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Interactive comment on "Necessary conditions for algorithmic tuning of weather prediction models using OpenIFS as an example" *by* Lauri Tuppi et al.

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The paper is providing a recipe how to optimise parameters within an ensemble NWP system. Such an optimisation is very difficult to realise and the paper, which is based on many years of experience in parameter optimisation, provides essential guidelines how to do it properly and should therefore be published. However, the presentation of the paper can still be improved and I provide suggestions in the following. The English language could also be improved.

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- l31: "Semi-realistic" What does this actually mean? I guess all tests in the paper are realistic?
- Page 2: I do not find the list of "synopsis guidance" very useful. It is not clear to me what the text in the brackets is meant to be. More detail? The results of this study? Readers should be told somewhere what they should take from this list. I would recommend to replace this list by a list that provides information on the degrees-of-freedoms that are important for optimisation (#parameters, forecast lead time, #ensemble members, minimisation algorithm, #initial conditions, cost function...). You could also think about a table to add information about advantages and disadvantages when increasing or decreasing the degrees-of-freedoms. You could then have another list of the "boundary conditions" including a couple of points from your list (reproducibility required? optimisation target known? computational resources available?...).
- End of introduction: It would help to provide a very brief overview on the sections that will follow.
- Section 2.2.: Maybe I have missed this but do ensemble members use different initial conditions? Ahh, I found it later on in Table 2. But this information seems to be relevant earlier.
- l87-91: I do not understand the discussion. Please re-word and explain jitter and dither... Personally, I would suggest to have more information on the optimisation methods but I leave this decision to the authors.
- l98: Have I missed something? What is the control and what is the perturbed in this case? Do you compare against the default parameter values? Or reanalysis? At l106 you refer to pseudo-observations which seems to be the same as the control? – Ahh, later I understood that you take the default value as

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truth and optimise towards it. However, it is still unclear how you define pseudo-observations. Are these point measurements? Or 3D fields? Do you add random noise to represent measurement uncertainty?

- l100: It should be explained why it only probes a "small fraction" of the domain, why it requires interpolation... this may not be clear to all readers.
- l119-120: I do not understand this.
- l124: During the first read, I was not sure whether you are using ensembles where each ensemble member is using a different parameter value. This could be clarified.
- l138: Why do you use different parameters for different tests?
- l188: "discrepancy of model versions" I do not understand this.
- l189: Why should it not converge for a non-linear response if you have enough statistics? At least slowly?
- l268: "In the six five-parameter convergence tests the parameter values converge toward the default values during the convergence tests in 20 out of 30 cases" It took me a while to realise that 5*6=30. This needs more explanation.
- l325: CPU hours or node hours? I guess it would help if you could provide some rough information on the computer that was used.
- Can you add a brief discussion of local or global minima in the parameter optimisation?
- Would the convergence with complexity be an option for optimisation (upgrade from L1→L2→L3→L4 for finer and finer parameter ranges)?

- Is overfitting a problem for lower complexity configurations?
- If you compare against reanalysis or observations, you will often need to use different initial conditions for the different ensemble members to achieve sufficient spread at the beginning of the predictions. How would this influence the discussion around L1-L4?

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