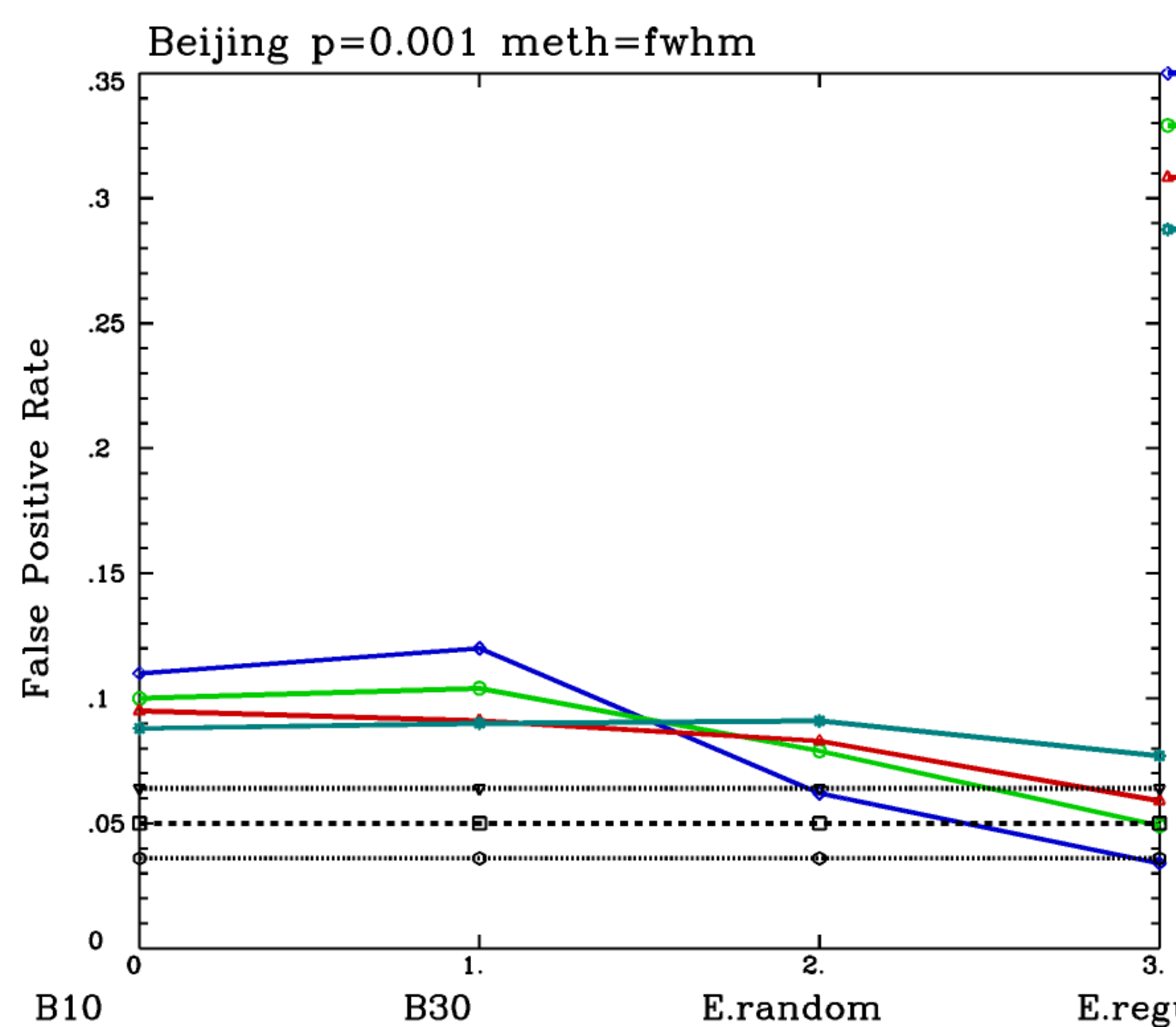
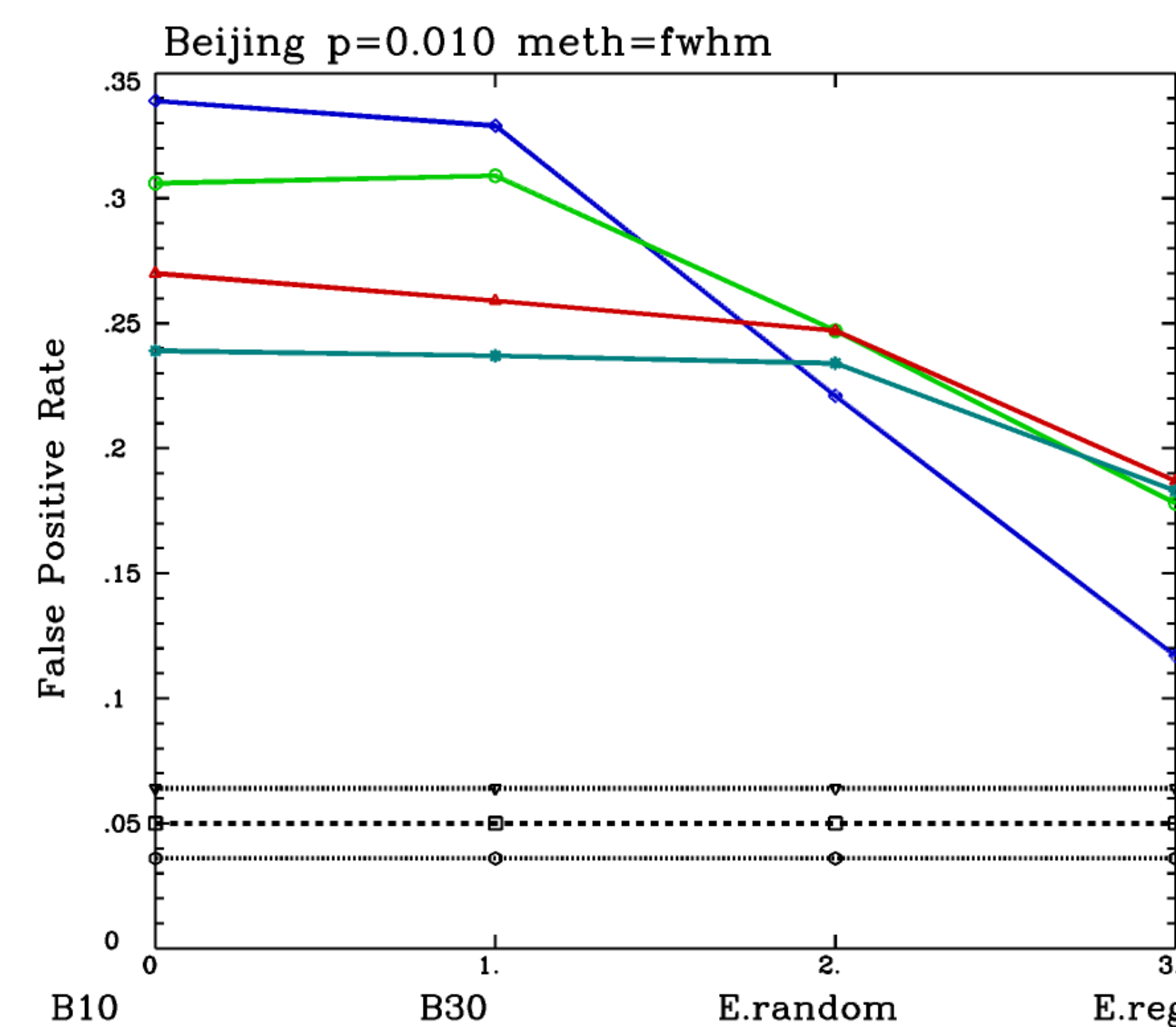


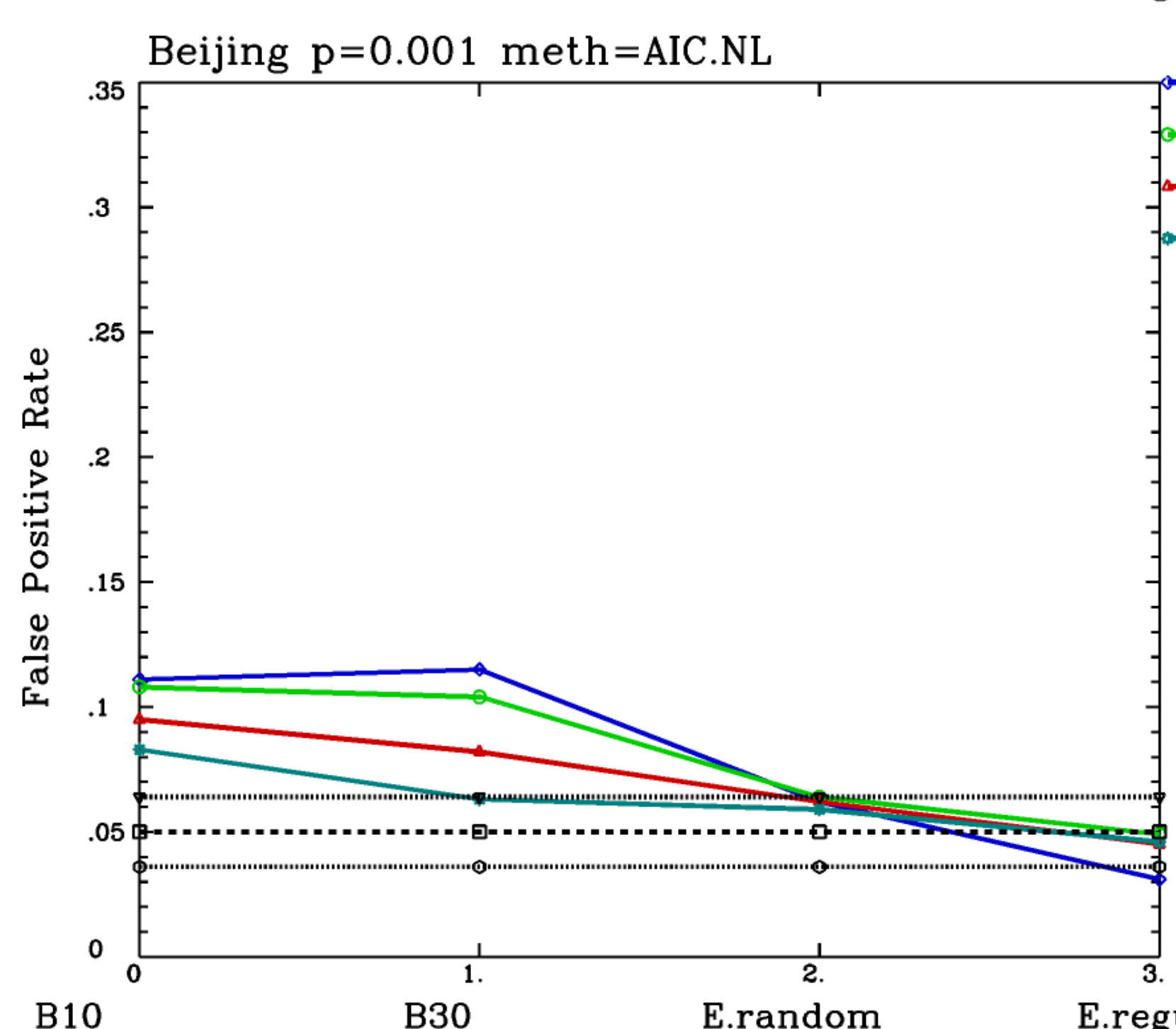
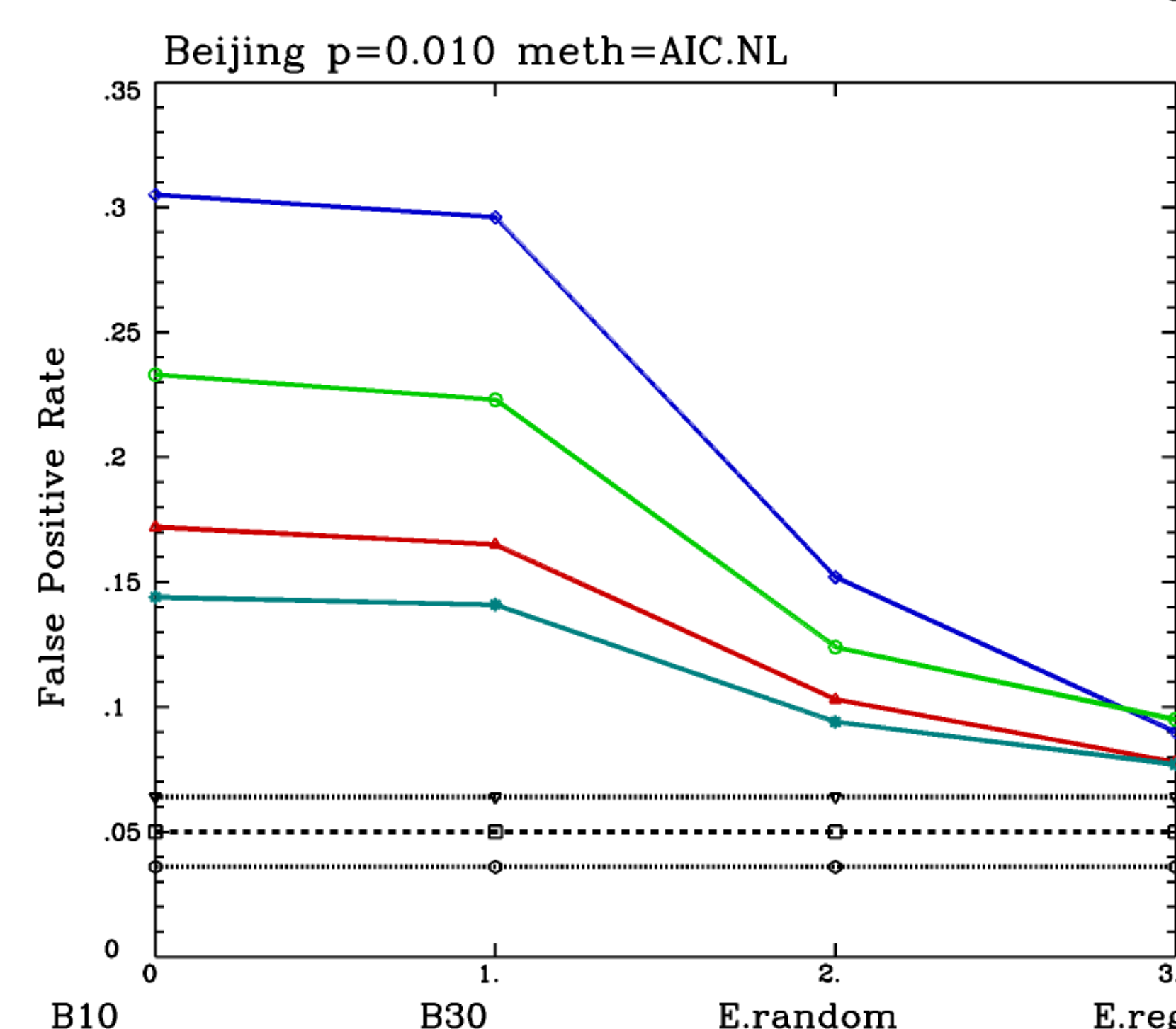
**(0) Scene of the Crime [E]**

- Carry out task-based analyses on rs-FMRI data
  - Carry out group analyses on 1K random subsets
  - Too many false positives in group statistics
- [E] A Eklund *et al*: Can parametric statistical methods be trusted for fMRI based group studies?  
<http://arxiv.org/abs/1511.01863> **Poster #1605**



**(1) Re-Run the Results in AFNI (3dttest++)**

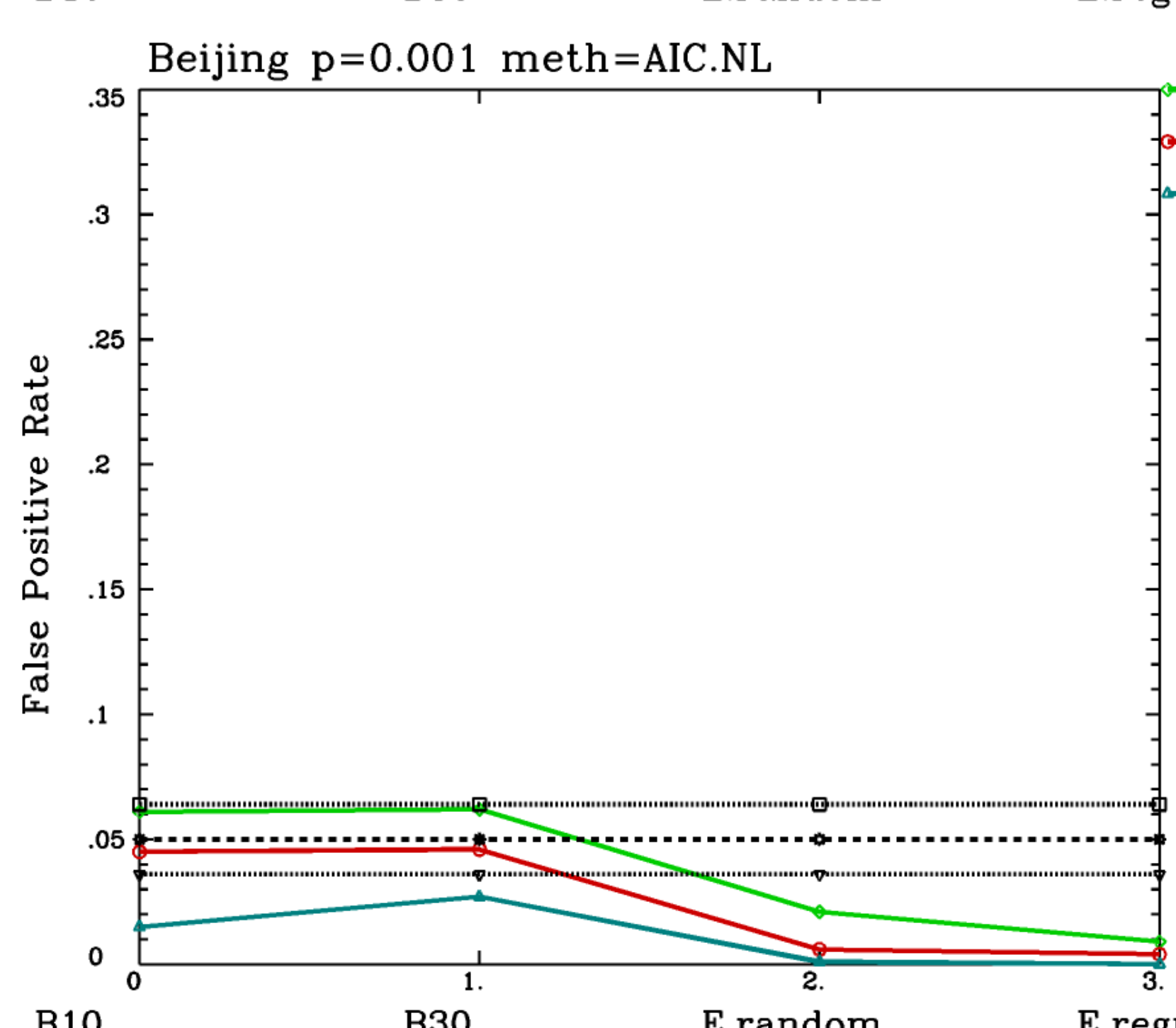
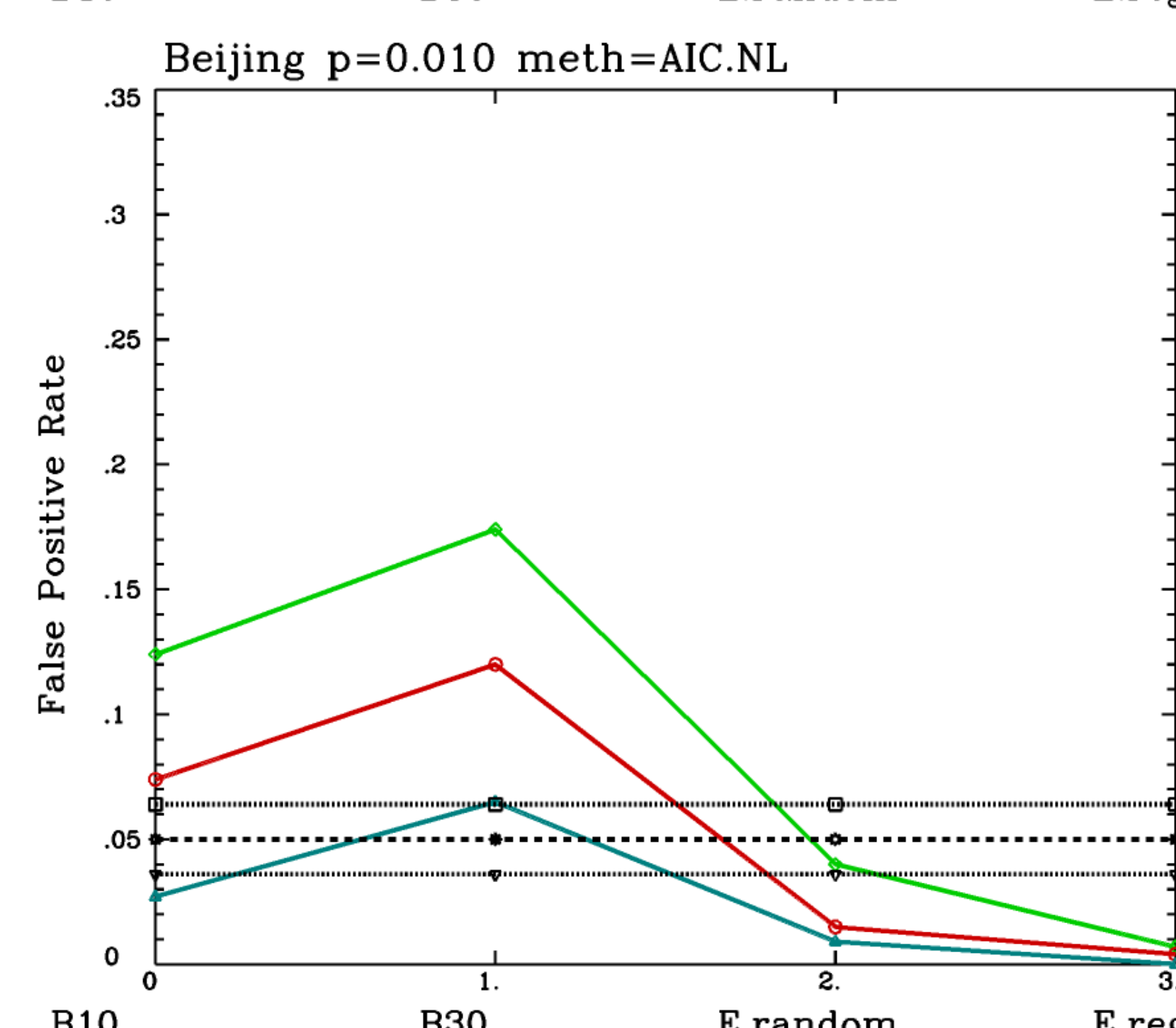
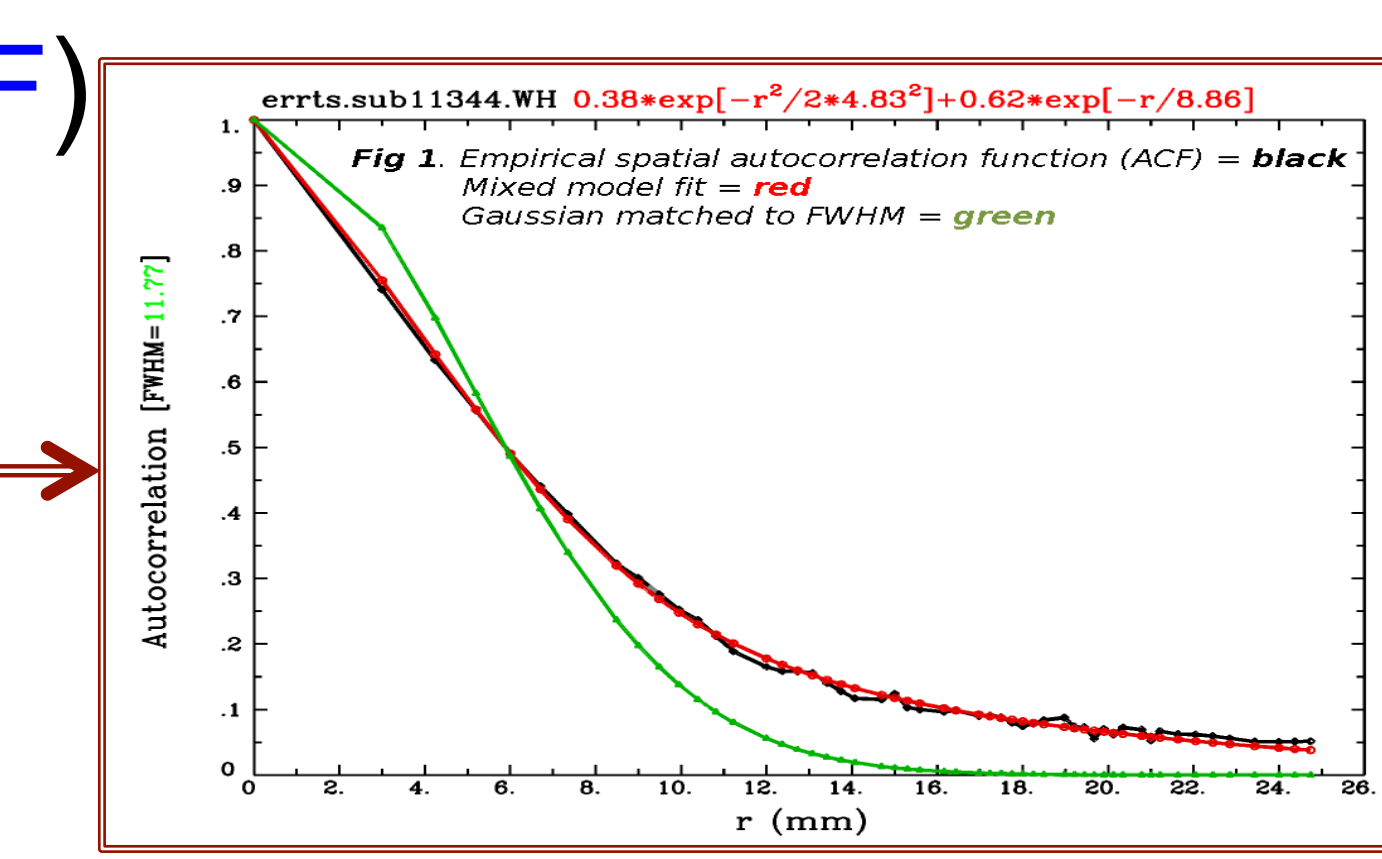
- Note vertical scale differs from Eklund's figure
- Using the "old" blurring method and using the "classic" method of estimating smoothness
- Using our currently recommended single-subject analysis pathway
- Results somewhat different from [E] but not much



**(2) Use new "global ACF" smoothness estimator**

- Some improvement towards nominal 5% band
- **The first culprit:** long tails in spatial Auto-Correlation Function (ACF)

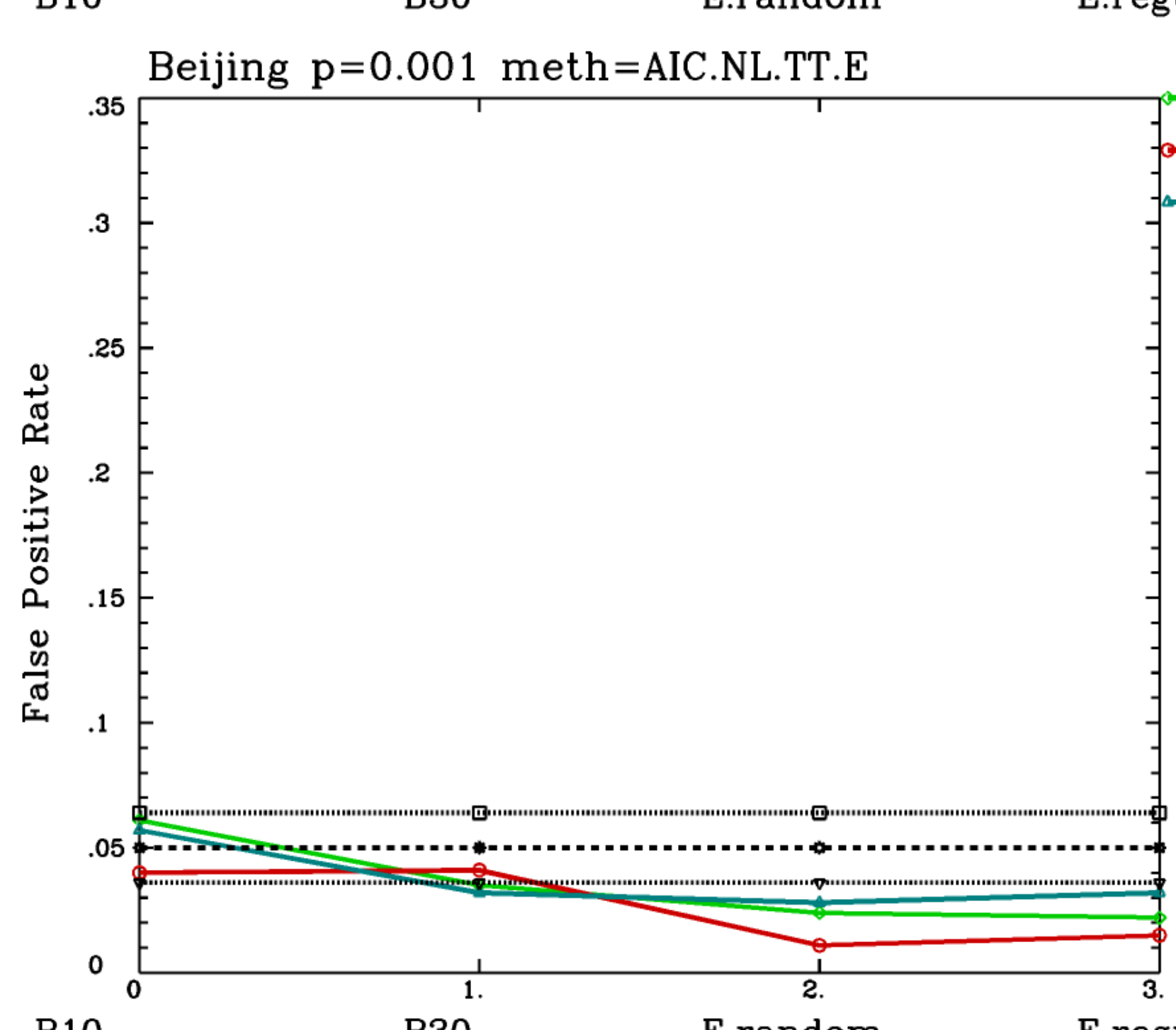
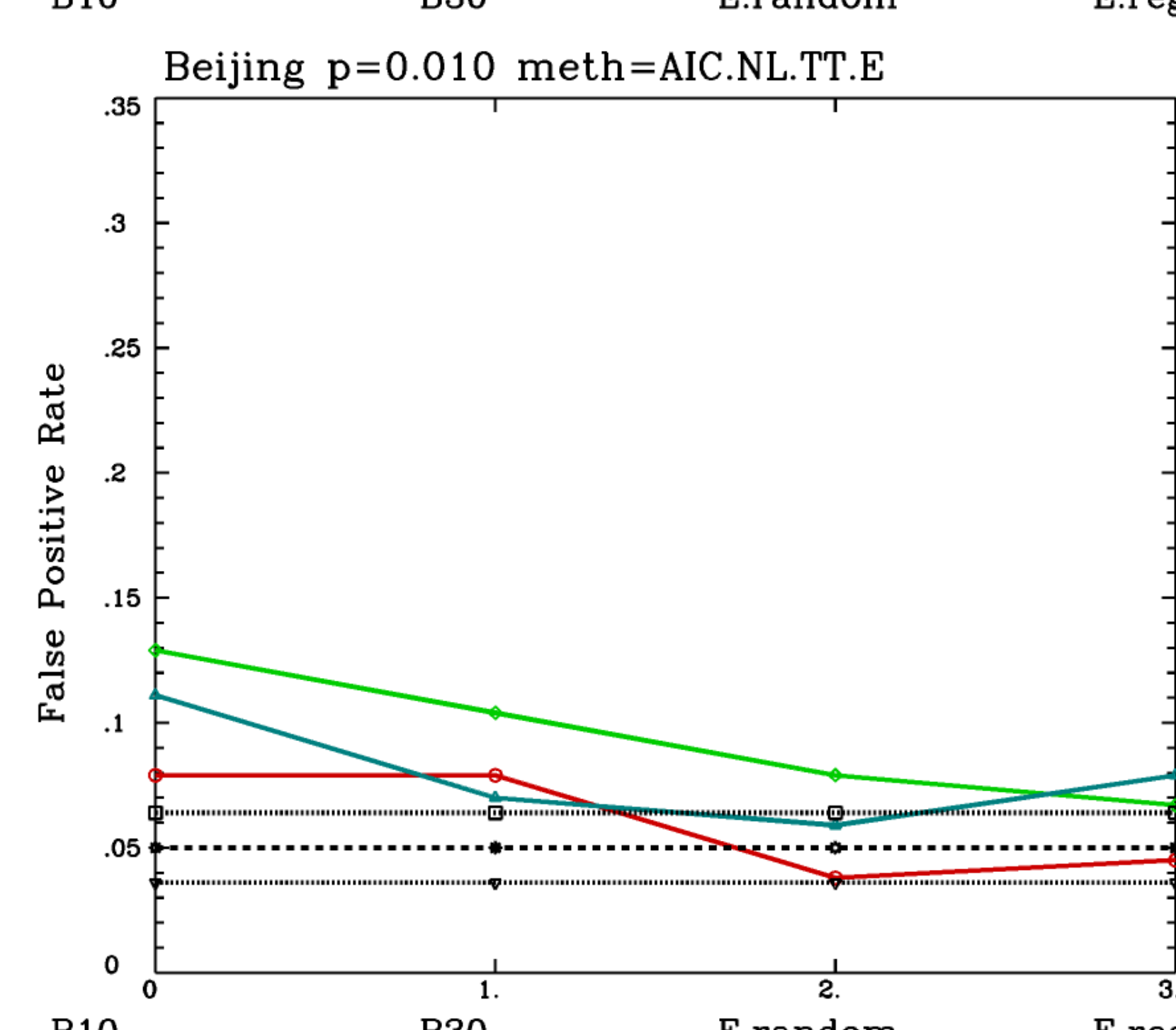
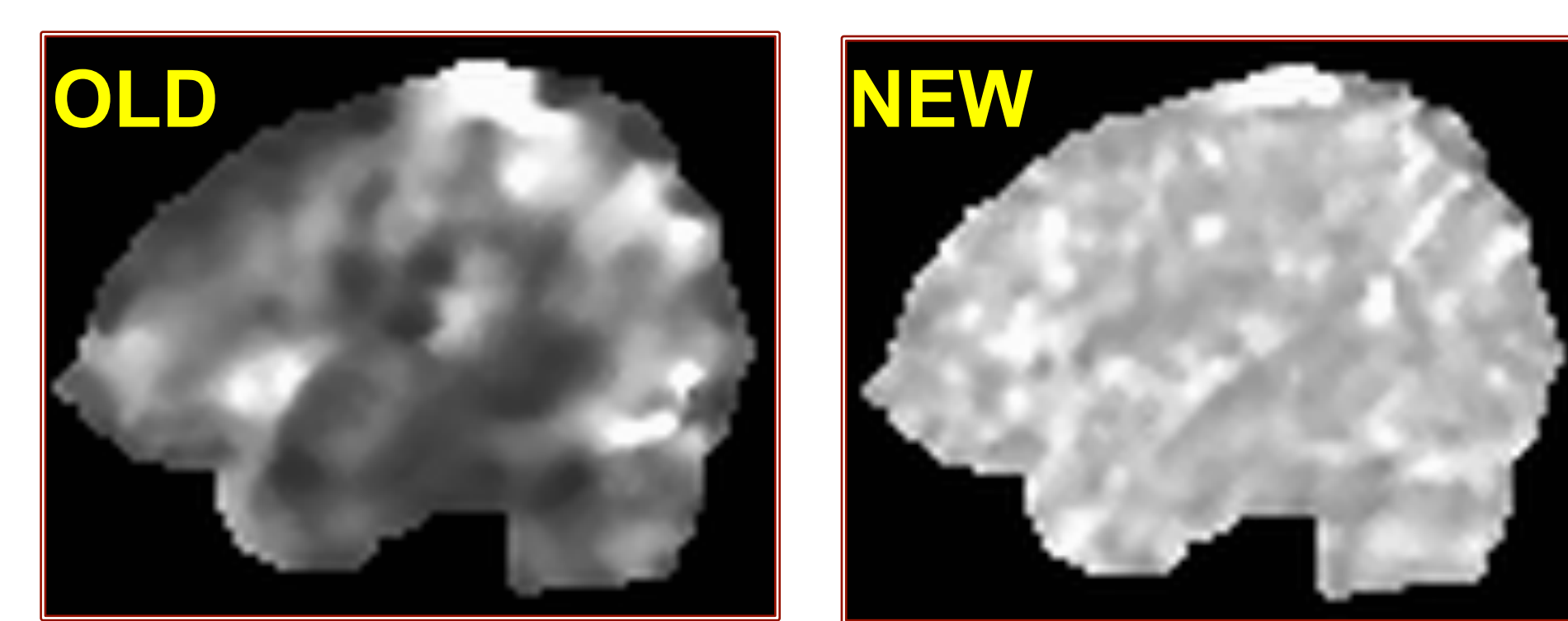
3 parameter model for ACF:  
$$a \cdot e^{-r^2/(2b^2)} + (1-a) \cdot e^{-r/c}$$
 Estimates (a,b,c) globally using all brain voxels



**(3) + Use new "local ACF" variable blurring**

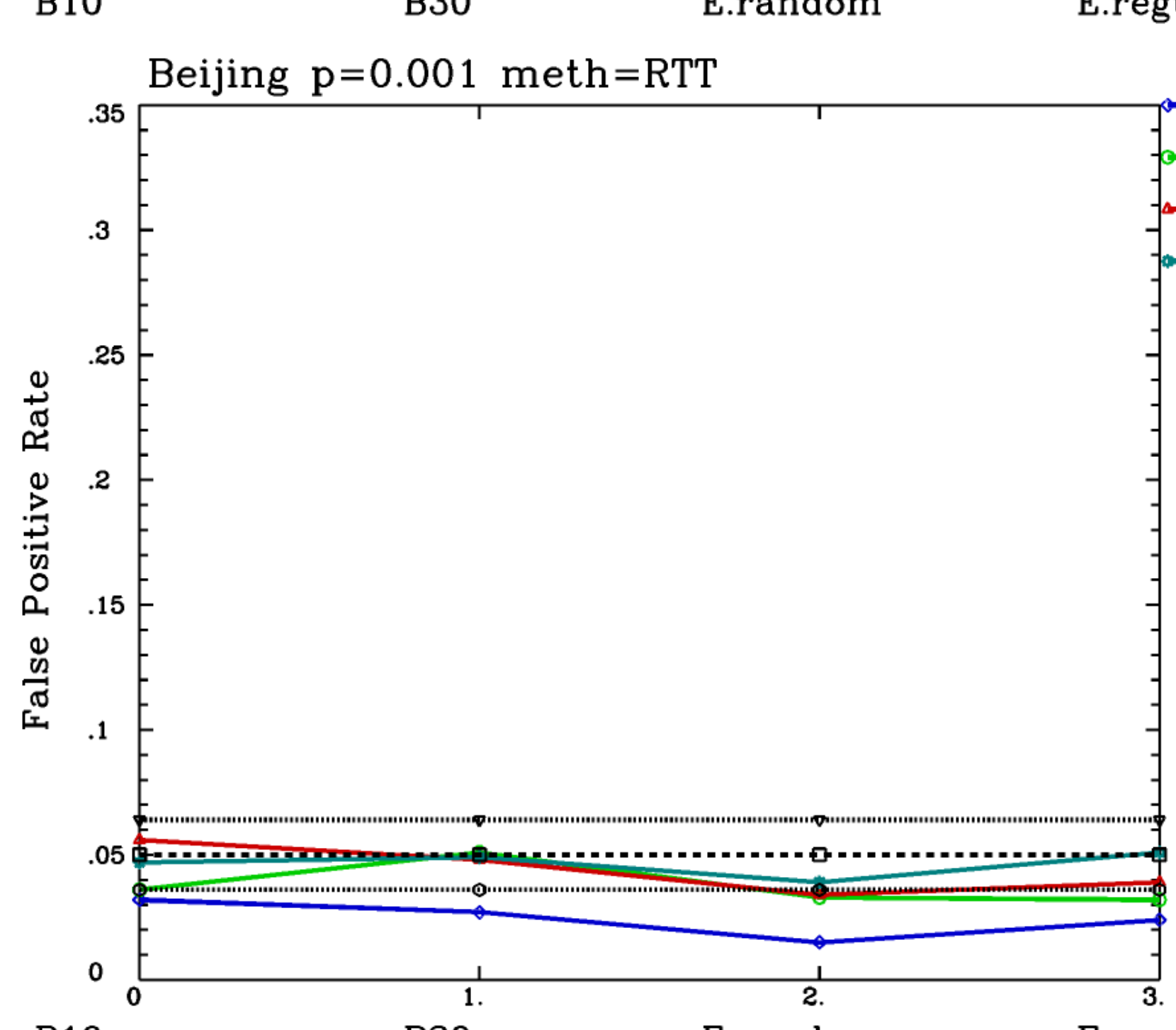
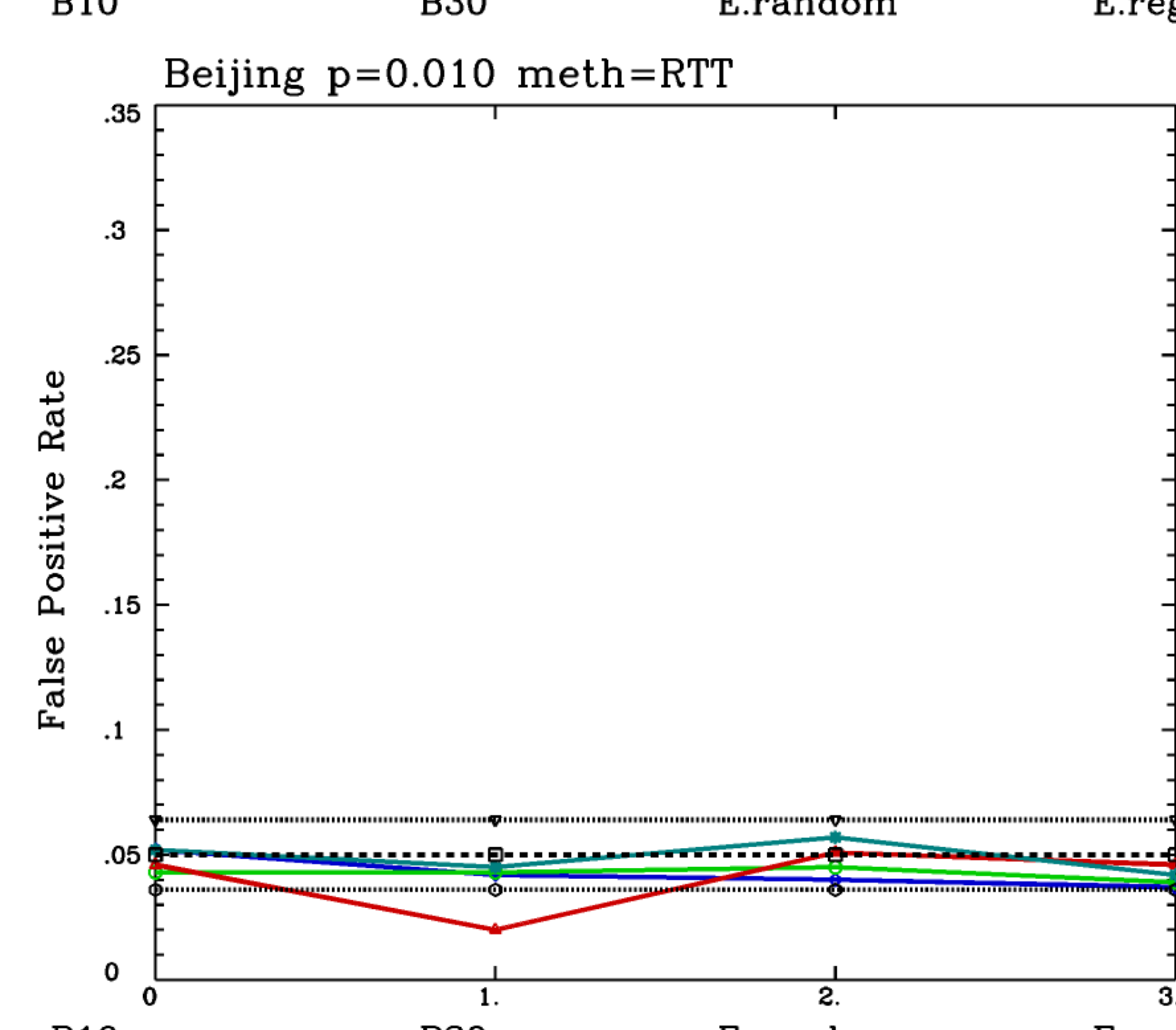
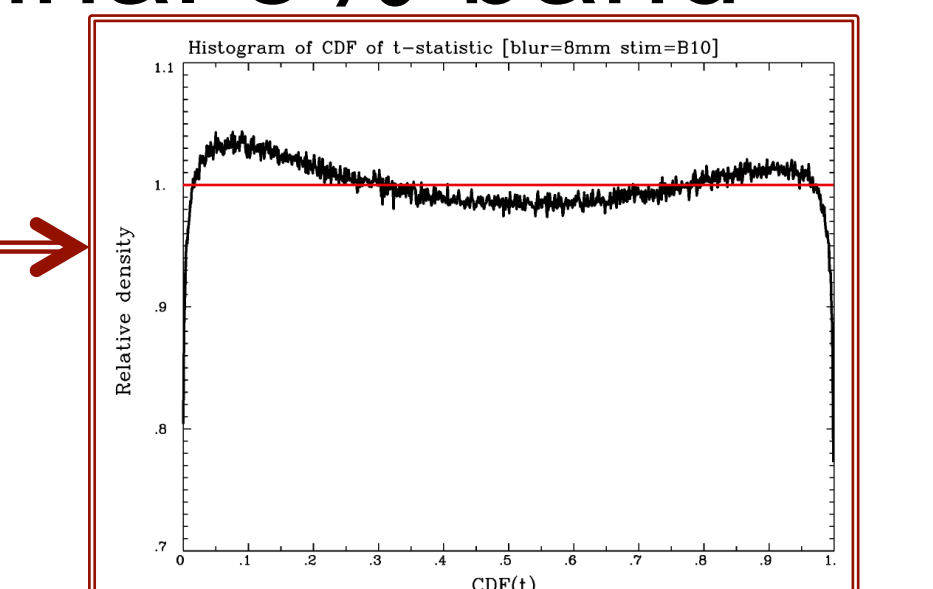
- Mixed improvement towards nominal 5% band
- **The second culprit:** strong spatial variability in smoothness

Local FWHM estimates for OLD and NEW blurring methods:  
Estimates (a,b,c) locally, Adjusts blurring locally



**(4) Use median of "local ACF" smoothness estimator on t-test residuals**

- Rather than use smoothness estimates from each subject (and then combine with median)
- More improvement towards nominal 5% band
- **A third culprit?** Outliers distort t-statistics Or residual smoothness issues?



**(5) Direct randomization and clusterization from t-test residuals**

- No estimation of smoothness needed
- Brute force computation
- Quick for t-tests (multi-thread 3dttest++ -Clustsim)
- Not easy for more complex statistics (eg, 3dLME)
- However, the results look pretty good here

Coming soon to an AFNI near you!  
(but some work yet remains)

**TL;DR**  
The processes of blurring and smoothness estimation can be improved to make parametric group statistics more reliable