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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "On the CCN [de]activation nonlinearities" *by* S. Arabas and S. Shima

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The authors discuss cloud droplet activation and deactivation in terms of saddle-node bifurcation.

By doing so they can employ a nonlinear dynamic approach to study the properties of such processes. Specifically, they approximate the drop growth by diffusion equation to a normal form of a saddle-node bifurcation (df/dt = a + f^2) and therefore they could use the properties of such form to study hysteresis and catastrophe behavior.

The approach and the mathematical insights are very interesting but in order to make this paper accessible to readers from cloud physics, the authors should be much more generous in the details they provide in the mathematical derivations, and invest efforts in translating the mathematical insights to physical ones. A reader that is not fully updated with the jargon of nonlinear dynamics will find this paper hard to follow. The

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Discussion paper

explanations in some sections are fully based on such jargon (see part 4 - "... the coalescence of the fixed points is associated with a passage through a bottleneck ...) On the same note, throughout the paper the explanations are very slim. It starts from the overview in the introduction in which the Kohler theory is hardly mentioned (although it is central in the paper). Moreover, many of the numbers provided there are not so accurate. One can have coarse mode aerosols larger than a micron. Concentration can vary between 10's to 10000's etc.

In the next chapters where they develop the mathematical framework, they should add guidelines and physical insights in each of the main steps. What does it mean Saddle-node bifurcation at Köhler curve maximum? They should explain in not from a mathematical point of view (" . . . when the fixed points coalesce into a half-stable fixed point . . .") but from a physical point of view. What is the meaning of this point. What can we learn about it from the Köhler theory?

This is true to all mathematical steps in the paper. While the mathematical derivations look right (as much as I checked) the math derivations details are slim and there is hardly no physical interpretation to the shown insights (which could make this paper much more relevant).

The above comments are applicable to all sections in the paper – readers that are not fully updated in the nonlinear dynamic math jargon will not be able to follow parts of this paper.

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