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Interactive comment on "The validity of the kinetic collection equation revisited – Part 3: Sol-gel transition under turbulent conditions" *by* L. Alfonso et al.

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This paper presents a discussion of the formation of precipitation as described by the kinetic collection equation. The emphasis is on the importance of stochastic component in causing "sol-gel transition", "runaway droplet" formation, and on the importance of turbulence for that transition. The paper is not suitable for publication in its present form for the simple reason that it is not clear what is original in this work. At very least it must be revised to explain what is new in comparison with prior work and to make clear the logical flow of ideas (e.g., current abstract is incomplete for understanding and the sections in the paper seem like disconnected pieces). Main weaknesses are:

1. "Sol-gel transition" is only a new name, and it is unclear what aspect of this concept

is novel to the rain formation problem. Contact with work done in two other fields, physical chemistry (gelation) and astrophysics (planet formation) is worthy of notice but does not suffice. Can the scientific novelty be expressed in a precise way?

2. The relevance of fluctuations compared to mean particle growth and runaway formation has been discussed extensively, for example by Langmuir (1948), Telford (1955), Robertson (1974), Gillespie (1975), Young (1975), Kostinski Shaw (2005), Wang et al. (2006), and others (including Bayewitz et al. 1974, already cited in the paper). Several of these authors treat the sudden conversion of cloud water to rain water and its dependence on stochastic fluctuations. Again, what is new here is not at all clear.

3. It is okay if the novelty is in the results of the simulations themselves, but that is not clear either. A dependence of gelation time on the coalescence rate (the collision kernels) is hardly surprising. Apparently the primary result of the simulations is that an increase in the collision kernel leads to earlier formation of a runaway droplet. Whether the increase is due to turbulence or some other effect is not demonstrated. Furthermore, the conclusion that "ratio ρ never reaches its maximum, confirming that the sol-gel transition does not take place under these conditions" is probably incorrect. The accompanying figure seems to indicate that it will take place, but at longer times than were simulated (consistent with the lower kernels).

4. The paper emphasizes the importance of stochastic element, but the turbulence contribution is introduced through a deterministic collision kernel. This appears inconsistent, or at very least incomplete.

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