

# Modelling Replicated Gibbs Point Process Models with Fixed and Random Effects

Janine B. Illian<sup>1</sup>

<sup>1</sup> University of St Andrews, Scotland, UK

**Abstract:** We consider spatial point patterns that have been observed in the same area at different points in time. We take a maximum pseudolikelihood approach (Besag, 1977) to parameter estimation in the context of Gibbs processes here (Stoyan et al., 1995, Illian et al., 2008). More specifically, we discuss several pair-wise interaction processes where the conditional intensity has a log-linear form and extend existing models such that the intensity and the interaction terms in the pseudolikelihood are expressed as a sum of fixed and random effects. We apply the approximate Berman-Turner device (see Baddeley and Turner, 2000) to a generalised linear mixed model with log link and Poisson outcome rather than a simple generalised linear model. Estimates are obtained using existing software for generalised linear mixed models based on penalised pseudolikelihood methods (Breslow and Clayton, 1993).

The approach is applied to a data set detailing the spatial locations of muskoxen in a fixed area in Greenland at different points in time within several years.

**Keywords:** Spatial point processes, replicated patterns, Berman-Turner device, random effects, glmm