Assessment of coagulation mechanisms in aerosol modeling with ICON-ART

Supervisor: Ali Hoshyaripour, Corinna Hoose

Karlsruhe Institute of Technology

Introduction

Aerosol coagulation significantly influences particle size distribution and atmospheric processes. Current implementations in ICON-ART primarily consider Brownian coagulation, which limits the model's accuracy for larger particles like volcanic ash or in turbulent and charged environments like aerosol plumes. Extending the coagulation kernel can improve the physical realism of aerosol interactions in ICON-ART simulations.

Research Question

Which coagulation mechanisms are most relevant under different atmospheric conditions, and how can they be effectively represented in ICON-ART?

Working plan

Step 1: Literature Review on advanced coagulation mechanisms (turbulence, van der Waals, electrical charges).

Step 2: Formulation of extended coagulation kernels suitable for atmospheric modeling.

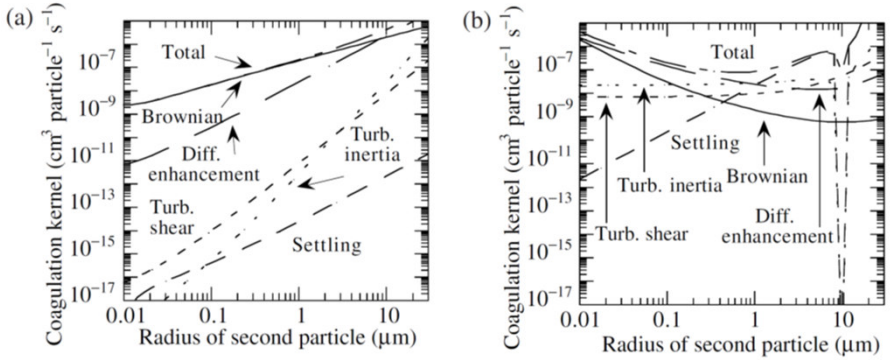
Step 3: Implementation of the new kernel into ICON-ART's aerosol module.

Step 4: Validation of the results, sensitivity analysis, writing of thesis

Requirements

Motivation, self-organization, interest in learning and team work

Programming: Fortran & Python (basic), shell & unix (basic)



(a) Coagulation kernels for five processes when a particle 0.01 μm in radius coagulates with particles of different size at 298 K. (b) Coagulation kernels for five processes when a particle 10 μm in radius coagulates with particles of different size at 298 K. (Jacobson 2005)

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