Some statistical issues in the construction of annual fire risk maps based on fire frequency data

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Abstract Wild fires cause extensive loss of property and life and inflict heavy damage on ecosystems, therefore they are a relevant public policy issue, particularly in Portugal. Policy responses for local and global fire management depend heavily on the proper understanding of the fire extend as well as its spatio-temporal variation across any given study area, and annual fire risk maps are important decision support tools in devising such policy responses. Annual fire risk maps are constructed based on annual satellite imagery data, which in its raw state, consist of the the location of observed fire scars in space and their sizes. Ideally such data set can be assumed to be generated by a spatio-temporal marked point process, discrete in time, continuous in space, and fire risk maps can be produced by estimating the predictive distribution of the intensity function of the point process. However, there are formidable computational issues associated with this approach. Often, the raw data is discretized in space over a pre-chosen grid of desired resolution, transforming it into fire frequency data consisting of fire inter arrival times. Fire frequency studies then focus on estimating the distribution of two related random variables, namely the time since last fire in a spatial unit, ie the survival function and the time between two consecutive fires, ie. mortality. The hazard function which is the rate of mortality conditional on survival until time t ties together the survival and the mortality distributions and therefore is the target quantity for modeling fire frequency data and producing annual fire risk maps. In this talk, we look at existing practices in producing these maps and we suggest improvements in the existing methods by incorporating the strong spatial dependence that exists between the grid cells which reduce bias as well as variance in estimated risks.