Talk 2.2

True and spurious anomalies in ambient dose rate monitoring

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A simple way of areal monitoring of ambient dose rate (ADR) is ground surveying carrying a dose rate meter coupled to GPS which logs measured ADR values together with geographical coordinates and date/time. This is the method used by the Citizen Science project Safecast [1], devoted, among other, to ADR mapping. The project has been founded shortly after the Fukushima accident 2011 in Japan and soon spread world-wide. Several thousand citizens contribute as volunteers, carrying detectors and sending data to Safecast.org, where they are presented in a map [1]. The project uses a standard device called bGeigie Nano (based on a GM detector), but in principle also other monitors of similar type can be used. For the sake of usability, such instruments are small and therefore sensitivity is relatively low.

Citizen monitoring involves a number of particular quality assurance (QA) issues, apart from conventional metrological QA. The former aspect has been addressed in [2], the latter in [3], both in [4] together with a statistical evaluation of ADR results from cities world-wide.

Usually, the detectors are carried in pockets, back bags, on bicycles or in cars near windows. Depending on the travelling speed and measurement period (5s for the bGeigie Nano), ADR anomalies of certain spatial extension can be detected. In order to generate not too noisy ADR maps, measurement periods are aggregated (12 periods for the bGeigie Nano), because individual periods usually contain only few counts, which however reduces spatial resolution.

This algorithm gives rise to spurious anomalies, i.e. ones generated by the measurement process. With some frequency, GM tubes can generate extreme count numbers per period, which denote count numbers largely exceeding what can be expected from Poisson count statistics. Such phenomenon is represented by isolated high-count periods, but aggregation generates seemingly extended anomalies, which we call spurious. In Safecast maps, the effect can pretend an ADR anomaly where in fact none exists. Only analysis of the raw log files allows identifying spurious effects. As an example, we discuss dose rate maps of Berlin and Vienna, parts of which have been monitored extensively with a bGeigie Nano device mainly carried on bicycle. Closer inspection of detected anomalies reveals some as real, some as spurious. We also discuss possible physical reasons for spurious signals.

References