More FMRI QC in AFNI: updates for afni_proc.py's automatic HTML review

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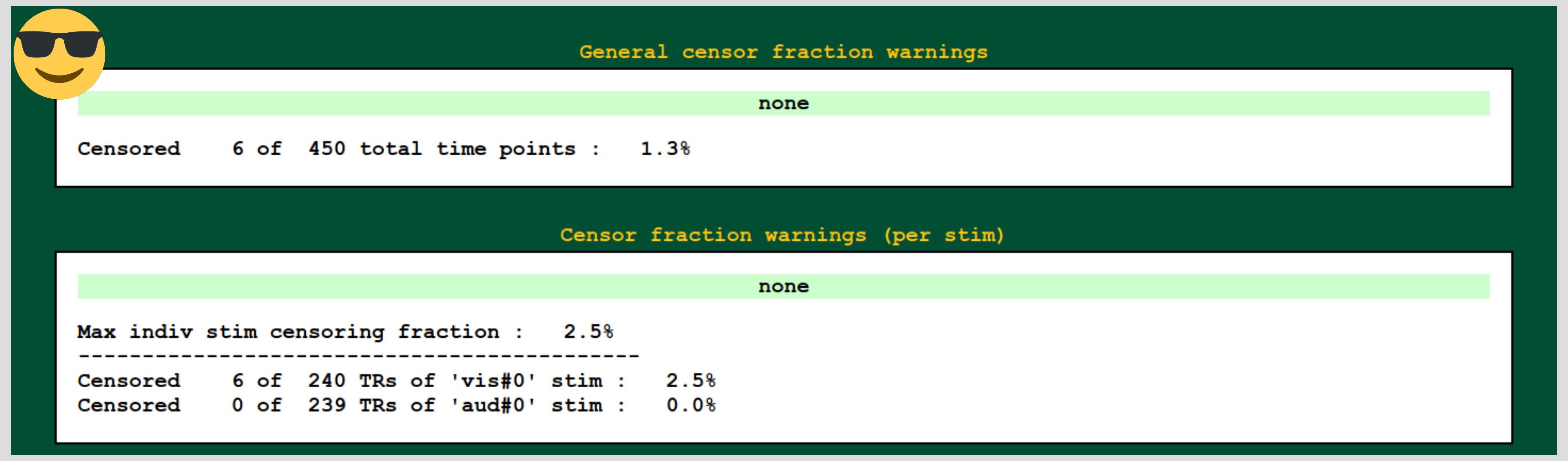
OHBM 2020

#2051

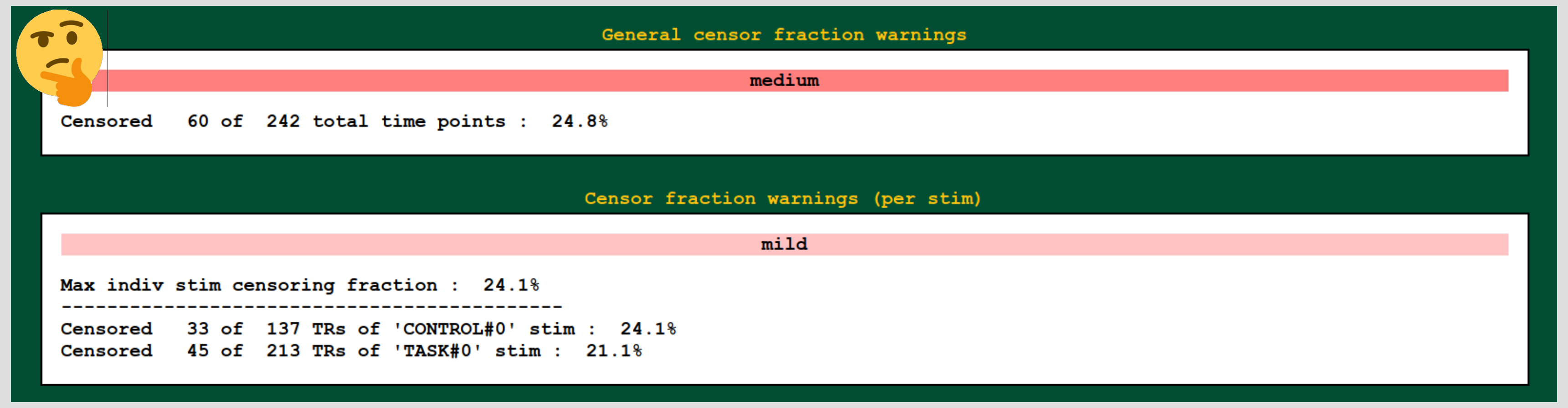
FMRI processing is hard. AFNI's[1] *afni_proc.py* makes QC easier. Here are new features in the QC HTML.

1) Check censoring both overall and per stimulus (for task-FMRI)

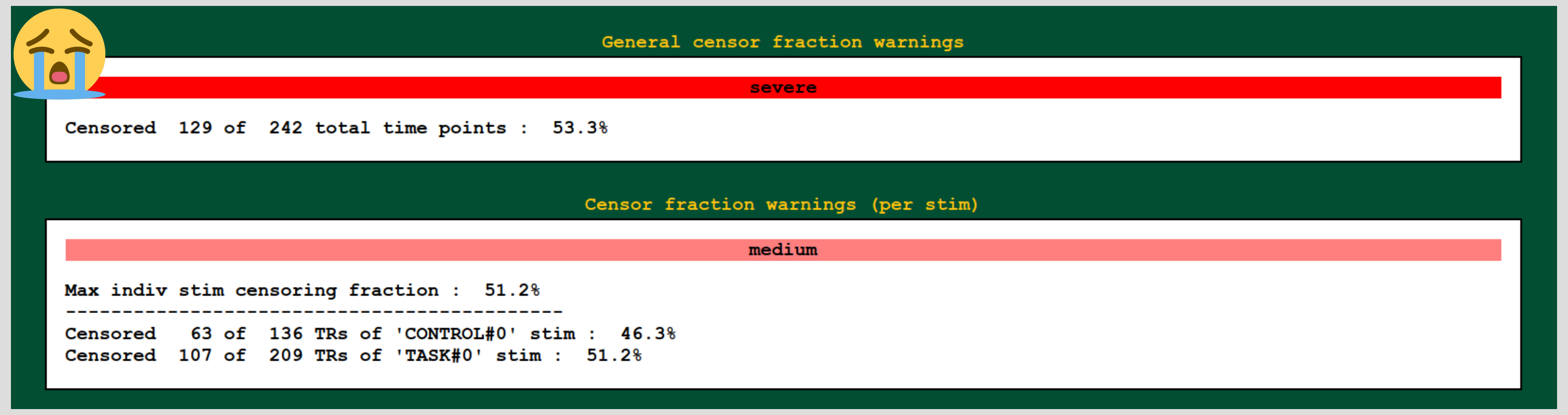
Motion censoring uses up degrees of freedom in data. Be careful to check overall, and for each stimulus type.



```
General censor fraction warnings

                                   none
Censored     6 of  450 total time points :   1.3%

Censor fraction warnings (per stim)

                                   none
Max indiv stim censoring fraction :   2.5%
-------------------------------------------
Censored     6 of  240 TRs of 'vis#0' stim :   2.5%
Censored     0 of  239 TRs of 'aud#0' stim :   0.0%
```



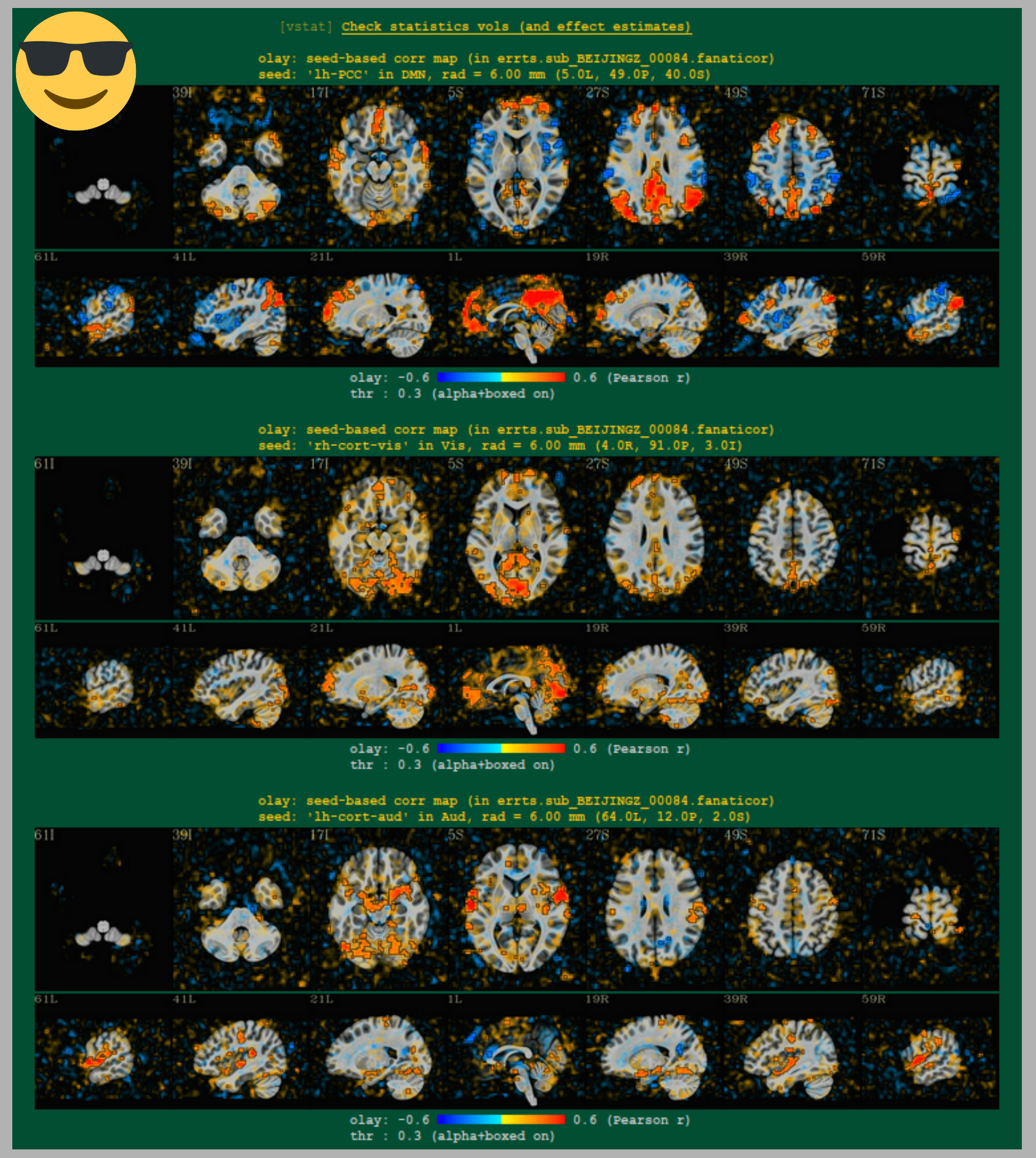
```
General censor fraction warnings

                                  medium
Censored   60 of  242 total time points :  24.8%

Censor fraction warnings (per stim)

                                   mild
Max indiv stim censoring fraction :  24.1%
--------------------------------------------
Censored   33 of  137 TRs of 'CONTROL#0' stim :  24.1%
Censored   45 of  213 TRs of 'TASK#0' stim :  21.1%
```



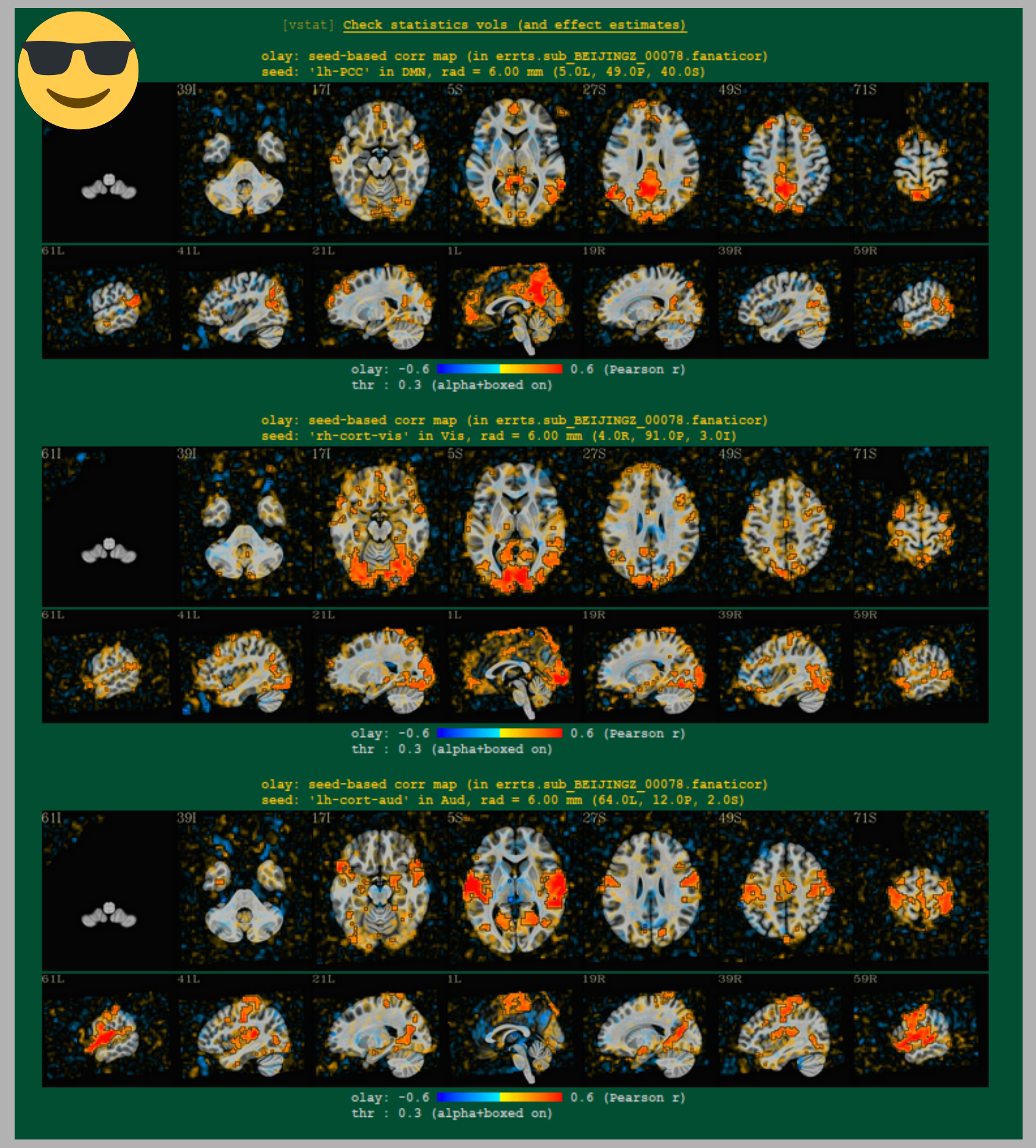
```
General censor fraction warnings

                                  severe
Censored  129 of  242 total time points :  53.3%

Censor fraction warnings (per stim)

                                  medium
Max indiv stim censoring fraction :  51.2%
--------------------------------------------
Censored   63 of  136 TRs of 'CONTROL#0' stim :  46.3%
Censored  107 of  209 TRs of 'TASK#0' stim :  51.2%
```

2) For resting state, check seed-based correlation of some major networks.

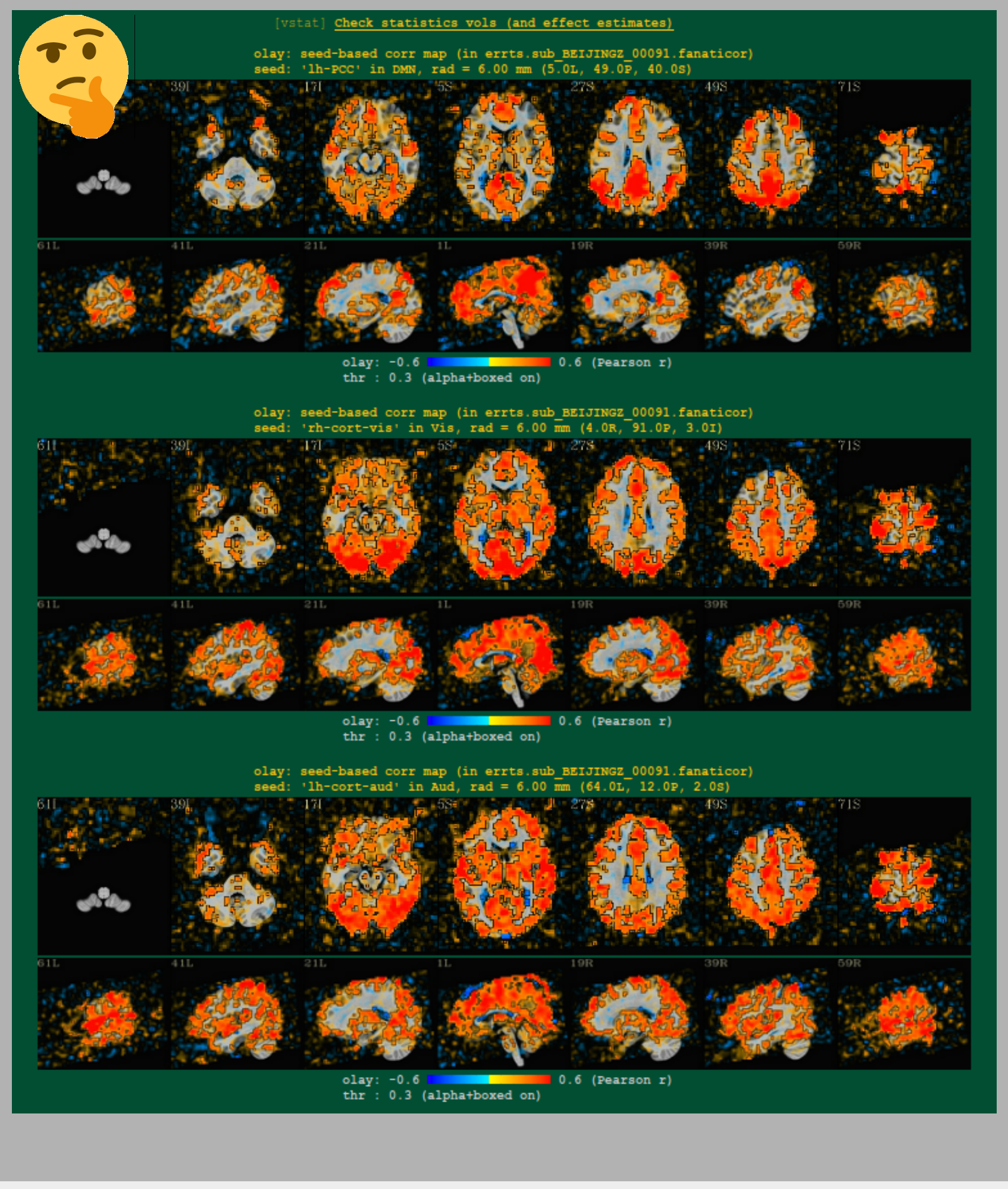
For known standard spaces, seeds for 3 networks are pre-loaded: visual, auditory, and default mode.



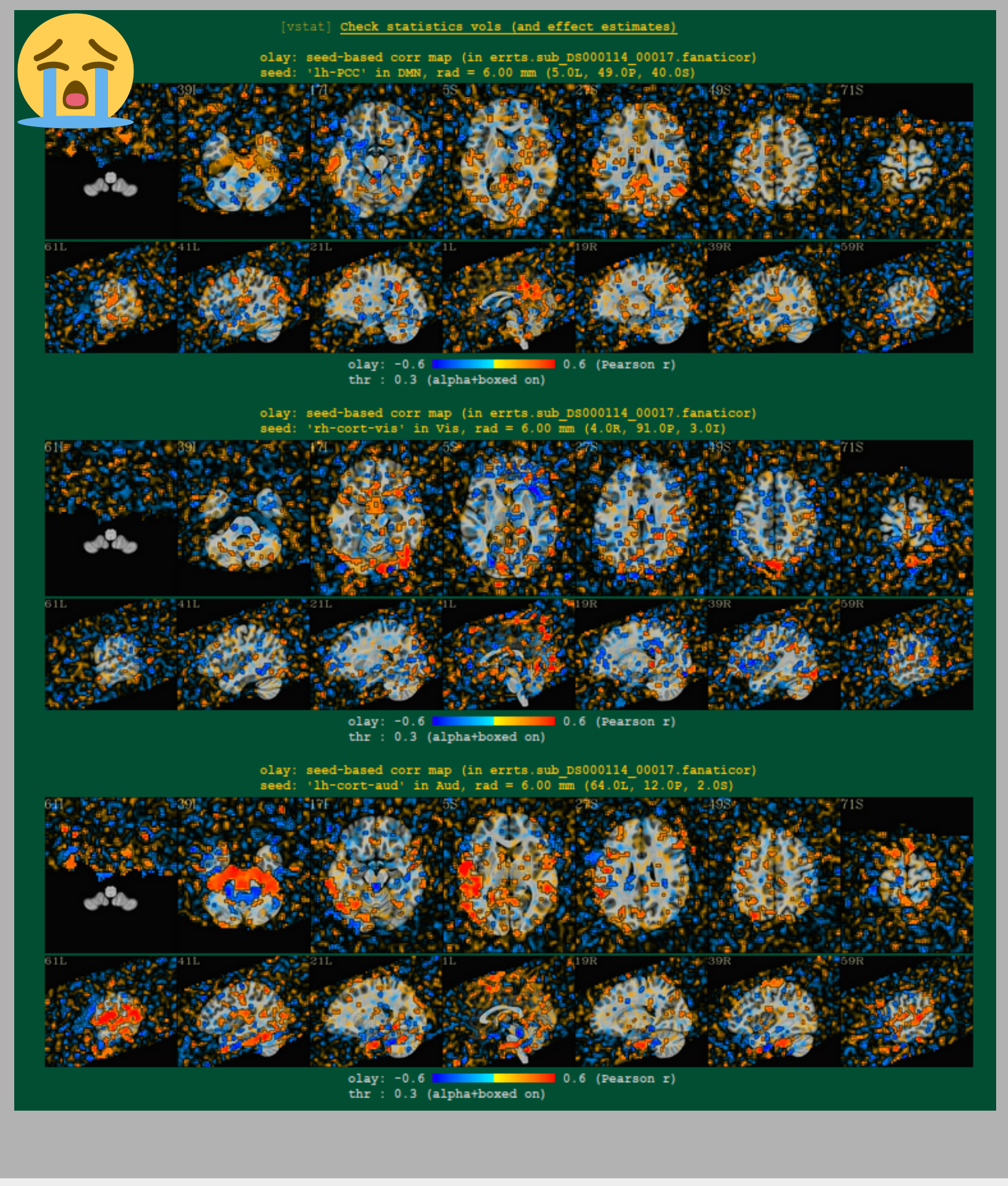
```
[vstat] Check statistics vols (and effect estimates)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00084.fanaticor)
seed: 'lh-PCC' in DMN, rad = 6.00 mm (5.0L, 49.0P, 40.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00084.fanaticor)
seed: 'rh-cort-vis' in Vis, rad = 6.00 mm (4.0R, 91.0P, 3.0I)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00084.fanaticor)
seed: 'lh-cort-aud' in Aud, rad = 6.00 mm (64.0L, 12.0P, 2.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)
```



```
[vstat] Check statistics vols (and effect estimates)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00078.fanaticor)
seed: 'lh-PCC' in DMN, rad = 6.00 mm (5.0L, 49.0P, 40.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00078.fanaticor)
seed: 'rh-cort-vis' in Vis, rad = 6.00 mm (4.0R, 91.0P, 3.0I)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00078.fanaticor)
seed: 'lh-cort-aud' in Aud, rad = 6.00 mm (64.0L, 12.0P, 2.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)
```



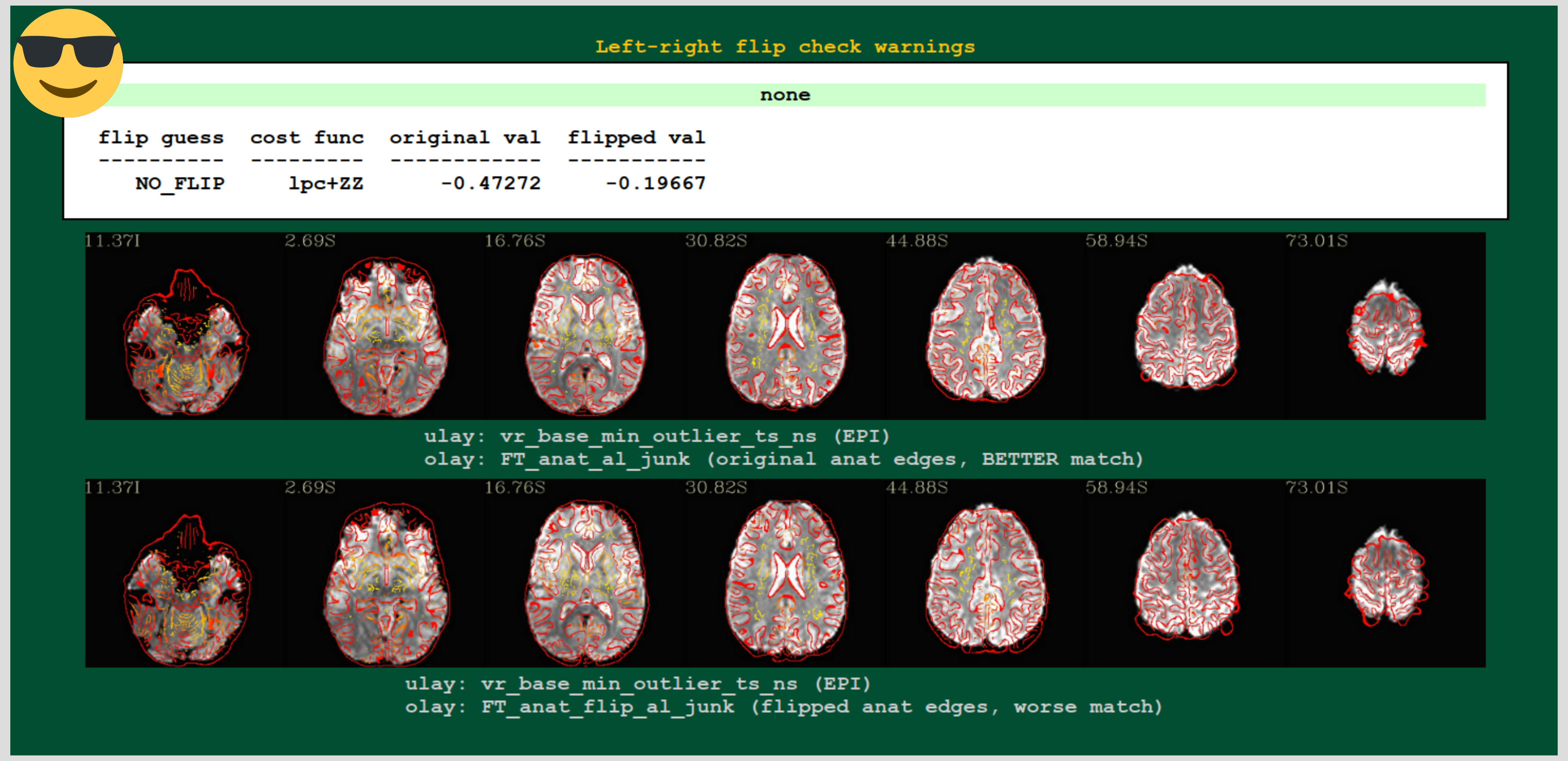
```
[vstat] Check statistics vols (and effect estimates)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00091.fanaticor)
seed: 'lh-PCC' in DMN, rad = 6.00 mm (5.0L, 49.0P, 40.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00091.fanaticor)
seed: 'rh-cort-vis' in Vis, rad = 6.00 mm (4.0R, 91.0P, 3.0I)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_BEIJINGZ_00091.fanaticor)
seed: 'lh-cort-aud' in Aud, rad = 6.00 mm (64.0L, 12.0P, 2.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)
```



```
[vstat] Check statistics vols (and effect estimates)

olay: seed-based corr map (in errts.sub_DS000114_00017.fanaticor)
seed: 'lh-PCC' in DMN, rad = 6.00 mm (5.0L, 49.0P, 40.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_DS000114_00017.fanaticor)
seed: 'rh-cort-vis' in Vis, rad = 6.00 mm (4.0R, 91.0P, 3.0I)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)

olay: seed-based corr map (in errts.sub_DS000114_00017.fanaticor)
seed: 'lh-cort-aud' in Aud, rad = 6.00 mm (64.0L, 12.0P, 2.0S)
olay: -0.6  0.6 (Pearson r)
thr : 0.3 (alpha+boxed on)
```

3) Check for left-right flips between EPI and anatomical volumes.

Surprisingly, this problem has been found in a lot of data[2] (in FCP, ABIDE, OpenFMRI,...). How can you be sure it isn't in yours? *Check both quantitatively and visually!*



```
Left-right flip check warnings

                                   none
 flip guess   cost func   original val   flipped val
 ----------   ---------   ------------   -----------
    NO_FLIP      lpc+ZZ       -0.47272      -0.19667
```

```
ulay: vr_base_min_outlier_ts_ns (EPI)
olay: FT_anat_al_junk (original anat edges, BETTER match)
```

```
ulay: vr_base_min_outlier_ts_ns (EPI)
olay: FT_anat_flip_al_junk (flipped anat edges, worse match)
```

```
Left-right flip check warnings

                                  severe
 flip guess   cost func   original val   flipped val
 ----------   ---------   ------------   -----------
    DO_FLIP      lpc+ZZ       -0.29740      -0.91482
```

```
ulay: vr_base_min_outlier_ts_ns (EPI)
olay: anat_sub_CAMBRIDGEB_00000_al_junk (original anat edges, worse match)
```

```
ulay: vr_base_min_outlier_ts_ns (EPI)
olay: anat_sub_CAMBRIDGEB_00000_flip_al_junk (flipped anat edges, BETTER match)
```

Online tutorial:
https://afni.nimh.nih.gov/pub/dist/doc/htmldoc/tutorials/apqc_html/main_toc.html

Acknowledgements: Research funded by the NIMH & NINDS Intramural Research Programs of the NIH, USA.

[1] Cox RW. 1996. Comput Biomed Res 29:162-173
[2] Glen DR, et al. 2020. Front. Neuroinformatics 14.