Starting point:

lmer(Yield~1+PrecZscore+PrecVar+TempZscore+TempVar+ (PrecZscore+TempZscore|ID))

* scaling or z-scores needed
* estimates of similar specifications seem to be similar -> **robust,** **good**

# The best models:

1. **No weights**

The best specifications of the error structure based on LR tests of serial correlation, and LR tests of random effects:

1. AR(1) errors

lme(Yield~1+PrecZscore +TempZscore , random= ~ PrecZscore + TempZscore|ID, correlation=corAR1(0,form= ~ as.numeric(Year)|ID))

1. MA(3) errors

lme(Yield~1+PrecZscore +TempZscore , random= ~ PrecZscore + TempZscore|ID, correlation=corARMA(0,form= ~ as.numeric(Year)|ID, p=0,q=3))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | pvcm from plm package (no AR or MA) | |
| No weights: Fixed effects | **AR(1)** | **MA(3)** | **Swamy 1970** | **County individual, mean** |
| Intercept | 1.685\*\*\* | 1.692\*\*\* | 1.610\*\*\* | 1.636 |
| Precipitation (Z – score) | 0.155\*\*\* | 0.162\*\*\* | 0.196\*\*\* | 0.200 |
| Temperature (Z – score) | -0.137\*\* | -0.141\*\* | -0.089 (p-val= 0.141) | -0.106 |
| AIC | 1130.211 | 1122.896 |  |  |
| BIC | 1180.522 | 1182.354 |  |  |

ANOVA: Precipitation explains much more than temperature (F tests: 44.4 and 7.8)

1. **Weights = Area of cropland**

lme(Yield~1+PrecZscore +cv\_Prec, random= ~PrecZscore+TempZscore|ID , weights=~Area, correlation= corARMA(form = ~ as.numeric(Year)|ID, p=2,q=2))

The best specification of the error structure based on LR tests of serial correlation, and LR tests of random effects:

ARMA(2,2) errors: