Supplement of Geosci. Model Dev., 17, 685–707, 2024
https://doi.org/10.5194/gmd-17-685-2024-supplement

Geoscientific Model Development
Open Access

Supplement of

Modeling below-cloud scavenging of size-resolved particles in GEM-MACHv3.1

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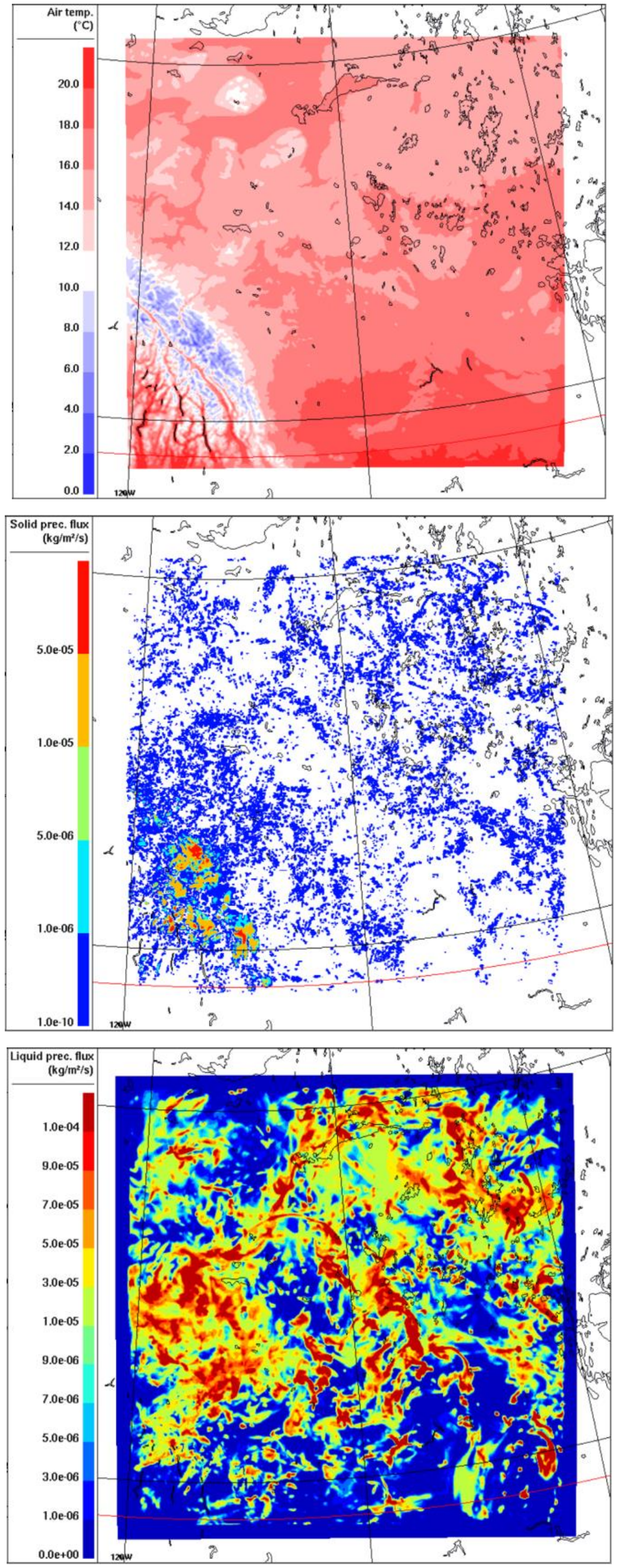

Figure S1: July average temperature, and total snow and rain fluxes.

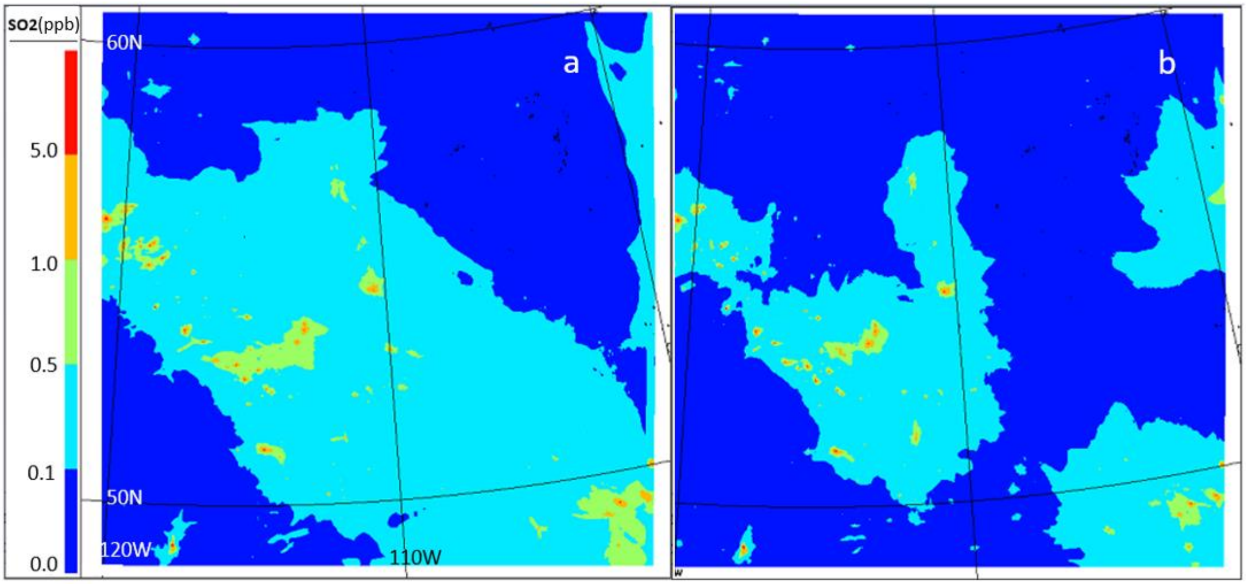

Figure S2: Averaged SO_2 concentrations (ppb) for April (a) and July (b). Most of the $SO_4^=$ and HSO_3^- in the region originates in emissions of SO_2 from the large stacks in the Oil Sands area. However, their influence when plotted as emissions is not easy to discern, since the relatively high emissions levels occur only in a few model grid cells (those in which the stack sources are located). To better show the relative influence of different sources of SO_2 as the emitted precursor of $SO_4^=$ and HSO_3^-, we have provided a map of average SO_2 concentrations over the region for the period of our simulations, in the SI. This clearly shows the hotspots of SO_2 associated with the Oil Sands sources, and the relative influence of other sources in the model domain.

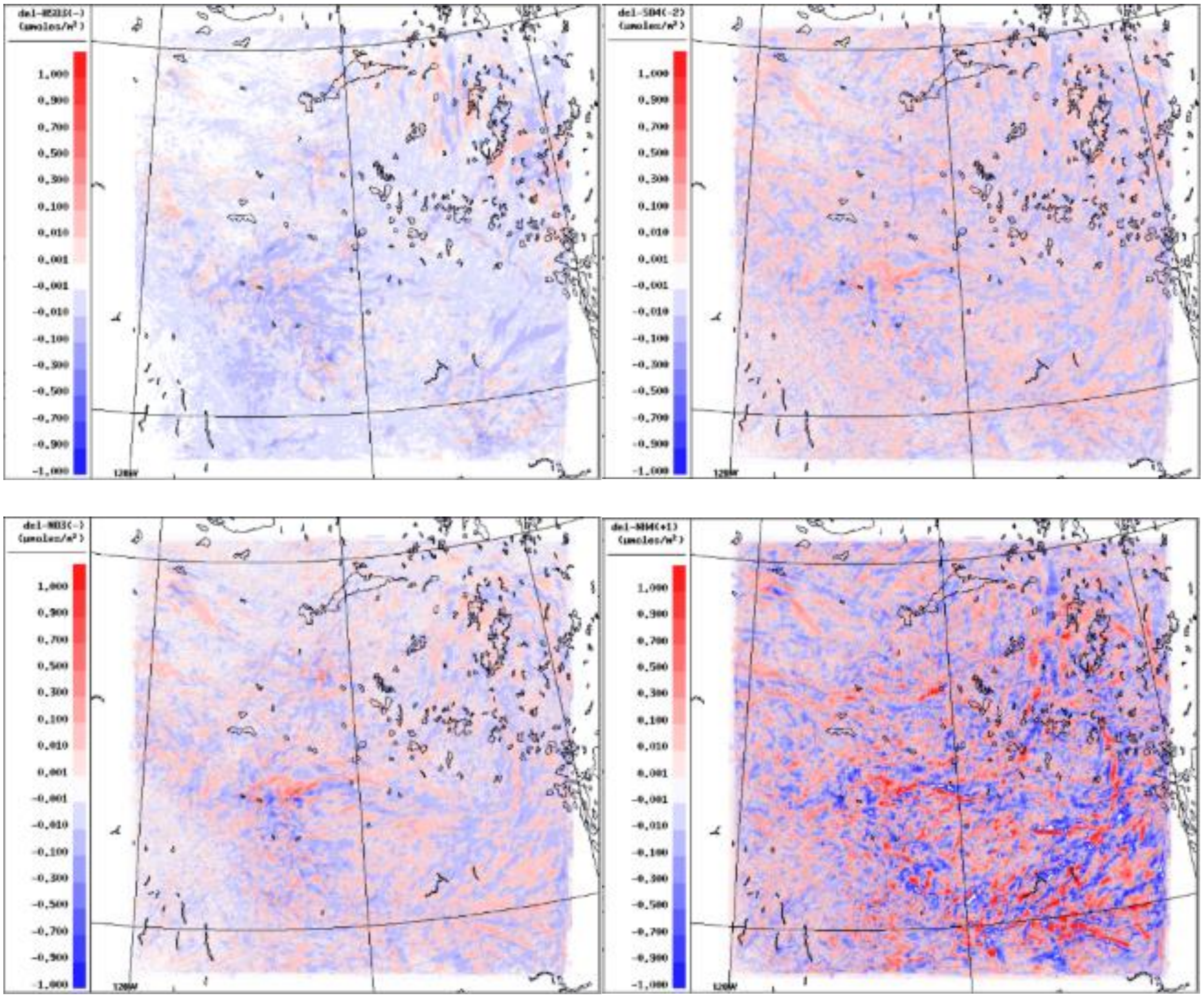

Figure S3: The net differences of mean SO_3^{1-}, $SO_4^{=}$, NO_3^- and NH_4^+ for the multi-phase and base-case (e.g. Multi-phase – base-case) for July 2018.

Values of domain-mean depositions - Base-case: SO_3^- = 0.027 (0.216), $SO_4^{=}$ = 0.187 (17.952), NO_3^- = 0.176 (9.68), NH_4^+ = 1.950 (21.45) μmol/m^2 (μg/m^2). Multi-phase: SO_3^- = 0.024 (2.0), $SO_4^{=}$ = 0.190 (18.24), NO_3^- = 0.177 (9.73), NH_4^+ = 1.962 (21.59) μmol/m^2 (μg/m^2).

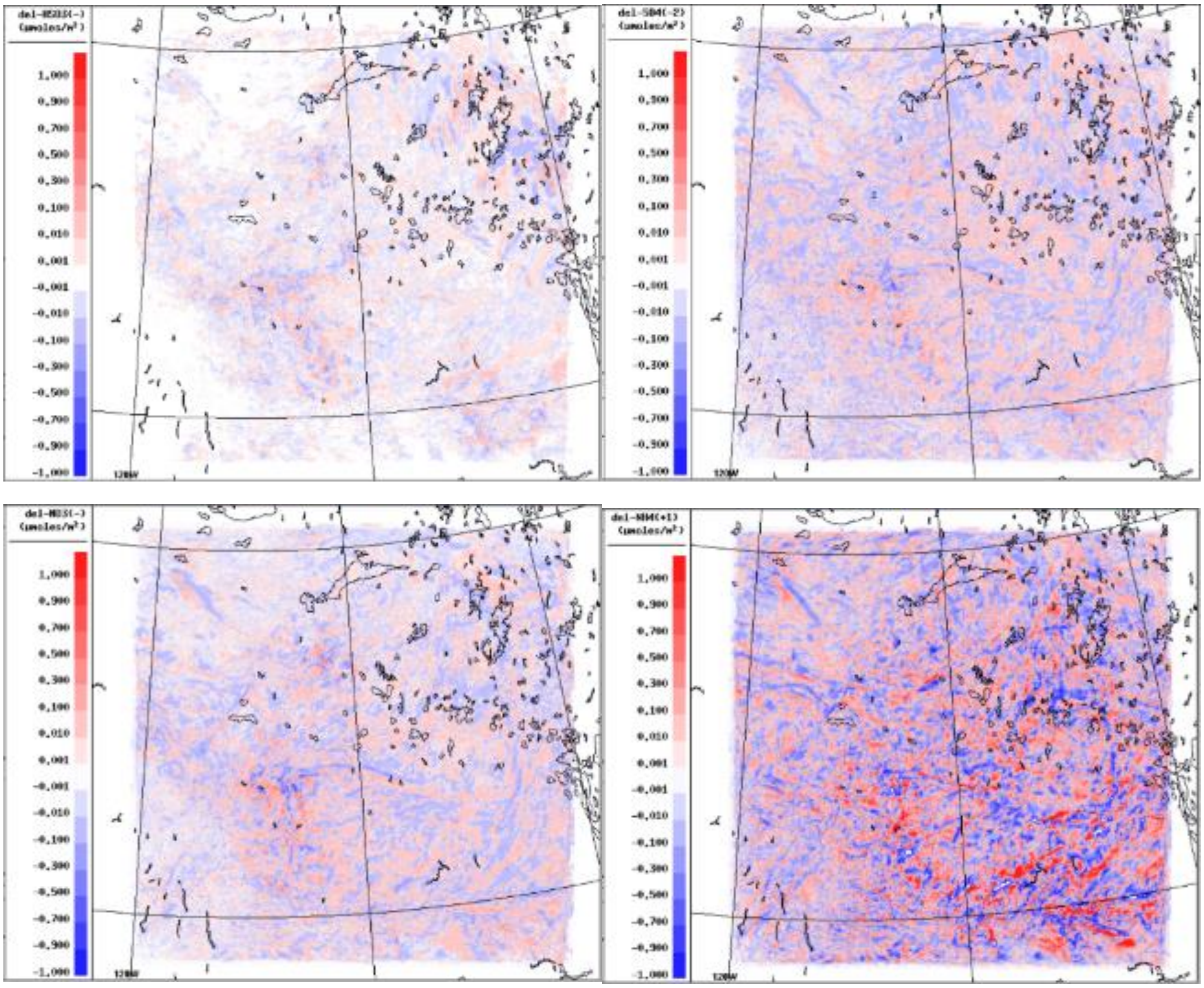

Figure S4: The net differences of mean SO_3^{1-}, $SO_4^{=}$, NO_3^{-} and NH_4^{+} for Wang2014 and multi-phase experiments (e.g. Wang2014 – multi-phase) for July 2018.

Values of domain-mean depositions – Wang2014: SO_3^{-} = 0.024 (1.92), $SO_4^{=}$ = 0.191 (18.37), NO_3^{-} = 0.178 (9.79), NH_4^{+} = 1.981 (21.79) µmol/m^2 (µg/m^2). Multi-phase: SO_3^{-} = 0.024 (1.92), $SO_4^{=}$ = 0.190 (18.24), NO_3^{-} = 0.177 (9.73), NH_4^{+} = 1.962 (21.59) µmol/m^2 (µg/m^2).

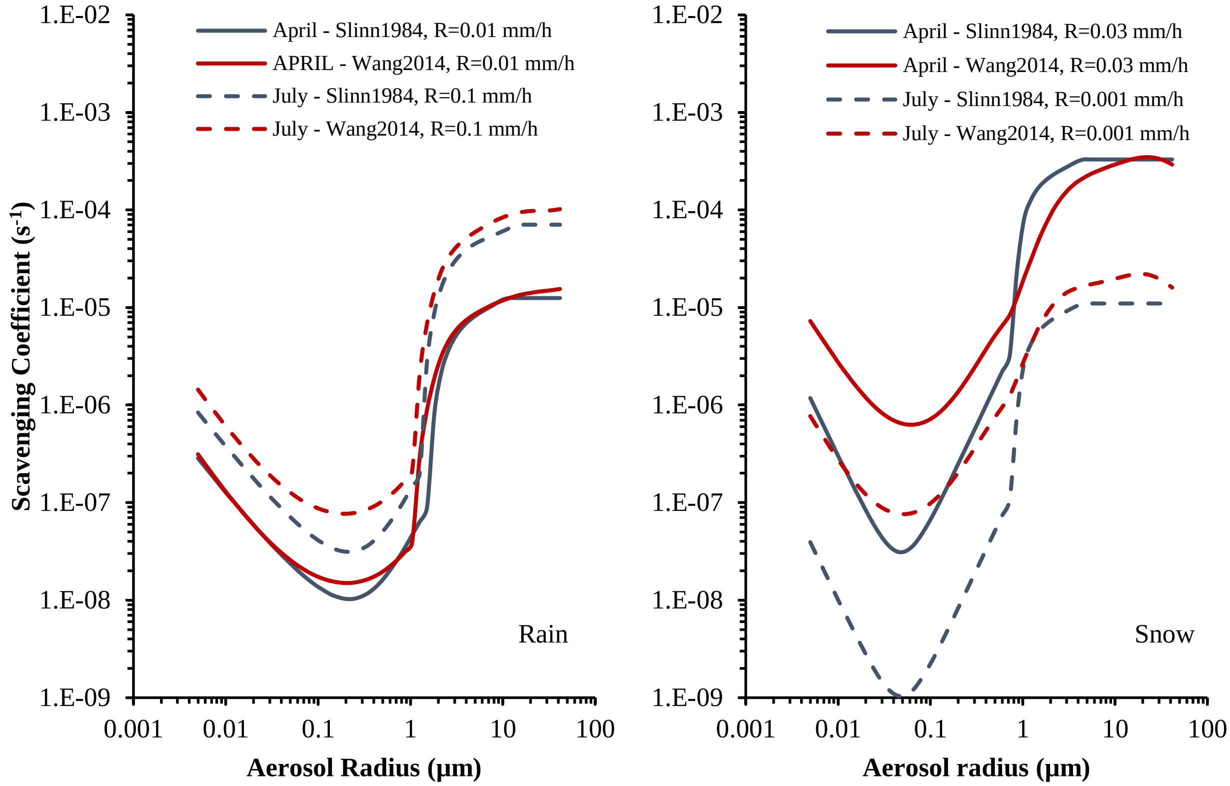

Figure S5: Rain and snow scavenging coefficients versus the particle's sizes for July and April 2018.