

Supporting Information for ”A binomial stochastic framework for efficiently modeling discrete statistics of convective populations”

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Contents of this file

Additional Supporting Information (Files uploaded separately)

1. Captions for Movies S1 to S3

Introduction The Supporting Information (SI) provided with this manuscript consists of three animations of simulations with the BiOMi framework. More precisely, one animation (S1) shows results for the Exp3 experiment, while two animations (S2 and S3) correspond to the Exp4 experiment. The main manuscript includes various two-dimensional snapshots of the population of objects during these experiments (see Figs. 8, 9 and 10). These movies have the purpose of providing additional information about their time-evolution, which should help putting these snapshots into better perspective. The movies are designed to highlight object interactions as well as clustering behavior on the microgrid. The experiment settings are fully defined in Table 1 and the text in Section 4.

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Movie S1. The first animation (ms01.wmv) shows the evolution of objects on the microgrid during Exp 3 with the BiOMi framework, as described in Section 4.3 and defined in Table 1. A 15×15 grid is used, with a grid spacing of 100 m and a time step of 60 seconds. Five species are included, each representing a different size-class of convective objects. The largest objects are shown as light green dots, while the smaller objects are shown in dark green, red, purple and then blue for the smallest. The radius is proportional to the object size. At the end of a life cycle the objects break up into two smaller objects, thus in effect creating a down-scale energy cascade. Only the largest objects are born randomly, exclusively taking place in gridbox (3,3). A weak horizontal advection is applied, so that objects age as they move away from the point source.

Movie S2. The second movie (ms02.wmv) shows the evolution of objects on the microgrid during Exp 4 with the BiOMi framework, as described in Section 4.4 and defined in Table 1. A 100×100 grid is used, with a grid-spacing of 100 m and a time step of 60 seconds. This grid is referred to in the text as the mesoscale domain with horizontal size $D = 10$ km. Only a single species is included, representing a small convective bubble or thermal. The objects are born randomly at a fixed rate and spatially interact under two rules of transition, as described in detail in the text. In contrast to S1 no advection is applied, so objects stay in their gridbox. All objects on the grid are shown as filled circles with slightly reduced opacity. Their color indicates the number of objects in the gridbox, to highlight clustering. The duration of the experiment is 24 hours.

Movie S3. The third movie (ms03.wmv) is similar to the S2 movie, but shows the population of objects during the simulation of Exp4 using a 1000×1000 grid. This grid is referred to in the text as the macroscale domain with horizontal size $D = 100$ km. Note that this time the objects are not shown individually; instead, a two-dimensional mesh plot is used, with the color indicating the number of objects per gridbox. The duration of the experiment is also 24 hours.