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## Spatiotemporal investigation of material property changes in building stone following initial emplacement

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Visual inspection of deterioration phenomena across the façades of a historical monument demonstrates the spatial variability of weathering processes. Multiple previous weathering simulation and exposure trials have been developed to investigate the connection between weathering processes and spatial variability of response. However, in landscape systems theory, stability is a function of both spatial and temporal components. Temporal sensitivity is a function of both the magnitude and frequency of formative events and the spatial sensitivity of the material.

One area of urban stone decay literature that requires further attention is the initial response of quarry 'fresh' material to emplacement within a building. Previous small-scale investigations have demonstrated that alteration commences within a few months to a year of emplacement. These early changes to the material will have a lasting influence upon the development of future weathering processes and their spatial distribution. The necessity to investigate both the spatial and temporal components of this transition, well suits the capabilities of spatiotemporal kriging tools.

The influence of aspect upon the initial alterations of the material's properties are of significance to interpreting the weathering response to transition. Therefore, five sandstone blocks were placed within an exposure frame, located in South Belfast, for a duration of one year. One block was exposed to each of the four cardinal points whilst the fifth was positioned to represent a horizontal surface on a structure, such as a window sill or balustrade. Permeability measurements were recorded in a regular grid across the exposed surface of the block once a month, creating a data set that is both spatially and temporally dense. No previous studies have collected a similar quantity of points, across both space and time, to investigate weathering processes. The application of only spatial techniques proved to be inappropriate to fully interpret the complexity of the changing material properties. Use of spatiotemporal kriging allowed the modelling of the sample blocks to illustrate the changing material properties over time. The outcome of this work is the development of a better-informed understanding of the initial alteration of building stones placed within the urban environment. Additionally, the observed variance of the temporal component has improved our understanding of the nature of early episodic change within the stone decay system.

