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Model investigation into rain enhancement by hygroscopic seeding in mixed-phase convective clouds

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Background

- Hygroscopic cloud seeding a potential way to enhance rainfall → improve water security

- Semi-idealized LES simulations based on observations at UAE

  – Moderate convective precipitation events (cloud top 8-10 km)

- Is the expected enhacement of collision-coalescence due to hygroscopic seeding the main process also in mixed-phase convective clouds?

Model

- UCLALES-SALSA

  - LES coupled with sectional aerosol-cloud microphysics model

  - Rimed ice description follows the P3 (Morrison and Milbrandt, 2015) approach

  - Rain drop formation and growth determined directly from collision-coalescence
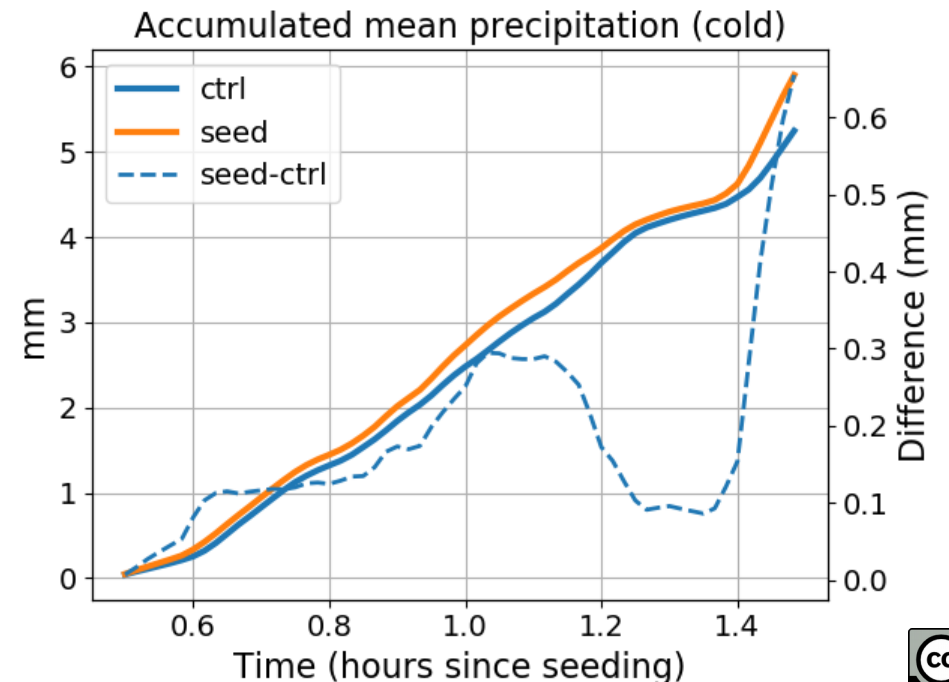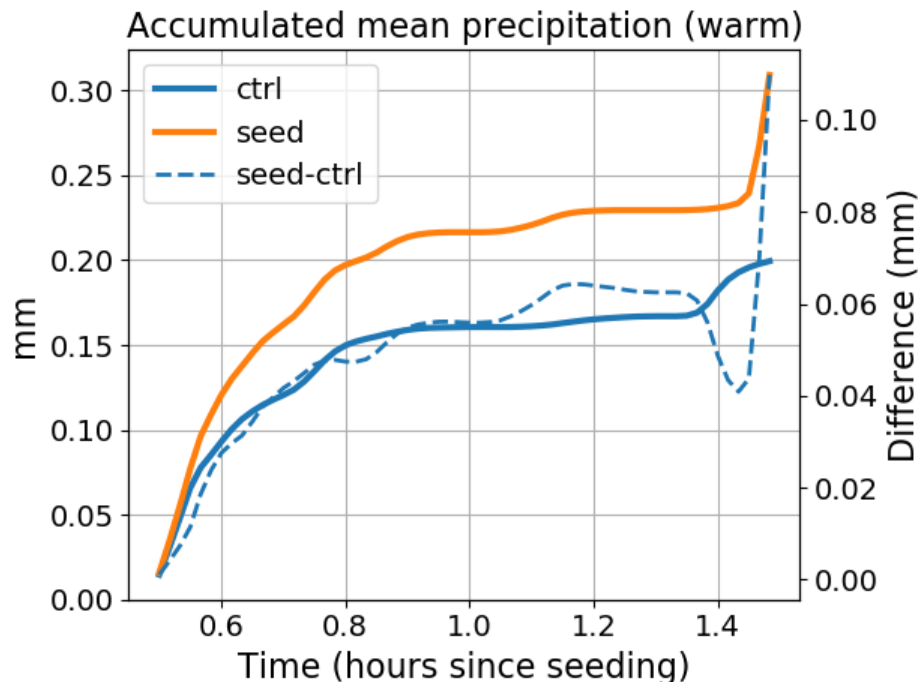
  - Non-equlibrium condensation
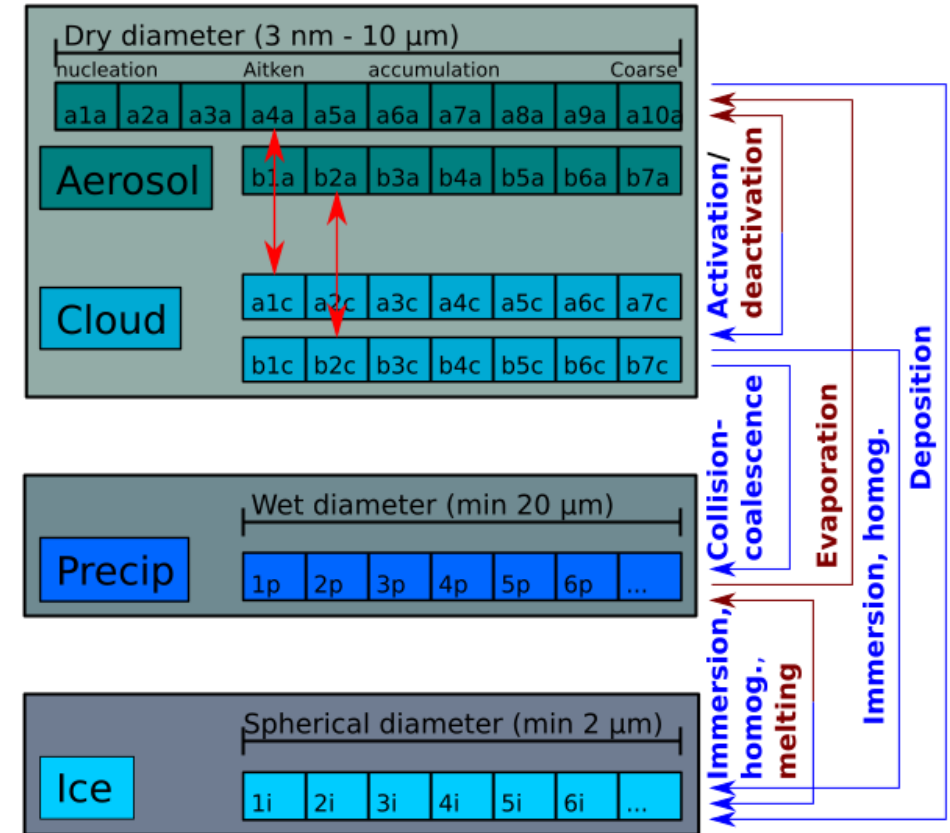
Key findings

- Increased rainfall is associated with an increase in rime fraction in all simulations
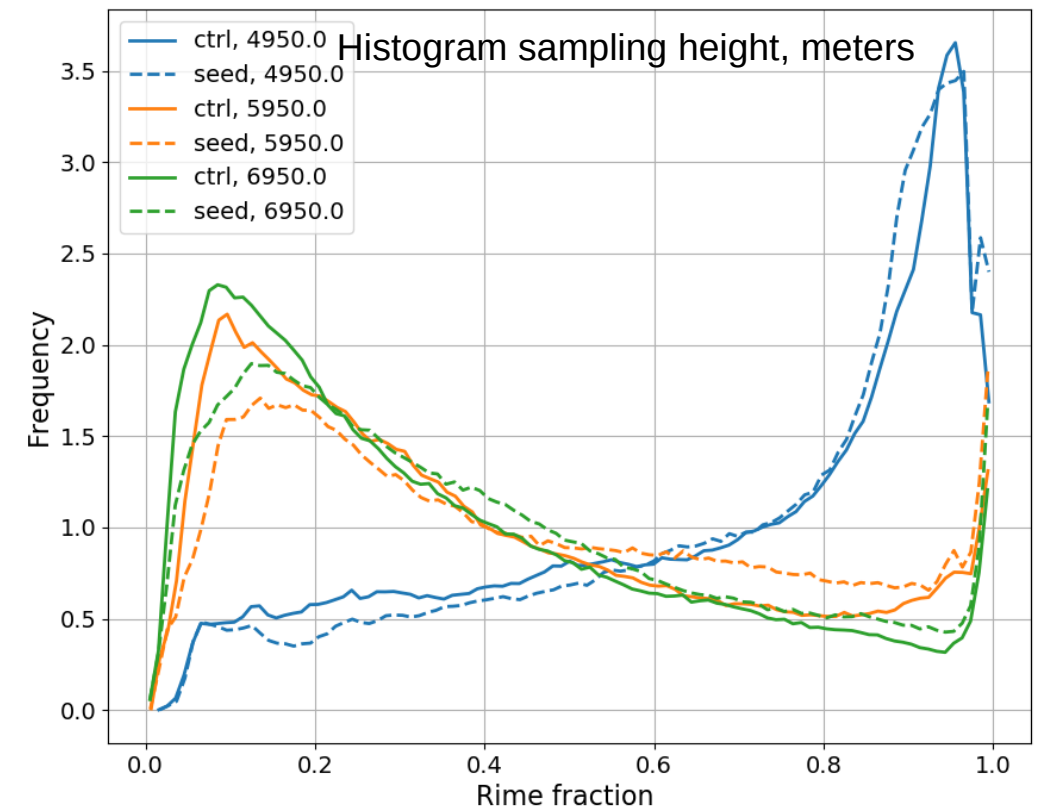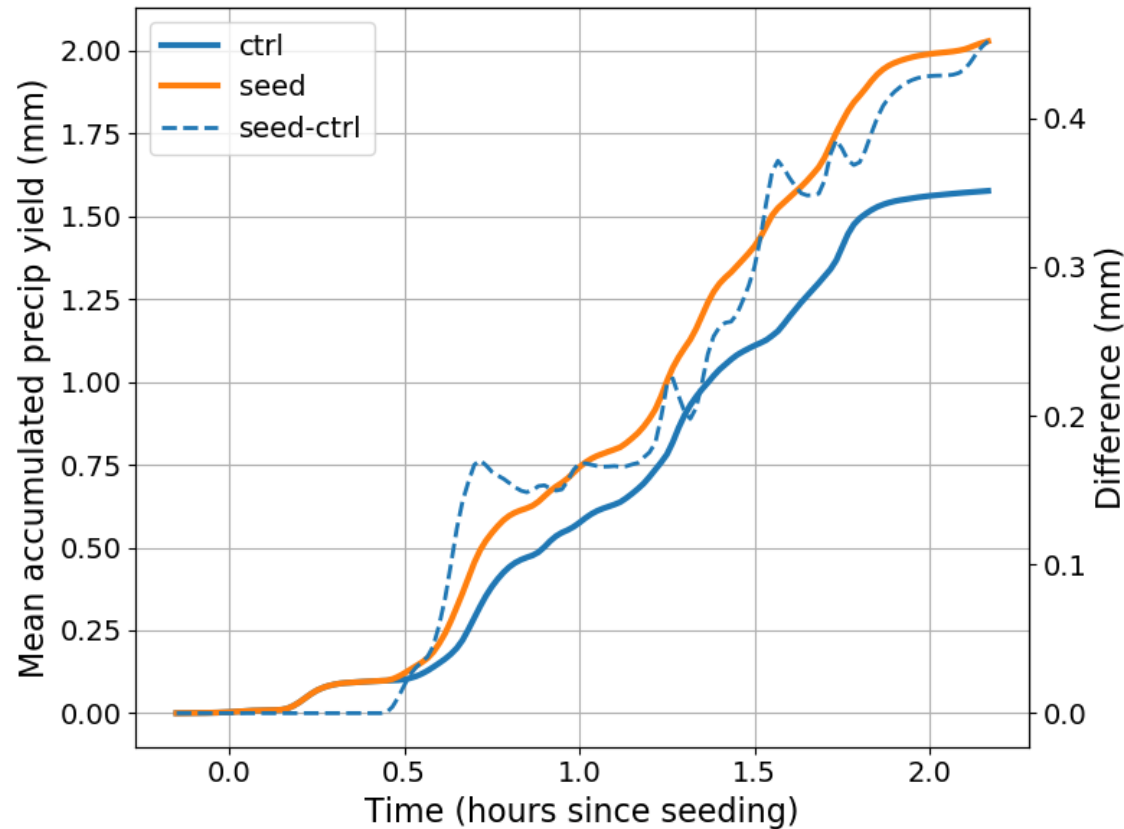
Key findings

- Divide precip events into warm and cold process dominated cells (melting ice → precip as an indicator)

- Absolute rainfall & absolute increase due to seeding always larger in "cold dominated" cells → introduction of hygroscopic particles leads to significant enhancement in riming and the cold precipitation process

- Results show sensitivity to model configuration (aerosol, moisture…); investigation is on-going

Thank you!