Geoscientific
Model Development
Discussions

Open Access

EGU

# *Interactive comment on* "The Lagrangian particle dispersion model FLEXPART version 10.3" *by* Ignacio Pisso et al.

**Anonymous Referee #2**

Received and published: 14 May 2019

The paper describes FLEXPART model development between versions 6.2 (last documented in Stohl et al. (2005)) and 10.3. It is well written, well presented and the authors have clearly spent significant time ensuring that it is ready for publication. A number of minor comments, suggestions and corrections are listed below. I have just one main comment concerning what is and what is not model development and where the line falls between FLEXPART and pre- and post-processing code and visualisation tools. The paper contains details of a number of (clearly very practical) uses and external code (e.g., the use of FLEXPART to calculate SRR, code to generate emissions and input meteorological files). It is beneficial to the community to share these for wider use. My question is, what constitutes FLEXPART and what is not part of the model? And, is the paper a FLEXPART model development paper or broader than this?

Minor Issues:

1. Simulations representing material everywhere (such as background fields), referred to in this paper as 'filling the whole atmosphere' or 'domain-filling mode', are particularly expensive in Lagrangian particle models. There must be some limit on the scale of such simulations which can be feasibly be conducted. The authors give no indication of this issue and furthermore, 'filling the whole atmosphere' (page 6, line 17) or 'the entire atmosphere is represented by particles' (page 6, line 33) gives the impression of global simulations. Can the authors discuss this? An example, giving the number of particles used and the size of the computational domain for such a simulation, would also assist here.

2. Information on the resolution of the meteorological data commonly used (e.g., the current temporal and spatial resolution of the ECMWF IFS and NCEP GFS input data) would be of interest and give some context (page 7, initial paragraph).

3. What is meant by 'input data' (page 7, line 15)? Is it just meteorological input data?

4. Typo in Figure 1 caption: The latitude and longitude values have been interchanged. The source is at 16.3274 degrees N (not E) and vice versa.

5. The authors mention that changes in the settling velocities are largest in the cold upper troposphere and this will impact the residence time of volcanic ash particles. Out of curiosity, does the new scheme increase or decrease the residence time?

6. On page 12 (line 30) it is stated that wet scavenging does not occur when the precipitation rate does not exceed 0.01 mm/hr. Some NWP models have had a problem with excessive amounts of drizzle. Is this limit related to this?

7. It might help the reader to add '(liquid and/or ice)' to '3-D cloud water mixing ratio' (lines 22-23, page 13) to clarify that it includes both components.

8. It's not clear what 'it' refers to (line 8, page 14). 'Sub-grid area fraction' or 'sub-grid precipitation rate' or 'grid-scale precipitation rate'?

9. There is an inconsistency in the definition of alpha in equation 4. The text says that for T>T_L, alpha = 1, whereas in equation 4, alpha =0 for T=T_L. Likewise for T<T_I, the text has alpha=0 whereas equation 4 indicates it should be alpha=1. For equation 4 to agree with the text, I think the T_L on the numerator should be T_I. Equation 9 also implies alpha is the ice fraction rather than the liquid fraction. I suspect, that equation 9 should be F_{nuc} = alpha * CCN_{eff} + (1 - alpha) * IN_{eff}.

10. Is the cloud and precipitation data time averaged or instantaneous (lines 17-24, page 14)? Peculiarities in wet deposition fields are obtained when using instantaneous data at high spatial resolution but with insufficient temporal resolution (of the input meteorological fields).

11. Is cl (lines 17, 21, equation 8, page 15) the same as c_l (line 27, equation 2, page13)? If so, I suggest consistent notation. If not, then cl needs to be defined here. I would expect S_i to increase with increasing cloud water and this seems contrary to equation 8, if cl is cloud water.

12. CCN and IN efficiencies 'increase with increasing particle size' – is this true? Good cloud condensing nuclei are sub-micron in size.

13. Where is Appendix 5.1.3 (line 24, page 16)?

14. Line 13 (page 18) doesn't make sense '. . .at the example. . .'?

15. Can the observation location be marked in Figure 3?

16. The sentence which spans pages 20 and 21 doesn't seem to follow across the page break. Should Seibert and Frank be in parentheses?

17. MPI has recently been introduced into NAME (version 8) (line 1, page 27).

18. It would help to indicate that Table 3 refers to the single node experiment in the caption. Furthermore, the number of nodes in the multiple node experiment only appears on Figure 8. Can it be a bit more prominent?

19. Why is S>2, S/n>1 for n=2 in table 4. Whilst some timing variation might be expected (e.g., perhaps due to the computer doing something else), one would still expect S to be some way short of 2.

20. Footnote 5 page 31: 'instructions' is misspelt.

21. For the layman, how does one set the number of nodes and cores (section 4.3)?

22. Table 7: what are the units of MASS?

23. I find Table 8 difficult to follow:

a. Earlier square brackets are used for the default value. Here they are used for the default unit and ordinary brackets for the default type. Furthermore on first reading, it is not clear that the word "default" in the final column header refers to "unit" and to "type". It might be clearer if it is written "{Default unit} (Default type)" (i.e., putting default within the brackets and using a different type of brackets).

b. Preldiff: What is the component D_i? Is it the diffusivity of the specie in the SPECIES_nnn file?

c. I note that the emission variation factors are specified in local time. Presumably, the time zone is given somewhere (or calculated based on location) and it must account for daylight saving time?

24. The prepending p is missing from pdryvel and pdquer (lines 2 and 3, page 38).

25. I don't think it is clear what "up to 1 hour" (line 26, page 39) means. Does it mean that delta t >= 1 hr or delta t <= 1 hr? Similarly does "up to 0.75 deg x 0.75 deg latitude / longitude resolution" (lines 28-29, page 39) mean delta lat >= 0.75 deg or delta lat <= 0.75 deg?

26. Should IND_RECEPTOR=4 for grid_wetdep_date_nnn.nc? (Note that Table 6 only has options 1 and 2 for IND_RECEPTOR - options 3 and 4 are missing.) Should IOUT =2, 3, 10, 11 (rather than 2, 3, 9, 11) for receptor_pptv?

27. Line 1 page 44: Should this read "and nnn is the species number" rather than "and species is the species number"?

28. There are a number of occasions where the text runs off the page (e.g., line 15, page 58).

29. Is there a typo on line 8 page 45: "verb|make|"?

30. Line 6, page 47: FLEXPART should be in capital letters.

31. Table 12: Hypothetical is misspelt. Also, should Test name 12 under gridded output have a description of "concentration and trajectory cluster in NetCDF"?

32. Line 1 page 50: Remove "and" to read "results from http://flexpart.eu".

33. I think a minus sign is missing from the options of tar in a number of places (e.g., tar xf . . . (line 19, page 53) should be tar –xf. . . Also lines 1, 7, 14, 21 (page 54).

34. As the authors state, GRIB-API support has been discontinued and ecCodes is the primary GRIB package at ECMWF. Appendix B1 appears to give instructions using grib_api only. Can these be updated to use ecCodes? Also, the meteorological files generated here (EA170122??) do not have a century label. How can pre 2000 met data files be generated and used?

35. Appendices C1 and C4: What is the time resolution of the meteorological data? The authors only give the spatial resolution.

36. Line 8 page 61: Assuming this is the Thomson mentioned on lines 1-2 (Thomson, 1987), there is no 'p' in his surname.