Integrating R-INLA with *R* spatial packages and ggplot2

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We develop a model for the space time distribution of tornado count data aggregated yearly over counties in Kansas in the USA. We use a Bayesian model to analyze local counts. A hierarchical model is chosen, in which the local counts are assumed to have a negative binomial distribution when conditioned on the distribution's mean and count parameters. Next in the hierarchy, the mean and count parameters each have a distribution, where the mean is assumed to be a spatial Gaussian process. The spatial Guassian process is composed of a mean that is linearly regressed onto local and global covariates. Both the intercept and the coefficients are allowed to vary spatially using intrinsic conditional autoregressive (ICAR) priors [1]. Finally, the model is fit by an INLA (Integrated Nested Laplace Approximation) [4] using the **R-INLA** [3].

We demonstrate the use of the *R* package **rgdal** to read in the tornado shape files, with *R* packages **maps** and **maptools** to generate a counties shape file. We use functions from the *R* **sp** and **spdep** packages to overlay tornado tracks onto the counties and generate a spatial neighborhood list [2], followed by `ddply()` from the **plyr** *R* package to generate yearly county tornado counts. We perform our analysis using **R-INLA** package to estimate posterior densities and means. We generate publication quality plots of these results using the **ggplot2** *R* package [5]. The example code and presentation will be created using *R-Studio* and published on Rpubs.

References

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[4] Rue, H., S. Martino, and N. Chopin (2009). Approximate Bayesian inference for latent Gaussian models using integrated nested Laplace approximations (with discussion).

[5] Wickham, H. (2009). *ggplot2: elegant graphics for data analysis*. Springer New York. GGPLOT2 `http://had.co.nz/ggplot2/book`.