RandomFields, an R package, and properties of simulated data using it.

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All data was simulated using the `RandomFields` package in `R`. Whereas, estimation was done within the TMB framework, so there may be miss-specifications that cannot be attributed to estimation capabilities, but rather just due to differences in frameworks. For instance, the scale (operating model) and range (estimation method) are not equivalent, and differ by a scalar of two.

No spatial correlation

When scale was set to a small number (i.e., 0.001) the spatial correlation in the simulated data was negligible and standard functions could be used to calculate the realized standard deviation of the simulated vectors of spatial deviation (e.g., $\omega_{x,y}$). Scale, which represents the distance at which the correlation falls to 0.10 of its maximum, cannot be set to zero, and any value smaller than 0.001 was sufficient to remove spatial autocorrelation in the simulated data.

The true variance used in the call to `RandomFields` was 0.5, or `sd = 0.71`.

Spatial correlation

When the scale value was set to 0.25, the base function in `R` to calculate standard deviation no longer gave the standard deviation used to generate the data.

Though the Moran's correlation gave back the true standard deviation at half of the input scale value.

Distributions

Code was originally adapted from that written by Dr. James T. Thorson, and, thus, the `RandomFields::RMgauss` function was used to generate a gaussian markov random field (GMRF). The documentation for `RandomFields` specifies that `RandomFields::RMgneiting` is hardly distinguishable from `RandomFields::RMgneiting`, but possesses neither the mathematical nor the numerical disadvantages of the Gaussian model.

The following code will show their similarity. Unfortunately, the graphic device is not compatible with `rmarkdown`.

```
plot(RandomFields::RMgauss(var = variance, scale = scale))
lines(RandomFields::RMgneiting(orig = FALSE, var = variance, scale = scale),
  lty = 2)
legend("topright", bty = "n", legend = c("Gaussian", "Gneiting"),
  lty = c(1:2))
```

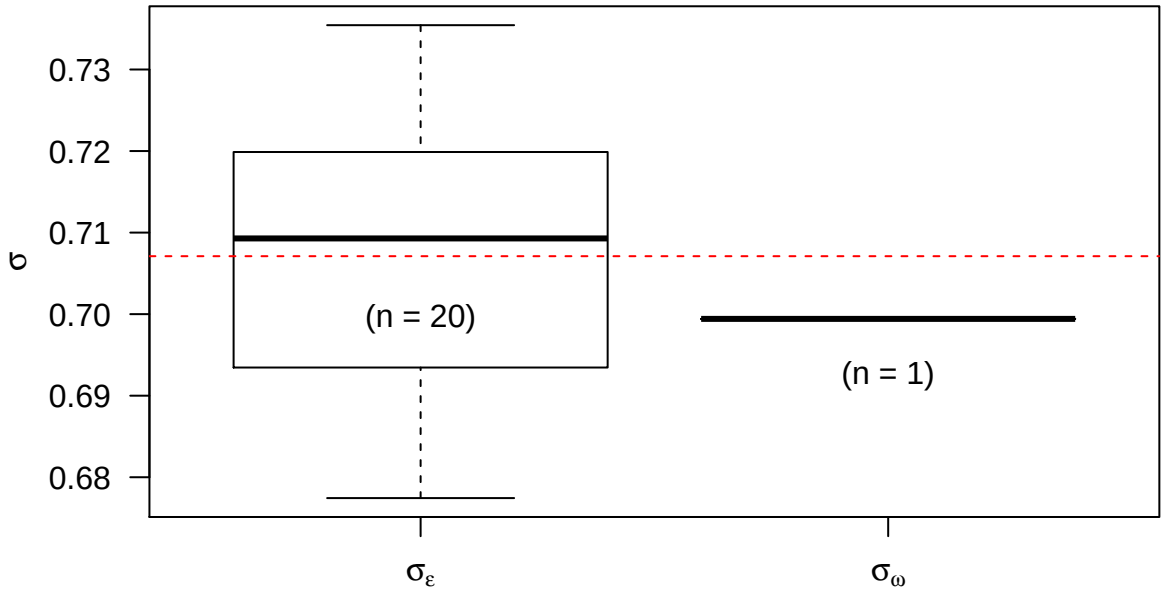

Figure 1: Estimated standard deviation of the simulated spatial fields using RandomFields package with a small scale value.

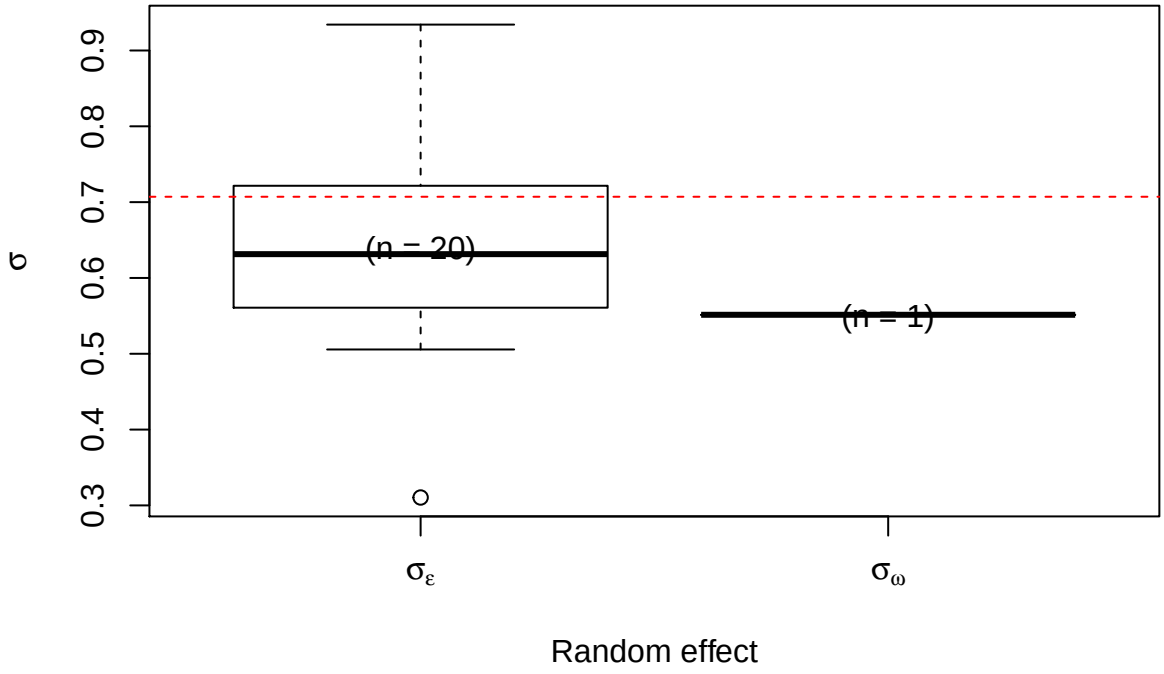

Figure 2: Estimated standard deviation of the simulated spatial fields using RandomFields package with a significant scale value.

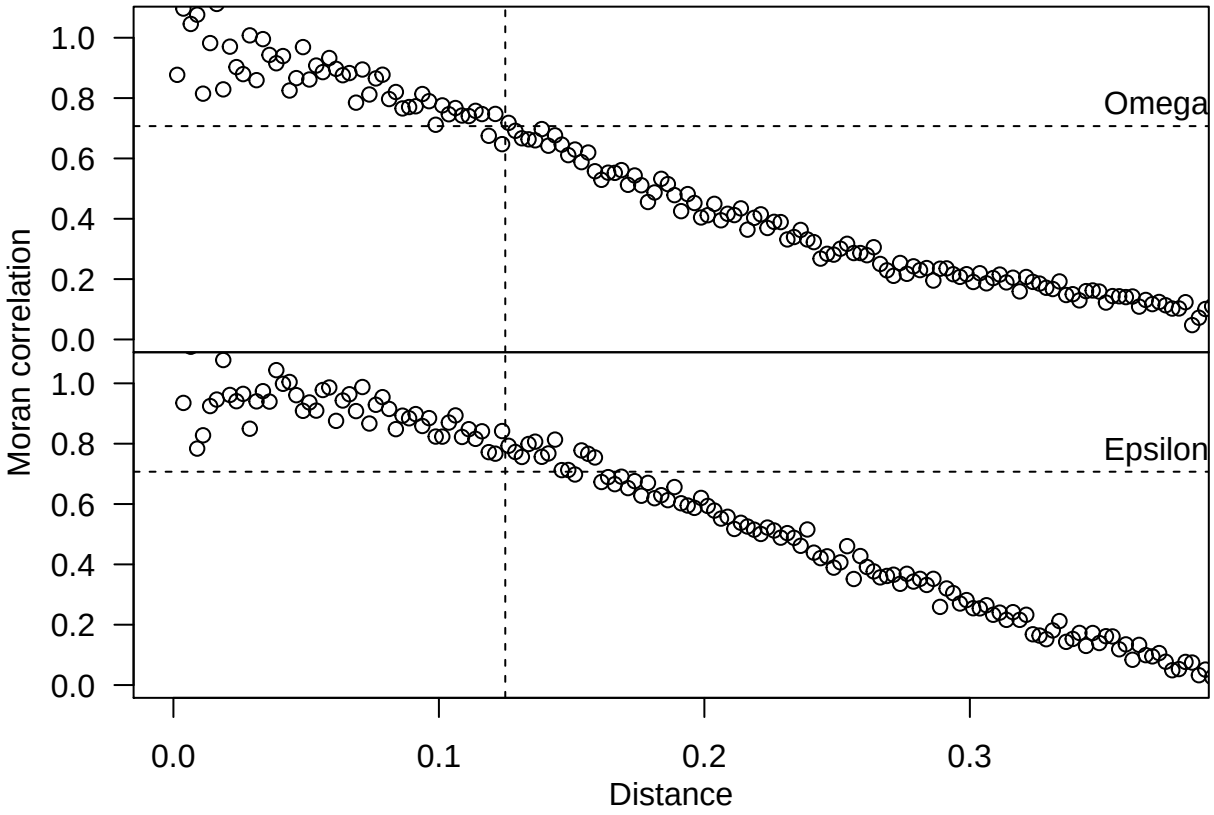

Figure 3: Moran's correlation versus distance (m).