Reply on RC2

Sebastian Müller et al.

Author comment on "GSTools v1.3: a toolbox for geostatistical modelling in Python" by Sebastian Müller et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-301-AC2, 2022

We thank the reviewer for his positive evaluation of our work. We appreciate his thoughtful comments, which we address further below.

- **Since other geostatistical tools offer several options for the random field generation (e.g., sequential Gaussian methods), potential users would need proper justification why GSTool uses only one method compared to others. Of course, Line 212 already explains its strength well, but it would be better if there are comparisons with other methods.**
  We have added a comparison with the other two popular classes of random field generation methods to section 2.2.2.

- **Although the labels for the x- and y- axes for some figures (e.g., 1, 2, and 4) are obvious, it would be helpful to understand if their labels are included in the figures.**
  We too are strong advocates of correct and understandable figure labels and it was a tough decision for us to omit them. But all the figures included besides a code snippet are the actual outcomes of these short pieces of code, without any hidden boilerplate. This means, that an interested reader can copy the examples and reproduce the exact same figures. That is why the figure itself is more of interest than what is shown in it. This reason and in order to not obfuscate or lengthen the code examples by setting the axes labels, was convincing enough for us to omit the labels.

- **In Eq. 4, do you mean that the variables "k" and "r" are vectors? If so, you can have an underline in the variable "r" in the Hankel transform in the right-hand side. It would be also easy to understand if Eq. 5 has the same variables "k" and "r."**
  The equations are actually correct, since "r" and "k" are referring to the norms of the vectors denoted by underlined "r" and "k". We added a note to the text at that point. Eq. 4 and 5 share the same notation.

- **In Line 205, the sentence does not start from the capital letter, "the k_i are mutually ...."**
  We corrected the spelling mistake.

- **In Sec. 2.3.1, for the random velocity field, is it possible to assign boundary conditions?**
  Unfortunately, this is not possible. Otherwise, this method would probably see much more widespread applications. It basically generates a spatial random field for each of the spatial dimensions of the velocity field and by multiplying them with a projector it is ensured that the vector field is divergence free. An example of how such velocity fields

can be applied is for transport simulations in the saturated subsurface, where boundary effects might not have a large effect. We have added following text to the end of the section: "Things like boundary conditions cannot be modelled with this method, but it can be used e.g. in transport simulations of the saturated subsurface (Schüler et al. 2016) or for studying turbulent open water (Kraichnan 1970)."

- **As far as observed in the code-snippets in Figs. 3 and 15, the ways of posing spatial anisotropy and spatio-temporal anisotropy (e.g., gs.Exponential(dim=, anis=)) seem the same even though they are described differently in Eqs. 6 and 23. How would you relate a spatio-temporal anisotropy ratio, "kappa," to spatial anisotropy ratio, "e."**
Thank you for this hint, since Eq. 23 was indeed wrong. We corrected the formulation to be in line with the implementation and now Eq. 6 and Eq. 23 are consistent. We also added a short note about the composition of the *anis* array.

- **The caption of Fig. 16 seems to indicate the opposite figures. The middle one is for cell centroids and the right one is for mesh points, respectively, according to each figure's title.**
We corrected the caption.

- **In Fig. 21, what does it look like if a cross-section of the regression kriging interpolation at the same longitude is presented together? Is it aligned with the cross-section of the universal kriging interpolation?**
That is a very good question. We added the cross-section of the regression kriging to the plot and adjusted the colors, so mean and trend fit the respective cross-section. As you can see, universal and regression kriging coincide in the data area but diverge outside of it.

- **The unit of Transmissivity in Figs. 24 may be square meter per second instead of meter per second.**
Thank you for pointing this out. We updated Fig. 24 as well as Fig. 29 and 30 that had the same mistake.