

## ***Interactive comment on “Technical note: The Lagrangian particle dispersion model FLEXPART version 6.2” by A. Stohl et al.***

**Anonymous Referee #1**

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### **General Comments**

The aim of this paper is to document the details of the latest version of the FLEXPART Lagrangian dispersion model that may help other investigators understand results from this model (and their possible limitations) and can also serve as a user manual. The model is already well established and has formed the basis for many refereed papers. Within the international community there are not only many users of FLEXPART but also many more scientists who rely on FLEXPART simulations to interpret their observations. For this reason, the paper is very suitable for publication in a recognised journal such as ACP. I agree with the other referees that the appendices should not form part of the journal paper but should be in some form of electronic supplement.

## Specific Comments

1. p.4744, l.27: The resolved vertical velocity in hybrid coordinates ( $\dot{\eta}$ ) is calculated on ECMWF model levels. Then all the data is interpolated into terrain-following Cartesian z-coordinates. Presumably  $\dot{\eta}$  is transformed at the same time into a vertical velocity in the new vertical coordinate, but this is not stated. More explanation is required.
2. p.4745, l.2: How does FLEXPART use total cloud cover and solar radiation from the ECMWF model? I could not see how they featured in the parametrizations discussed later.
3. Eq.(7): why is there a factor of 100 multiplying  $u_*^2$ ?
4. Eq.(11): this scheme is usually called an “Euler step” and is numerically unstable for many smooth velocity fields. For example, if it is used to integrate the path of a point around a circular, anticlockwise vortex the numerical solution spirals outwards at a rate proportional to the time-step. Therefore, the order of approximation is not the only issue. Is the Petterssen scheme numerically stable in this situation like the midpoint scheme in Numerical Recipes [Press et al]?
5. Eq.(16) would be obtained as the first order approximation to (17) for small  $\Delta t/\tau_L$ . If (17) is valid for a wider range of  $\Delta t/\tau_L$ , why is it not used in all cases? Is it just to save computational cost?
6. Section 4.5: I was not convinced of the validity of the mesoscale velocity fluctuations, especially given the reasonably high resolution of the ECMWF global model. Why include them if the mesoscale structure is not known? Can it be established that they improve the simulation?
7. Below eq.(36): should be  $\beta = T_{1/2}/\ln 2$ .

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8. Section 7.3.1: There seem to be many free parameters in the resistance formulation of deposition rate. Is this complexity warranted given the other uncertainties in the model (for example sub-grid scale transport) and the difficulty of evaluation using data? Are there references to FLEXPART simulations where these schemes have been used for a specific gas?

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4739, 2005.

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