



Figure 24.19. Spatial \times Temporal interaction term based on the type III model. This is the $f(\text{Year}_2, \text{group} = \text{County}_1, \dots)$ term. Blue counties have a relative large negative random effect, white counties have random effects between -1 and 1 and red counties have large positive random effects.

24.9.6 Type IV interaction

The type IV interaction is based on the cross product between the spatial correlated random effect u_i and the long-term component γ_s . We again have the main terms $Spatial_i$ and $Temporal_s$. These are the BYM and the rw2 smoother. In the type IV interaction we assume that deviations from the $Temporal_s$ trend at a specific county are not only correlated in time (as in the type II interaction) but also correlated with neighbouring counties. That is a waste spill in a river that takes a couple of years to clean up and affects various neighbouring counties. Knorr-Held (2000) shows that the correlation is for first- and second-order neighbours in time and in space.

The formula for the type IV interaction is given by