**Geoscientific
Model Development
Discussions**

Interactive comment on "Numerical uncertainty at mesoscale in a Lagrangian model in complex terrain" *by* J. Brioude et al.

J. Brioude et al.

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We would like to thank the reviewer for her/his time and effort to review our manuscript and for her/his interest in the paper. We have added some clarifications in the paper. The referee comments are in bold, our answers are given below:

It would be helpful, if the authors could complement a few words of interpretation, whether these resolution-dependent errors can be attributed more to the numerical integration scheme of FLEXPART or more to the subgrid variations of the wind, which are missing with the coarser spatial grid or the longer output periods

We think that the increase in uncertainty with temporal and spatial resolution is more

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likely due to the subgrid variations than the integration scheme in FLEXPART. It is the reason why trajectory uncertainty increases with an increase in orography (as shown by figures 5 and 6). In complex terrain, the subgrid variability of the wind becomes much larger. Therefore, a linear interpolation in space and time of a wind field (necessary to calculate lagrangian trajectories) with a larger grid spacing (or time interval) will generate larger errors than with a smaller grid spacing. A comment in the section 3.3 has been added in the revised version.

Specific comments

page 969, line 13: ": : : ensembles of independent elements": it is not quite clear, what the authors mean by "elements", at least not without reading the reference.

Elements refer to the elements in an ensemble, like independent elements in a gaussian distribution.

page 972, line 24 to p.973, line 8 : at first glance, the description of the model's setup is a bit confusing to me: is "time step" the WRF output interval of 30 (60, 120) minutes or FLEXPART's internal integration time step or the 24-h simulation interval ? Are the 15 million trajectories homogenously distributed over the whole simulation domain? What were the exact criteria for the selection of the 108 geographic locations (line 6). From the text it sounds as if these were the only grid cells populated by the endpoints of the forward trajectories, but when the forward trajectory start points were homogeneously distributed all over the computational domain I would the endpoints expect to cover most of the domain area, too? Why is the number of particles in the forward/backward calculation so much different (15 million versus 108*5000)? Did you mean the following: every 30 (60, 120) minutes within the period from 16 to 20 May 2010, 15 million particles were released, homogeneously spread over the surface of the computational domain, and tracked for 24 hours each ?

The time step is the FLEXPART integration time step. We added this clarification in the

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text. The 15 million trajectories are started at the surface, initialized homogeneously in space and time (over the surface of the domain and within the time period from May 16th to 20th). Overall, the number of forward trajectories is much larger than the back-trajectories because they spread in the 3D domain over time, and it is necessary to have a large number of forward trajectories to calculate accurately a tracer concentration for each grid cell. Since the backtrajectories are started directly from the grid cells of interest, less trajectories are necessary. This difference in number of trajectories is one of the major advantage of backtrajectories over forward trajectories when a limited number of receptors (grid cells) has to be analyzed. The geographic locations were taken every 5 grid cells in x direction (every 40km), and every 10 grid cells in y direction (every 80km). Those values were chosen to restrain the number of data and trajectories within a manageable amount. We added those details in the revised version.

page 986, figure 1.: please add units to the x- and y- axis (seems to be a grid index ?)

There is no unit here. It is a grid index as you said. We added "x" and "y" as labels of the axis.

Technical corrections Page 971, line 20: missing space between the words 'dot' and 'vertical'

corrected.

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