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Geoscientific Model Development Discussions

Interactive comment on "Stochastic perturbations for parametrisation tendencies in a convection-permitting ensemble" *by* Clemens Wastl et al.

Anonymous Referee #2

Received and published: 9 November 2018

Does the paper address relevant scientific modelling questions within the scope of GMD? Yes

Does the paper present a model, advances in modelling science, or a modelling protocol that is suitable for addressing relevant scientific questions within the scope of EGU? Yes

Does the paper present novel concepts, ideas, tools, or data? Yes

Does the paper represent a sufficiently substantial advance in modelling science? Yes

Are the methods and assumptions valid and clearly outlined? Yes

Are the results sufficient to support the interpretations and conclusions? Yes

Is the description sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes

Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes

Does the title clearly reflect the contents of the paper? Yes

Does the abstract provide a concise and complete summary? No, the line 13 phrase 'lead to statistically significant improvements...compared to the original SPPT' is not supported by the figures that state statistical significance with respect to an ensemble with no stochastic physics. The abtract or the figures must be corrected in order to be consistent. It is acceptable to mention results that are not statistically significant, but they must be stated as such.

Is the overall presentation well structured and clear? Yes

Is the language fluent and precise? Yes

Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes

Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, figures 3-7 must be improved as requested by the other referee.

Are the number and quality of references appropriate? Yes

Is the amount and quality of supplementary material appropriate? Yes

———————————— general comments This is a good paper. It is in the scope of the GMD journal. The research is original and interesting to the ensemble prediction community. It is a significant incremental improvement to the well-known SPPT

scheme. It ties in nicely with related work recently published by Christensen et al.

The presentation is generally clear, scientifically rigorous and well structured.

Specific comments

page 2, line 10: clarify '(e.g. surface fluxes if surface tendencies are not perturbed)' because the SPPT concept could be applied to surface tendencies, although this has not yet been done (for technical reasons).

page 2, line 14: 'destroys the physical consistency' - what do you mean by consistency ? Please clarify or delete. One could simply state that tapering means that model errors near the top and bottom are not represented.

page 2 line 28: 'no interaction of the uncertainties between the schemes is considered'. To be fair, it should be more precisely stated that no interaction _inside the timestep_ is considered. As soon as you perturb the model state, all physics parametrisations will start acting differently at the next timestep. (intuitively the specific originality of iSPPT is that it perturbs physical interactions that occur at timescales shorter than the timestep)

Technical corrections

page 3 line 6: typo 'Meteorlogie' line 10: add a mention to HIRLAM, who are actively developing AROME. line 12: Bénard (with an accent) (I seem to recall Bubnova has one, too) line 24: you mean 'ensemble size', not 'ensemble spread'. Spread and ensemble size are different things, unless you use ensemble size to do something else that produces spread, in which case that 'something else' needs to be stated.

page 4 line 14: append 'at each gridpoint' line 15: correct 'defined by a tapering function (see below)' because you have not defined it yet. line 16: delete the text between parentheses, because it is a repeat of line 7-8 (or the other way around if you prefer). line 18: delete either 'the way' or 'how'.

page 5 line 5: move the sentence about tuning to section 2.3, because it s part of the

experimental setup. line 15: please explain in what sense SPPT was 'unsatisfactory' on the Austrian domain line 19: typo 'diretlcy'

page 7 line 5: typo 'variablese'

page 8 line 11: typo 'adopted' -> 'adapted' or 'adopted in' line 16: rewrite 'supersaturation is translated in a slightly positive temperature increase' (also, 'positive increase' is a tautology)

page 9 line 5: the phrase 'model error is not noticeably influenced' needs to be corrected because (1) model error and forecast error are different things, and (2) error realizations can change even if their statistics do not. You probably mean 'ensemble average error (and/or average member forecast error) is not noticeably changed', since you seem to argue that the reliability of spread is improved by stochastic physics (which would be a valid statement). line 28: insert 'score _differences_ ... in Fig 5 are much smaller'

page 10 line 18: again, replace 'model error' by 'ensemble average error' or 'average forecast error'. line 19-20 replace 'negative CRPS difference' by 'a reduction of CRPS' line 21: replace 'partially' by 'to a lesser extent'

page 11 line 8: replace 'at convective days' by 'on convective days' line 19 insert 'tendencies _of_ U, V, T and Q' line 20 correct 'to _a_ control ensemble' line 24 'reveals a significant increase': a claim of statistical significance is a serious one, so it must be precisely expressed: with respect to what is the increase statistically significant ? SPPT or no SPPT ?

page 12 line 6: insert 'analysis of a _set of_ convective events' line 11: use a more precise term than 'critical', e.g. 'non-consistent', 'physically unsatisfactory', etc. line 12 replace 'switching off tapering' by 'tapering switched off' line 13 grammar '_these_ perturbed fields' line 14: 'could be switched off' is ambiguous', either write 'it is likely that it could be switched off' or 'we have switched it off' line 34: 'is considered critical'

is unclear, do you mean 'unsatisfactory' ?

page 13 line 2: replace 'provides' by 'can provide' because microphysics do not always increase temperature. line 4: you do not really know that 'it cannot be assumed that T and Q have exactly the same error characteristic'. Better write 'it seems wrong to assume that T and Q have exactly the same model error characteristics'.

References: please check the accents for all authors (e.g. Vié etc) a valid web address must be supplied for gray literature references (namely, Palmer et al 2009 and Szucs 2016)

Figures: besides the already mentioned problems with the labelling, the colours for pSPPT and ipSPPT in Fig 3-7 should be made easier to distinguish, perhaps by using a lighter blue for pSPPT. They are impossible to tell apart on two of my screens (not to mention their legibility for most colour-blind readers).

with best regards

—- end of comments —

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