Comment on esd-2022-7
Anonymous Referee #2

Referee comment on "An updated assessment of past and future warming over France based on a regional observational constraint" by Aurélien Ribes et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2022-7-RC2, 2022

Title: An updated assessment of past and future warming over France based on a regional observational constraint

Authors: Ribes et al.

Summary:
This paper assesses the past and future warming over France at the regional scale. One highlight of this paper is about the usage of Kriging for climate change, a method based on Bayesian Statistics, to get the posterior estimation of the projections after "assimilating" observations, which should substantially reduce the estimation uncertainties. As a researcher working on data assimilation, it is very inspiring and enlightening to see how data assimilation methods can be used for climate projections. The paper is well-written and clear. It would be great if the authors can show more details about the Kriging for climate change (KCC).

Recommendation:
Minor revision
Major Comments:

- More detailed procedure describing the KCC is needed, which can be put in the appendix. Especially how you set the prior covariance for \( x \) in eq.(2). You mentioned at Line 150 that “\( \mu_x \) and \( \Sigma_x \) are estimated as the sample mean and covariance of the CMPI6 model forced responses.” But how do you calculate \( \Sigma_x \) exactly? How does \( \Sigma_x \) look like? For data assimilation, the setting of prior error covariance requires a lot of efforts. What’s the dimension of \( \Sigma_x \). Is it diagonal or block diagonal? Does Kriging requires the calculation of inverse of \( \Sigma_x \)?

- You mentioned near line 130 that “\( x \)…where each element is an entire 1850-2100 time series of the forced response.\”, but what is the exact dimension of \( x \)? If \( x \) is large, how to you invert \( \Sigma_x \)?

- Near Line 120: what’s the exact dimension of your vector \( y \)? Near line 160, you mentioned that no measurement error is assumed. Do you mean \( \Sigma_y = 0 \)? Can you give an explanation what’s the impact of setting \( \Sigma_y = 0 \) in KCC, specially how does your influence influence the posterior?