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RADON CONCENTRATIONS IN SCHOOLS AND IN DWELLINGS: A STUDY ON ASSOCIATION, CO-REGIONALISATION AND BIVARIATE MODELING

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Most indoor radon (Rn) surveys concentrated on residential Rn, so far. People spend, however, significant part of their lifetime at work, in places different from home. Thus, Rn exposure at work places can contribute importantly to overall Rn exposure. Consequently, new Rn regulations such as the European Basic Safety Standards, emphasize limiting Rn exposure at work alike the one at home. A particularly important workplace is school, equally for students as for teachers and other staff. Several countries, therefore, started early with surveying Rn in schools and kindergartens. In addition, sampling schools is logistically simpler than residential surveys, so that school surveys may serve as surrogates of residential Rn surveys, which are far more demanding on resources.

One largely open question is, whether or to which degree there is a spatial relationship between Rn concentrations in schools and in homes. If there is one between these variables, it would allow estimating one from the other, or using both in joint spatial estimation. For physical reasons – because home and school Rn have partly the same sources, namely the ground below the buildings – one would expect that such relation or association exists. Other sources and controlling factors, specific to schools and homes and different between these types of buildings, may however obscure the relation. A further cause, which contributes to concealing that relation, is that naturally, schools and homes cannot be located at the same site, but in some distance from each other, over which the geogenic control can also vary. In fact, it is known that the geogenic radon potential is subject to high small-scale variability. The resulting problem of "non-collocated data" renders the analysis particularly complicated and affords specific statistical techniques.

In this contribution, we investigate four georeferenced bivariate (home, school) datasets with this respect: one originating from a pilot study in Sokobanja district, Serbia (where statistical association of the variables has been demonstrated); a dataset from Macedonia; one from Banja Luka, Republika Srpska, and one of a regional school survey in Upper Austria together with the values of the Rn potential (standardized residential indoor concentration) in that region.

As methods of spatial analysis applied to recover statistical association of spatially non-collocated variables, we apply different techniques, among them nearest-neighbour association, correlation of spatially aggregated means, cross-variography and categorical association. If successful, the result can be used for bivariate cross- and co-estimation of the variables.

We demonstrate methodology and first results, which show that the statistical association is not quite easy to recover. Weak association has the consequence that estimation of one from the other implies high uncertainty. We also propose physical reasons for our findings.