24.9 Spatial-temporal correlation for areal data

Figure 24.19. Spatial × Temporal interaction term based on the type III model. This is the \( f(\text{Year2, group = County1},...) \) 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 \( \gamma \). We again have the main terms Spatial, and Temporal, These are the BYM and the rw2 smoother. In the type IV interaction we assume that deviations from the Temporal 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