

Even if a copy-editing of the manuscript (spelling, grammar, sentence structure) is mandatory and will be done automatically and even if English is not my mother tongue, I take the freedom of suggesting possible changes, which, together with other technical comments, will hopefully guarantee a good quality of the published paper.

- 1) Throughout the whole paper, words “period” and “frequency” are used. But the work consider spatial variations of the physical quantities, so that I would use “wavelength” and “wavenumber”, instead.
- 2) Throughout the whole paper “small scale” is used. I know that “small/big scale” is often used in the scientific literature to denote small or big scale-lengths, but this is wrong, in my opinion. Think to geographical maps. A map at scale  $1:1,000,000=10^{-6}$  does not show many details: topographic maps at scale  $1:10,000=10^{-4}$  (i.e., 100 times greater!) provides many more details. Therefore, I prefer to use “fine-” vs “large-” scale or “short” vs “long” scale-length. In several cases, “scale length” should be preferred to “scale”.
- 3) Line 4. Should “of” be erased?
- 4) Line 181. I wouldn’t use “Fourier series” here, because Fourier series refers explicitly to the use of complex exponentials or sinusoidal functions, whereas here the authors refer to the linear combination of a generic orthogonal basis.
- 5) Figure 1. It is important to state whether the color maps for corresponding figures ( $\ln K$  or  $h$ ) in (a) and (b) share the same limits or if different limits are considered for figures referred to the same quantity.
- 6) Line 222. Should “calibration” be substituted with “forward modeling”?
- 7) Line 226. I would prefer “ $(x_i, y_i)$ ”, instead of “ $\langle x_i, y_i \rangle$ ”, because  $\langle \rangle$  is used in (47) to denote an average and  $\langle , \rangle$  is often used in mathematics to denote inner products.
- 8) Line 237. Check expression “the whole number multiples”. May be, “all the integer multiples”?
- 9) Line 261. Check “fields represented as”. May be, “fields are represented by”?
- 10) Lines 261 & 262. Verb “to represent” is used three times in short distance.
- 11) Line 165. Expression “functions of corresponding” should be corrected.
- 12) Lines 175ff. “Pr” is used to denote a “probability density function”, but it remembers “probability”. A different symbol should be preferred.
- 13) Line 304. The use of Gaussian distributions is common, mostly because it permits to perform analytical computations and to simplify mathematical development. I wouldn’t introduce this assumption as a matter of fact or as a property of general validity.
- 14) Line 342. “To” should be added after “corresponding”, shouldn’t it?
- 15) Line 350. Is “made” the right word? May be, “extracted”, or something similar?
- 16) Line 361. Statement “iterations were counted only when there was a reduction in the loss function” sounds very strange to me. The steepest descent method should yield a reduction of the objective function at each iteration. To my knowledge, the best way to apply it in inverse problems for groundwater hydrology is to compute the direction of change according to the gradient of the objective function with respect to the parameters to be fitted and then to perform a 1-D minimization of the objective function along that direction. May be, here a fixed step along the direction opposite to the gradient was used at each iteration?

- 17) Line 423. “For” should be written with upper case “F”.
- 18) Line 434. Check expression “spanned the K-L basis functions”. I think that “by” is missing after “spanned”.
- 19) Line 438. Sentence “In the base case (featuring all available information) was shared with the main MC study” should be rephrased.
- 20) Line 458. Acronym “iid” hasn’t been defined, has it?
- 21) Line 473. Is “that” missing after “idea”?