Abstract Submitted
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Computation of droplet interactions in a turbulent flow[1] CLAUDIO TORRES, LOUIS ROSSI, University of Delaware — To simulate tropical mesoscale clouds, we compute flows induced by interacting droplets in a turbulent background flow. The calculation of interactions between droplets, modeled as Stokeslets, is the most computationally expensive component in the full cloud simulation. In practice, we have found GMRes to be a superior algorithm for solving this system relative to block-Jacobi and similar schemes, and we report on our attempt to analyze the suitability of this algorithm in general circumstances. Our stability study reveals that a disperse cloud of droplets GMRes will converge robustly. However, when a large number of droplets ($\sim$40) cluster, the condition number grows and GMRes may stagnate. This change in behavior is related to the distribution of the eigenvalues of the matrix. For a uniform disperse set of droplets, we found that the eigenvalues can be enclosed by an ellipse around 1, with some eigenvalues having a small imaginary part. However, for a clustered set of droplets some eigenvalues start to approach zero, indicative of poor GMRes performance. Finally, we will report on our attempts to develop an effective preconditioner to accelerate these calculations on peta-scale computing machines.

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