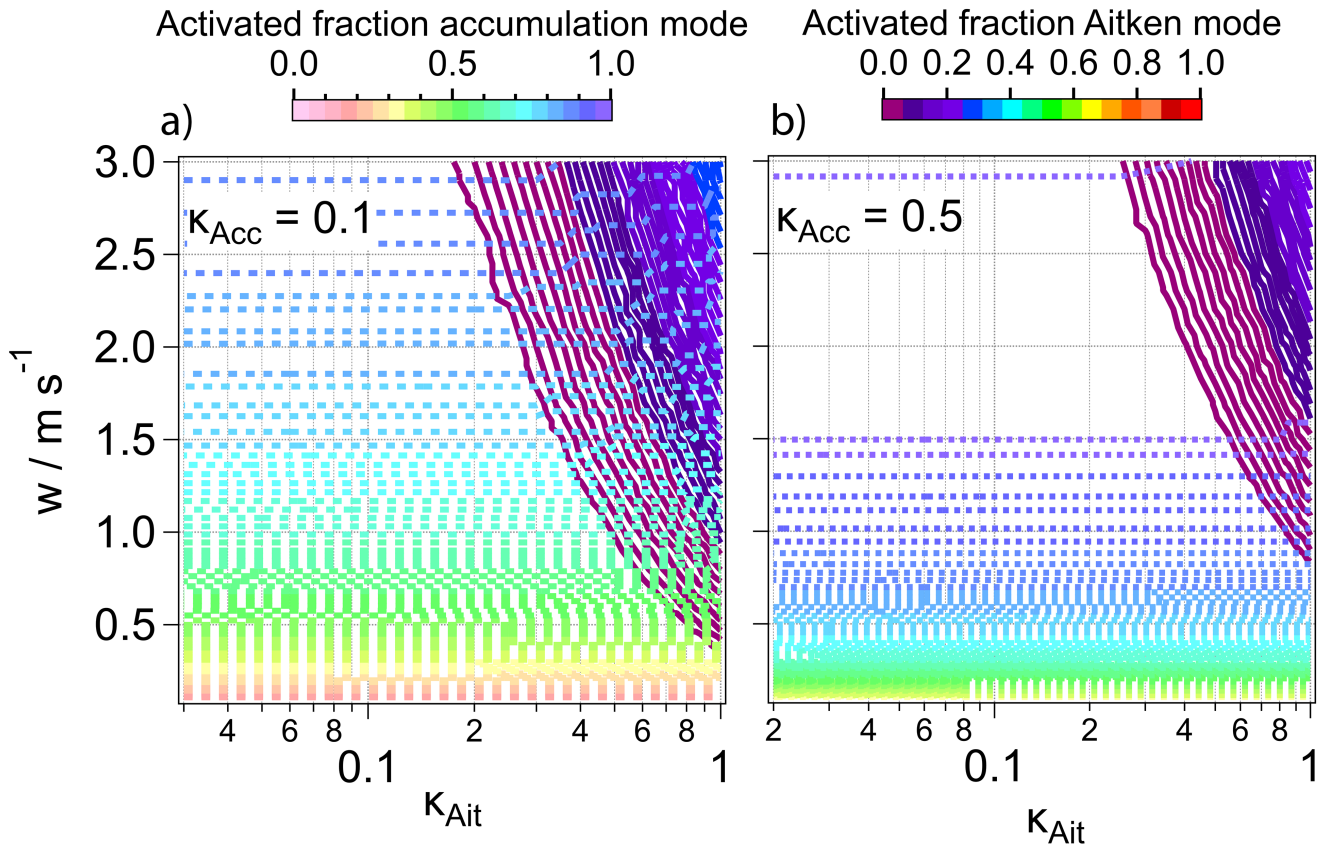

Figure S9. Activated fractions for accumulation mode ($F_{act,acc}$, dashed lines, ≤ 1) and Aitken mode ($F_{act,Ait}$, solid lines) for a) κ_{acc} = 0.1 and b) κ_{acc} = 0.5, corresponding to the results in Figure 6 c and d.