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Reply on RC1

Peter A. Taylor et al.

Author comment on "Surface deposition of marine fog and its treatment in the Weather Research and Forecasting (WRF) model" by Peter A. Taylor et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-344-AC2, 2021

We appreciate Dr Beljaars generous comments, especially his support of a constant flux layer model.

In a separate, recently submitted, research note, Taylor (2021), deposition velocity issues, of fog and other aerosol are investigated through a model (CFLGS) of "Constant Flux Layers with Gravitational Settling". This addresses issues of which process, gravitational settling (w_s or V_g are both commonly used as symbols) or turbulent flux and deposition, carries the downward flux.

In the current paper (ACP-2021-344) we present the CFLGS result (Eq 3) but within our WRF calculations the turbulent diffusion and gravitational settling adjustments at each time step are computed in different modules. Gravitational settling is computed as a part of the Thompson microphysics module while turbulent diffusion is dealt with in the MYNN boundary layer and surface modules. This splitting is mathematically sound but we should note that the Thompson microphysics scheme, with mp_physics=8, works with a gamma function distribution of droplet sizes rather than having a single droplet size and single gravitational settling velocity, the case we have considered in CFLGS. The lower parts of the WRF SCM profiles shown in Fig 2 have the same general form as the CFLGS solution but will not correspond to our single value of the ratio $w_s/ku_\square$. The Thompson microphysics module uses separate gravitational settling velocities for liquid water and droplet number, each of which may vary with height, based on averages over assumed gamma function distributions.

References

Taylor, Peter A., 2021, Constant Flux Layers with Gravitational Settling: with links to aerosols, fog and deposition velocity. Submitted to ACP. (ACP-2021-594)