4. What do possible realisations of the uncertain DEM look like?

The plots of the default Digital Elevation Model (DEM) and the realisations created using the Monte Carlo simulation are shown in figure x. A visual comparison shows very limited differences between the realisations and the default DEM. This can also be observed in the basic mean, standard deviation, minimum and maximum value statistics as shown in table x. The mean and maximum values of the default DEM are more or less similar to the means and maximum values of the realisations. The standard deviations of the realisations are slightly higher compared to the default DEM, but the differences of standard deviations between the realisations are again minimal. The higher standard deviation can be explained by the fact that the presence of measurement errors are taken into account when the realisations are created. The presence of errors introduces uncertainty which reduces the accuracy of the realisations and as a result, the standard deviation increases. The introduction of measurement uncertainty can also be seen in the minimum value. The default DEM is recorded in cm above NAP (the Dutch reference elevation of 0 cm). Introducing measurement uncertainty means that a certain location of measured elevation 0 can, in reality, have a true elevation which is less than zero. The realisations take this aspect into account and that clarifies the negative minimum values in all realisations.

The comparison between the default DEM and the realisations in figure x also shows that the realisations are more noisy, whereas the default DEM has clear patches of similar elevations and gradual borders between different elevations. The presence of noise in the realisations can be explained by the rather low spatial correlation between the measurement errors as can be seen in the Variogram of the residuals in figure x. The high nugget of the Variogram indicates that at short distances there is limited spatial correlation between two reference points. The lack of spatial correlation means that close by reference points can have a large difference of the values which results in noise on the realisations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DEM | Mean | Sd | Min | Max |
| DefaultDEM | 352.21 | 366.24 | 0 | 2887.27 |
| Realisation 8 | 351.31 | 371.00 | -8.64 | 2871.81 |
| Realisation 23 | 351.71 | 371.72 | -129.34 | 2837.86 |
| Realisation 40 | 353.76 | 372.68 | -87.11 | 2828.59 |
| Realisation 73 | 352.16 | 372.42 | -52.69 | 2881.02 |
| Realisation 85 | 351.00 | 371.52 | -59.47 | 2859.05 |

