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# Ship plume dispersion rates in convective boundary layers for chemistry models

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Abstract. Detailed ship plume simulations in various convective boundary layer situations have been performed using a Lagrangian Dispersion Model driven by a Large Eddy Simulation Model. The simulations focus on the early stage (1–2 h) of plume dispersion regime and take into account the effects of plume rise on dispersion. Results are presented in an attempt to provide to atmospheric chemistry modellers a realistic description of characteristic dispersion impact on exhaust ship plume chemistry. Plume dispersion simulations are used to derive analytical dilution rate functions. Even though results exhibit striking effects of plume rise parameter on dispersion patterns, it is shown that initial buoyancy fluxes at ship stack have a minor effect on plume dilution rate. After initial high dispersion regimes a simple characteristic dilution time scale can be used to parameterize the subgrid plume dilution effect in large-scale chemistry models. The results show that this parameter is directly related to the typical turn-over time scale of the convective boundary layer.

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