

Interactive comment on “Estimating sediment thickness by using horizontal distance to outcrop as secondary information” by Nils-Otto Kitterød

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Received and published: 30 May 2017

The title does not clearly reflect the contents of the paper. To a geologist, sediment can crop out. Outcrop does not imply basement. Therefore, I assumed the paper would discuss the relationship of a sub-surface unit thickness to the distance from its own nearest outcrop. The abstract did not correct this false impression. After reading the whole text I suggest that the title should have been: “Estimating unconsolidated sediment cover thickness by using horizontal distance to bedrock outcrop as secondary information.” Distance to outcrop could also be termed distance to zero isopach. Had I understood this from the title or abstract I would not have agreed to referee the paper; I have too little first-hand experience with semi-variograms and kriging to be considered an expert referee.

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The paper clearly and thoroughly investigates the value of adding distance from the zero isopach to standard kriging of point measurements of the thickness of young sediment cover. It concludes that co-kriging with that additional information reduces the absolute error and improves precision.

The paper tests co-kriging against borehole data for the whole of Norway. The data handling is explicit. The paper provides some standard, straightforward suggestions for culling data from public databases, for avoiding bias due to cell size and grid origin (not origo?), and for mitigating biases introduced by uneven sampling and outlier data. The many equations that aid the understanding of the methods range from trivial formulations for error, mean and standard deviation to more complex kriging matrices that I am not fully competent to check for accuracy. Fortunately, the methods are all supported by references to established literature. The exploratory statistics and the cross-validation are both thorough. The application to a large area like Norway seems contrived, but it serves to demonstrate the utility of adding knowledge of distance from the zero isopach; i.e. adding geologic map information. For more local studies, there would seem to be better non-invasive geophysical controls on the thickness of sedimentary cover; i.e. gravity anomalies. In many regions the public databases would include gravity anomaly maps. For tectonically active regions, the mapped traces of faults would seem to be a complementary source of control for sediment cover thickness.

Although the overall presentation is well-structured and clear, the manuscript contains many grammatical flaws, notably the mismatch of subject and verb (singular and plural), but none of these obscures the meaning. At first, I had difficulty understanding dual use of h in the application of window sizes in Δh to moment measures of D and L as a function of separation, h . Otherwise, the text was mostly clear on first reading.

Minor flaws by page and line number (page:line):

1:4 tested by comparing
2:3 soil properties . . . have
2:5 one example is
2:14 one of the variables . . . is
2:24 delete"horizontally"
2:33 for minor, write small
3:16 The area . . . is
3:24 drilling is terminated [before reaching basement] because
4:26 erosion [products] were deposited
5:4 There is no mandatory method
5:8 Wells . . . were also
6:26 origin
7:1 origin
7:10 in geostatistical terminology (delete the)
7:22 the data are censored
8:6 the mean . . . and variance . . . were calculated
9:26 which makes
12:26 maps . . . were
13:3 cannot be ruled out
13:6 the data (delete material)
14:28 clustering has

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14:31 and then calculation of experimental

15:8 inversely proportional

15:32 analysis indicates

16:10 Despite these uncertainties (delete of)

16:18 despite the significant (delete of)

16:18 experimental data (delete material)

16:27 the number . . . has

16:30 for “and” write “but”

17:8 database . . .was used

17:13 differences were

22:Figure 2 caption lower right and upper left are reversed

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-658, 2017.

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