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Detecting Anomalous Behaviours in the GNSS Coordinate Time Series of the NERC British Isles continuous GNSS Facility (BIGF) Network

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In this research, the three components (ΔN, ΔE and ΔU) of the GNSS coordinate time series of the NERC British Isles continuous GNSS Facility (BIGF) network were analysed to detect anomalous behaviours. The network was analysed by means of studying the temporal dependences in each GNSS station through time using Artificial Neural Network, studying the spatial dependences between the stations across the network using Spatial Autoregressive Model and a combined (temporal and spatial) analysis. The results show how different types of anomalies can be detected by the proposed approach. These anomalies vary between: [1] Small to large offsets due to undocumented changes; the smaller the offset is, the harder it gets to be detected by the temporal analysis while the spatial analysis is the best analysis, amongst the three analyses, in detecting smaller offsets; [2] Site-specific outliers, which are usually detected by the temporal analysis algorithm; [3] Processing artefacts; which can be detected by comparing the detected anomalies of both the temporal and the combined analyses; [4] Changes in velocity estimates, which are detected by the spatial analysis algorithm.. The results show some differences between the coordinate components as: [1] The ΔE component is more vulnerable to anomalies regarding changes in velocity estimates; [2] The ΔU component is more correlated spatially than the plan components; [3] the spatial correlation in the high-frequency components is higher than that of the low-frequency components within a time series.