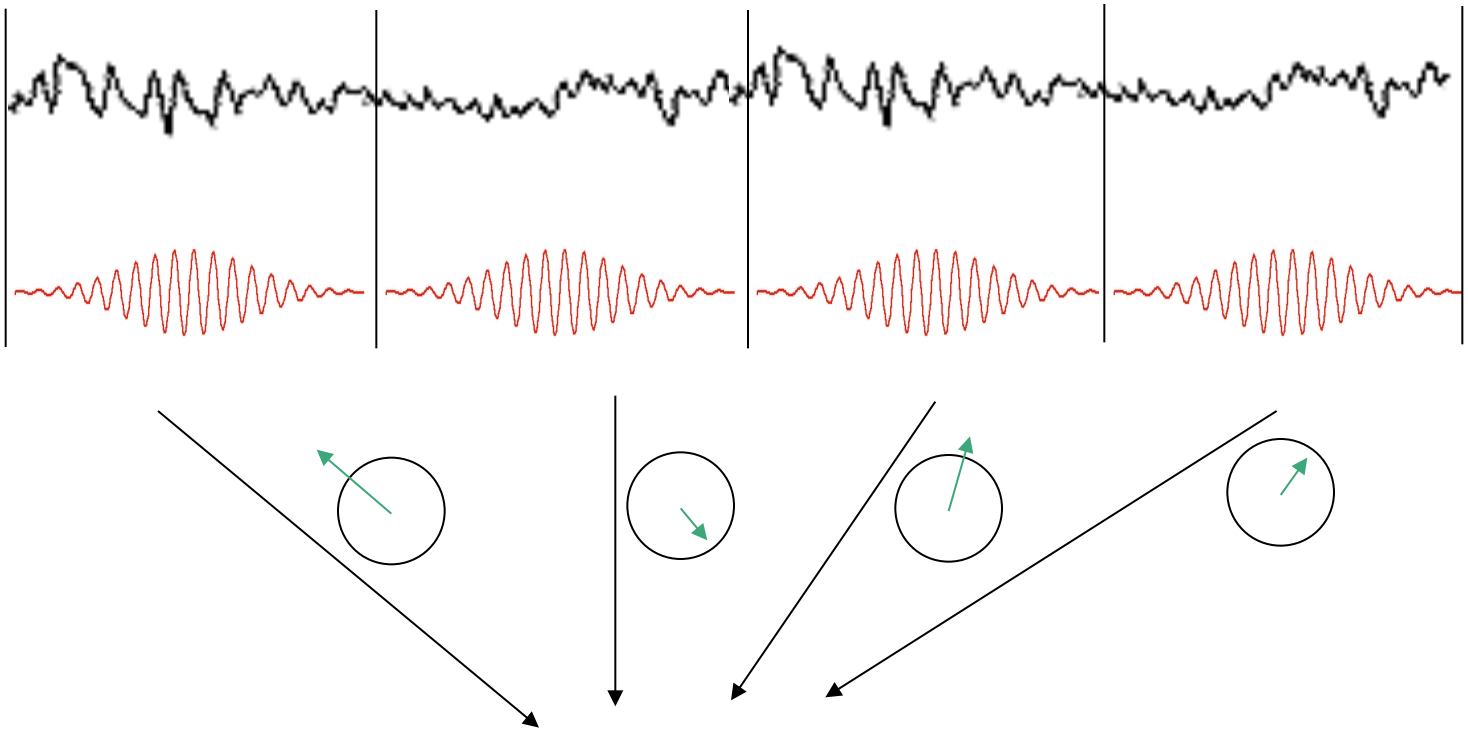
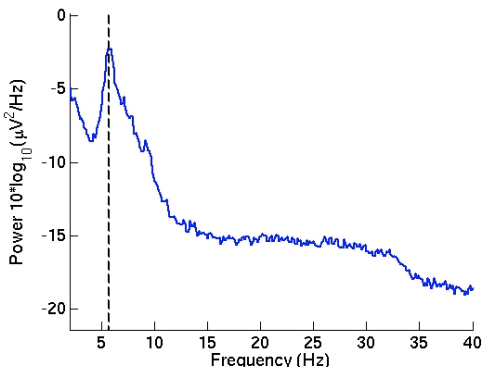
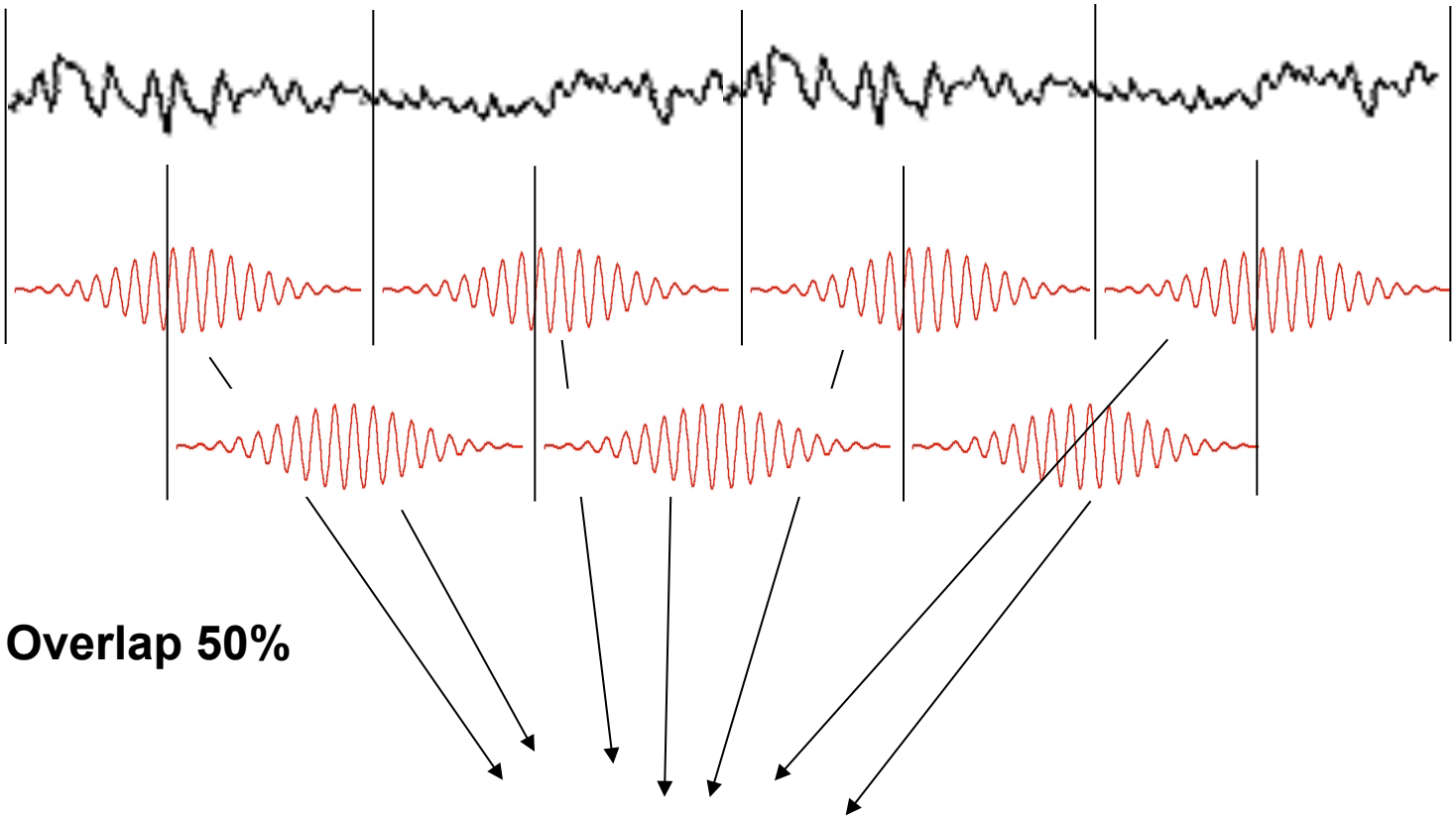


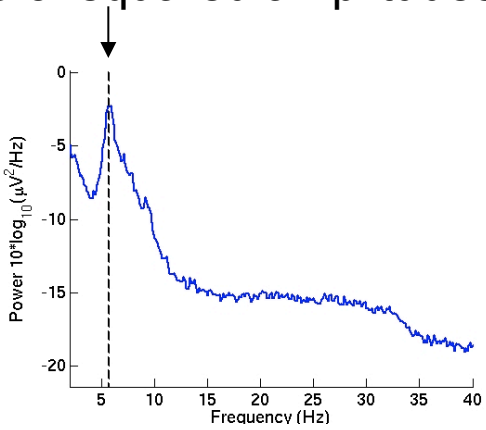
Average of squared absolute values

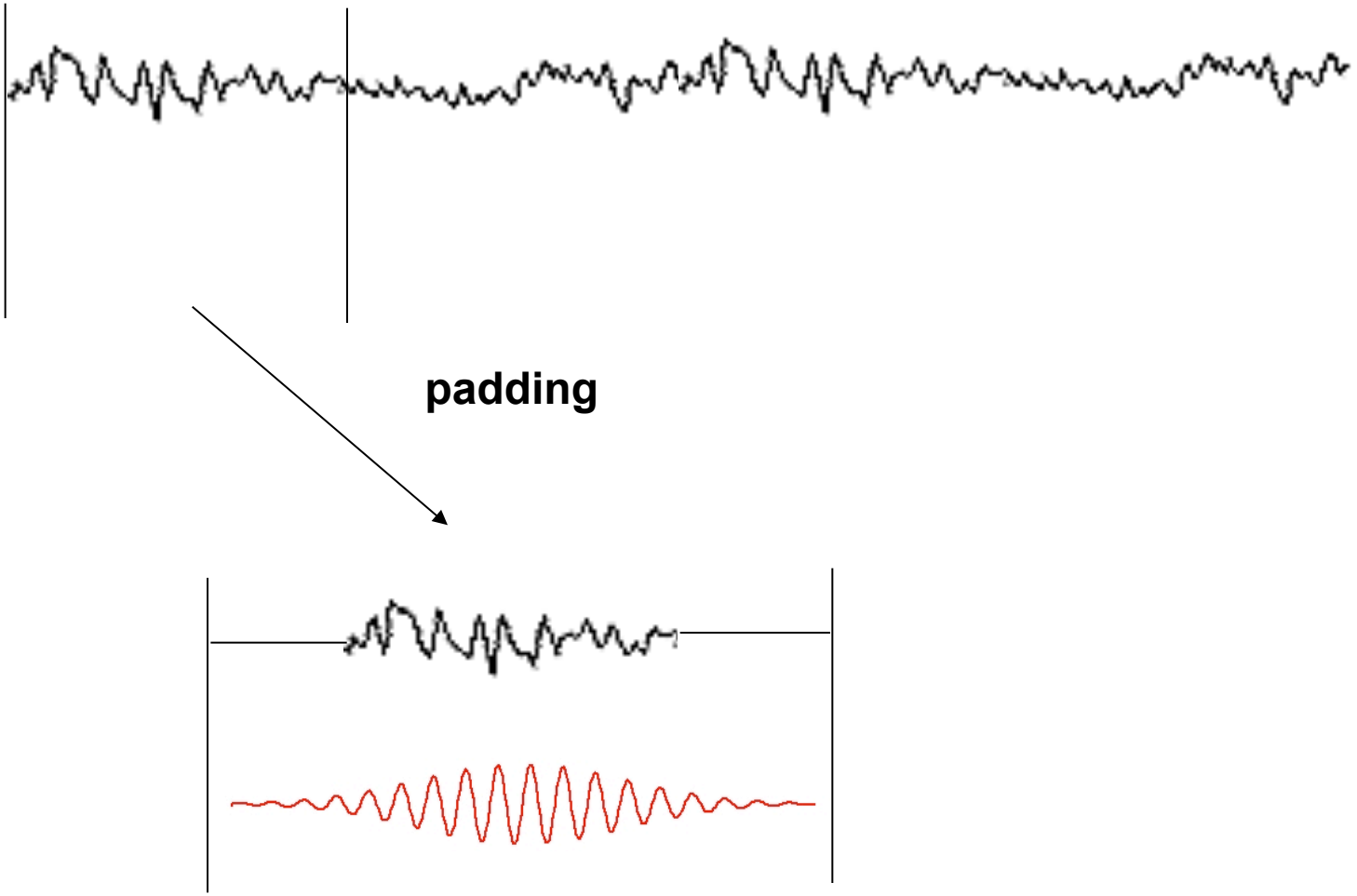


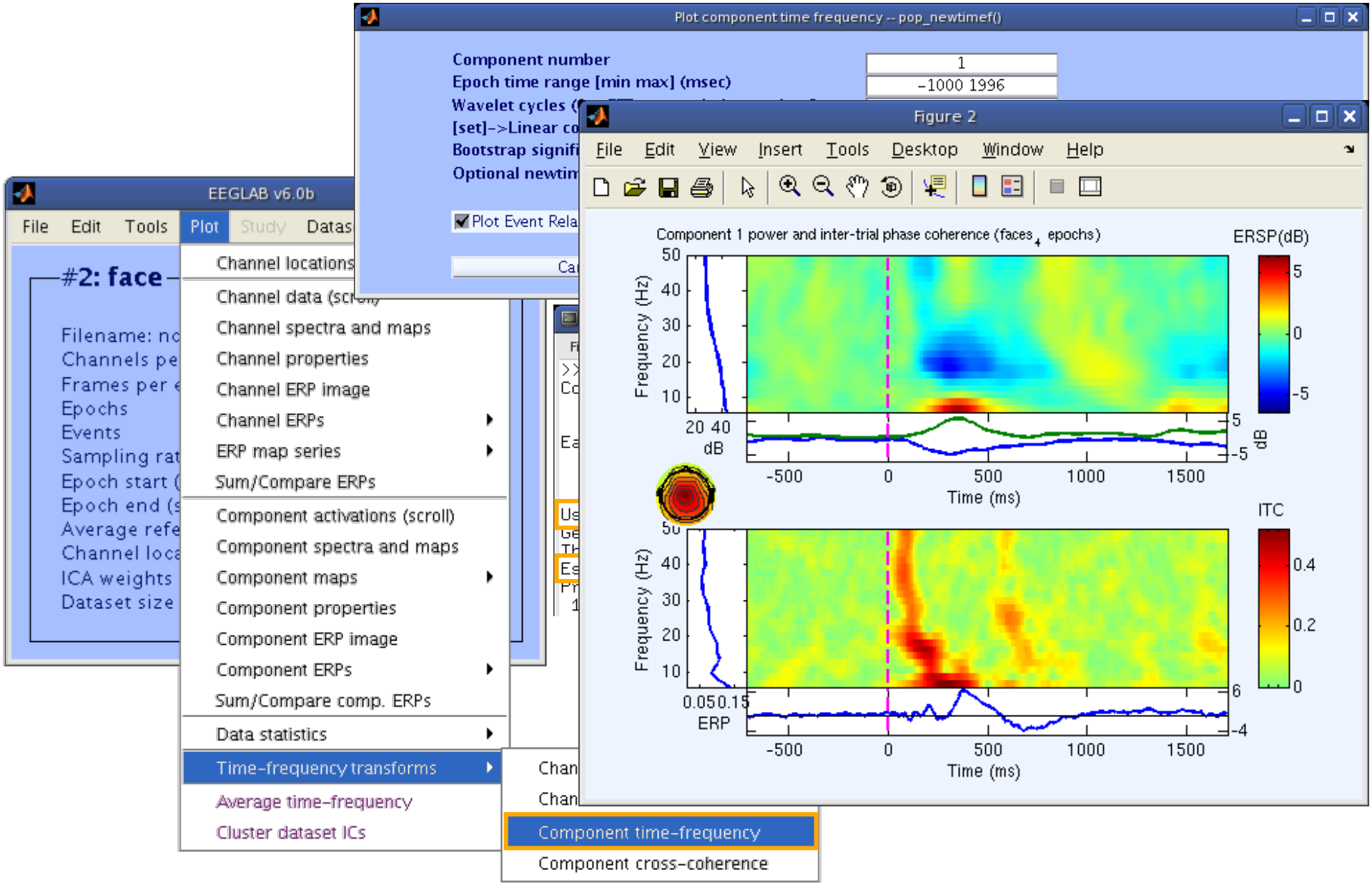


Overlap 50%

Average of squared amplitudes




padding


Plot component time frequency -- pop_newtimef()
Component number
1
Epoch time range [min max] (msec)
-1000 1996
Wavelet cycles (
[set]->Linear co
Bootstrap signifi
Optional newtim
Plot Event Rela
Ca
EEGLAB v6.0b
File Edit Tools Plot Study Datas
#2: face
Filename: no
Channels pe
Frames per e
Epochs
Events
Sampling rat
Epoch start (
Epoch end (s
Average refe
Channel loca
ICA weights
Dataset size
Channel locations
Channel data (scroll)
Channel spectra and maps
Channel properties
Channel ERP image
Channel ERPs
ERP map series
Sum/Compare ERPs
Component activations (scroll)
Component spectra and maps
Component maps
Component properties
Component ERP image
Component ERPs
Sum/Compare comp. ERPs
Data statistics
Time-frequency transforms
Average time-frequency
Cluster dataset ICs
Chan
Chan
Component time-frequency
Component cross-coherence
Figure 2
File Edit View Insert Tools Desktop Window Help
Component 1 power and inter-trial phase coherence (faces, epochs)
ERSP(dB)
Frequency (Hz)
50
40
30
20
10
20 40
dB
5
0
-5
-500
0
500
1000
1500
Time (ms)
ITC
0.4
0.2
0
0.05 0.15
ERP
6
-4

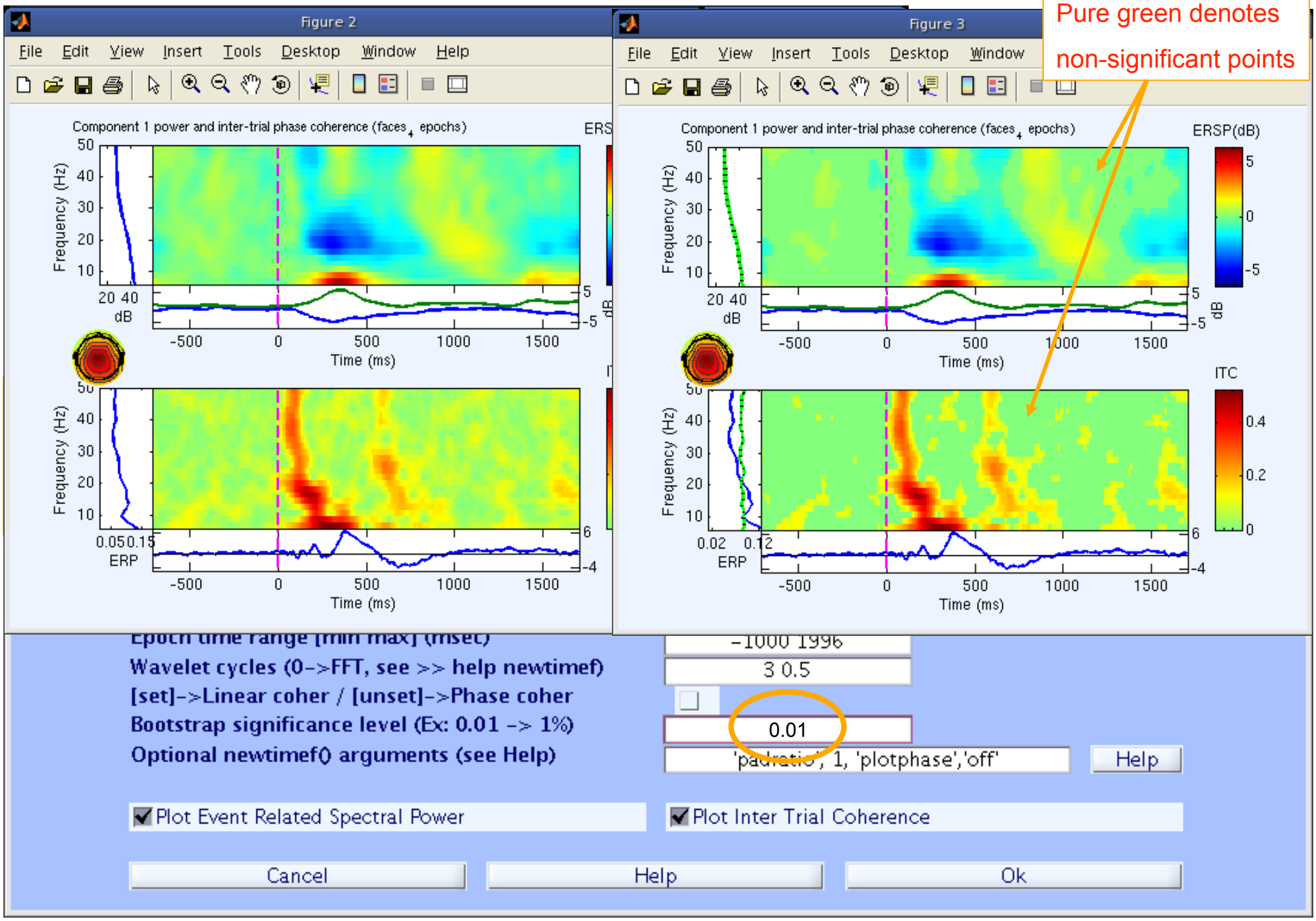


Figure 2
File Edit View Insert Tools Desktop Window Help
Component 1 power and inter-trial phase coherence (faces4 epochs)
Frequency (Hz)
Time (ms)
ERP
dB
Figure 3
File Edit View Insert Tools Desktop Window
Component 1 power and inter-trial phase coherence (faces4 epochs)
ERSP(dB)
ITC
Pure green denotes non-significant points
Epoch time range [min max] (msec)
-1000 1996
Wavelet cycles (0->FFT, see >> help newtimef)
3 0.5
[set]->Linear coher / [unset]->Phase coher
Bootstrap significance level (Ex: 0.01 -> 1%)
0.01
Optional newtimef() arguments (see Help)
'padratio', 1, 'plotphase','off'
Help
Plot Event Related Spectral Power
Plot Inter Trial Coherence
Cancel
Help
Ok

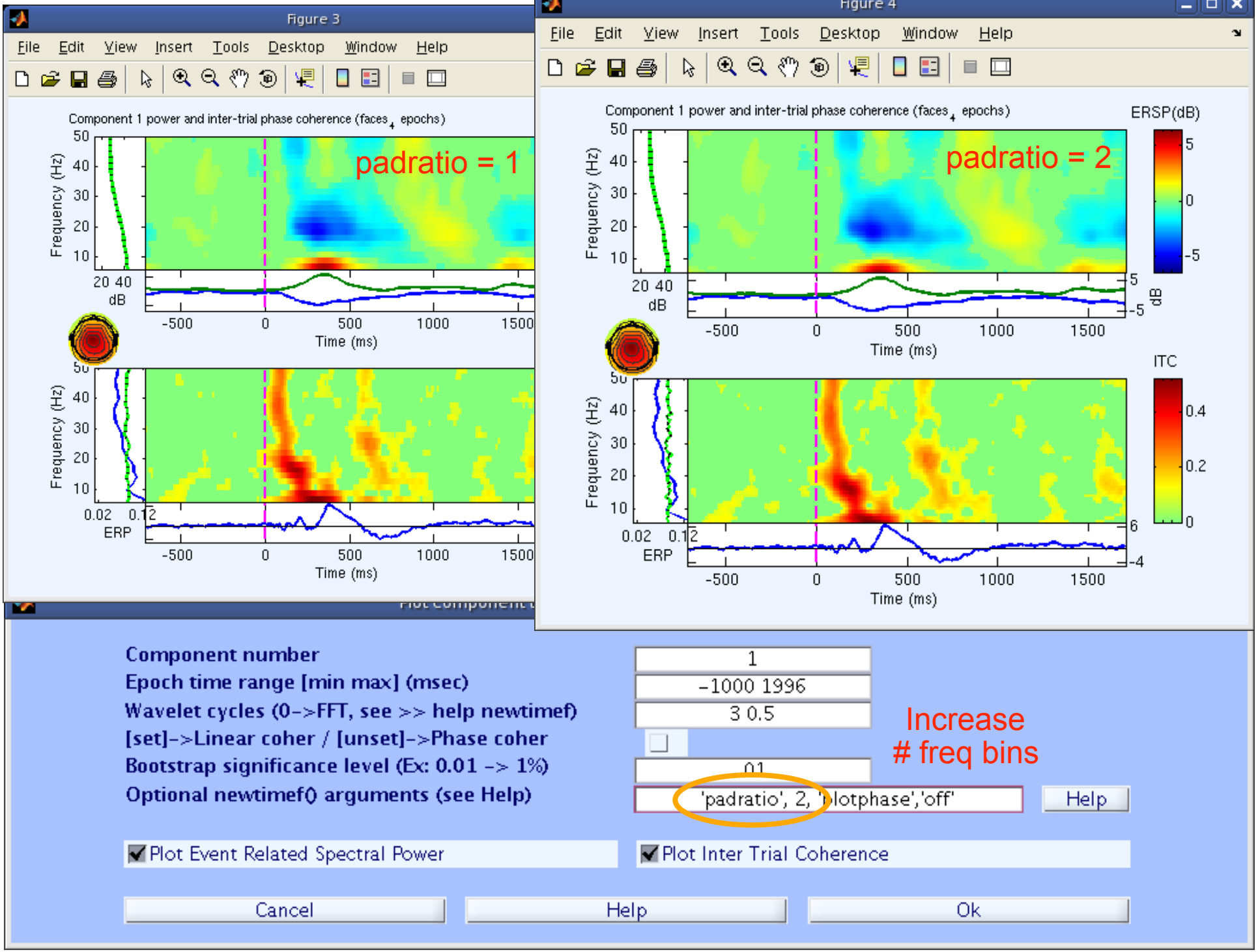
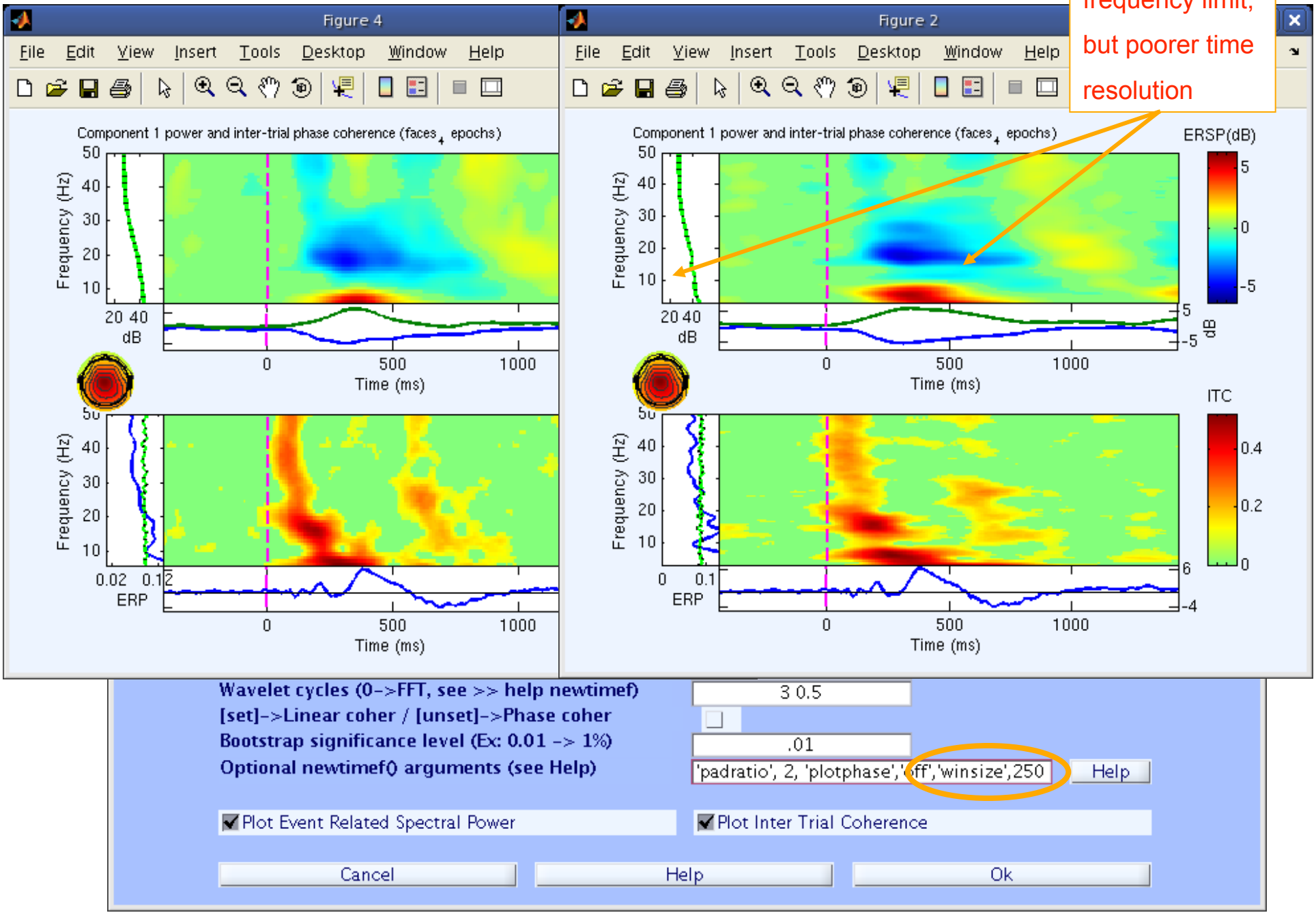
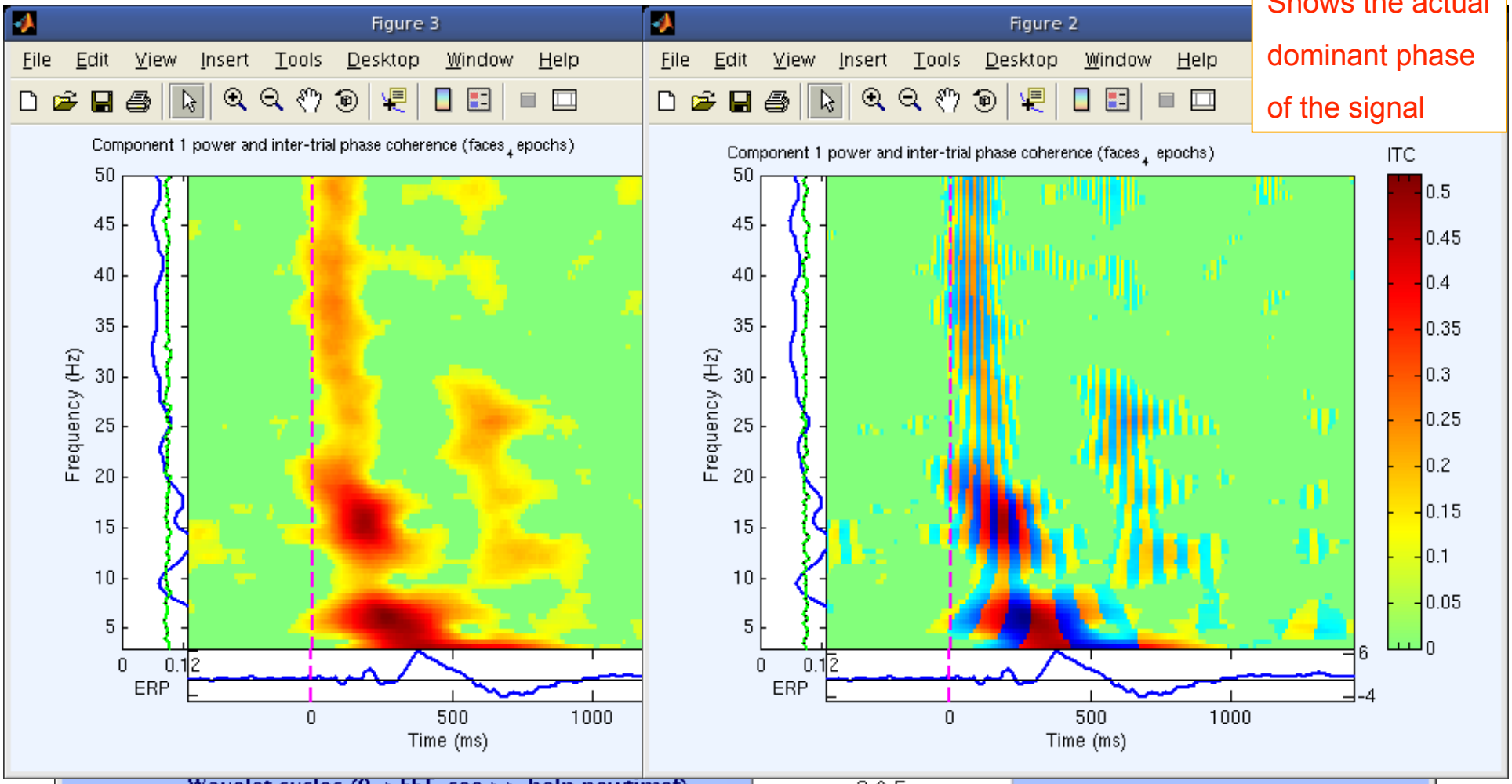


Figure 3
File Edit View Insert Tools Desktop Window Help
Component 1 power and inter-trial phase coherence (faces, epochs)
padratio = 1
Frequency (Hz)
dB
ERP
Time (ms)
Figure 4
File Edit View Insert Tools Desktop Window Help
Component 1 power and inter-trial phase coherence (faces, epochs)
padratio = 2
ERSP(dB)
ITC
Component number
1
Epoch time range [min max] (msec)
-1000 1996
Wavelet cycles (0->FFT, see >> help newtimef)
3 0.5
[set]->Linear coher / [unset]->Phase coher
Bootstrap significance level (Ex: 0.01 -> 1%)
01
Optional newtimef() arguments (see Help)
'padratio', 2, 'plotphase','off'
Help
Increase
freq bins
Plot Event Related Spectral Power
Plot Inter Trial Coherence
Cancel
Help
Ok


Notice lower frequency limit, but poorer time resolution
Figure 4
Figure 2
File Edit View Insert Tools Desktop Window Help
Component 1 power and inter-trial phase coherence (faces4 epochs)
ERSP(dB)
ITC
Frequency (Hz)
Time (ms)
dB
ERP
Wavelet cycles (0->FFT, see >> help newtimef)
3 0.5
[set]->Linear coher / [unset]->Phase coher
Bootstrap significance level (Ex: 0.01 -> 1%)
.01
Optional newtimef() arguments (see Help)
'padratio', 2, 'plotphase','off','winsize',250
Help
Plot Event Related Spectral Power
Plot Inter Trial Coherence
Cancel
Help
Ok

Shows the actual dominant phase of the signal



Wavelet cycles (0->FFT, see >> help newtimef) 3 0.5

[set]->Linear coher / [unset]->Phase coher

Bootstrap significance level (Ex: 0.01 -> 1%) .01

Optional newtimef() arguments (see Help) 'padratio', 2, 'plotphase','on','winsize',250 Help

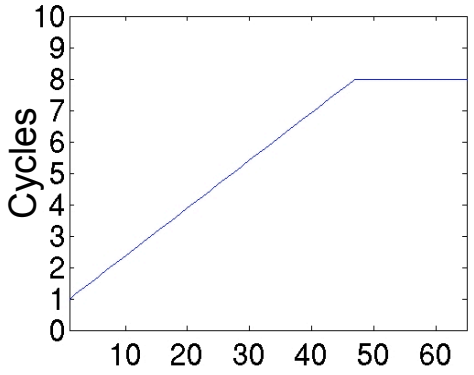
Plot Event Related Spectral Power

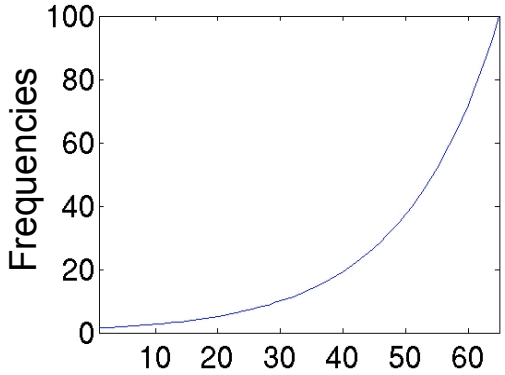
Plot Inter Trial Coherence

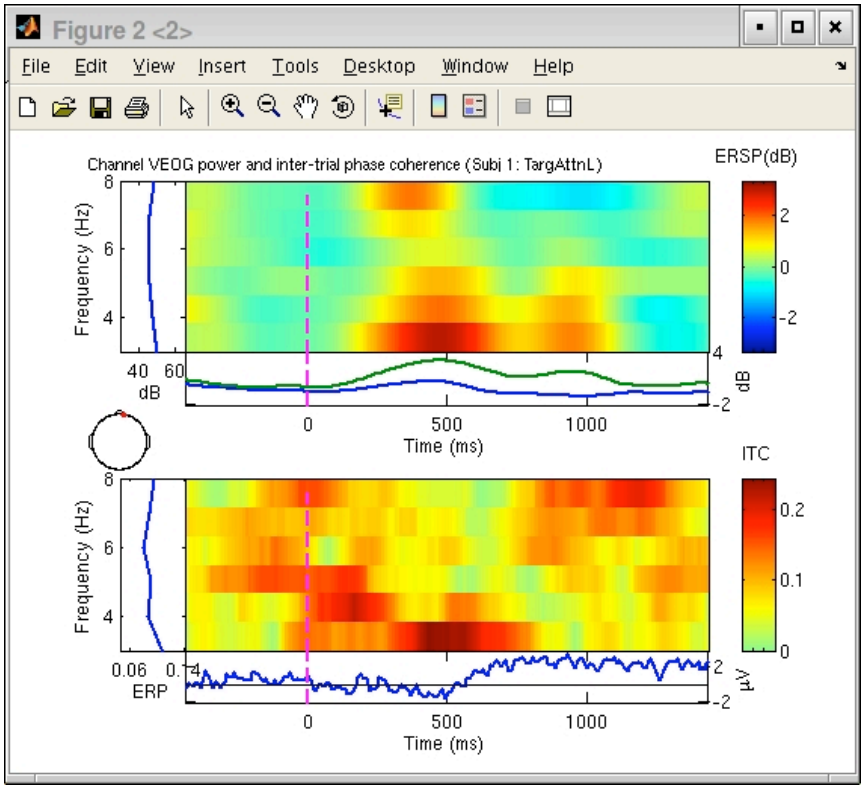
Cancel Help Ok

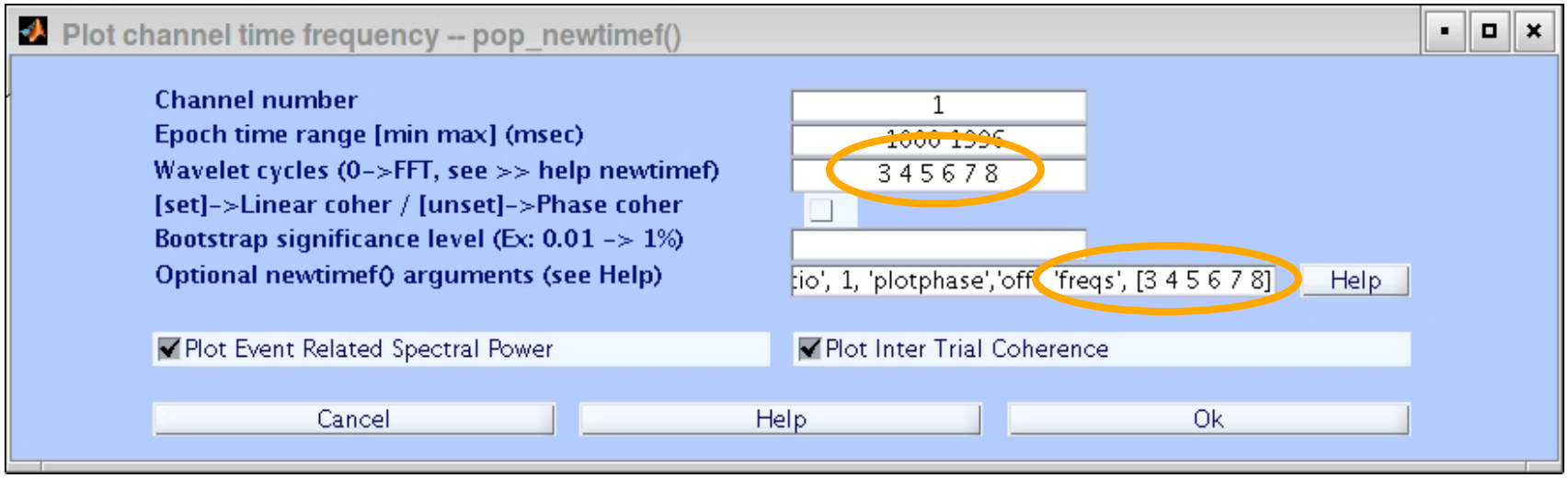
To visualize both low and high frequencies

freqs = exp(linspace(log(1.5), log(100), 65));
cycles = [linspace(1, 8, 47) ones(1,18)*8];









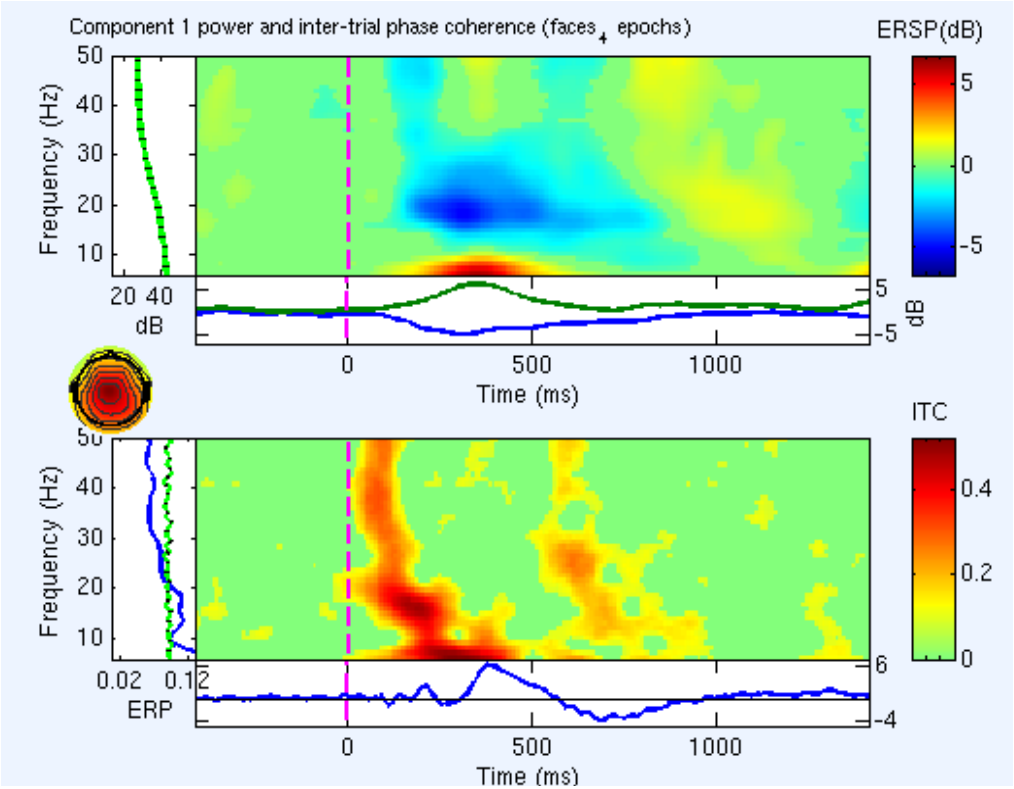
Evoked versus induced

- Evoked = ERSP of the average ERP
- Induced = usually standard ERSP
- Real induced

  (1) standard ERSP with ERP regressed out of every trial

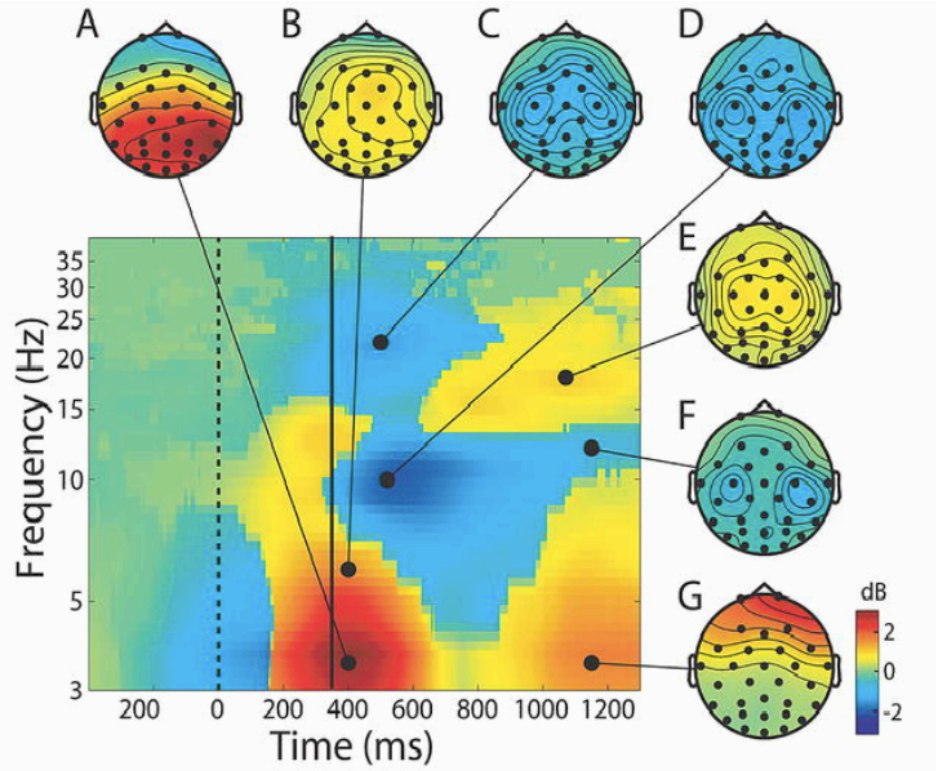
  (2) standard ERSP minus ERSP of the average ERP scaled for averaging effect

In any case, looking at the ITC provides the amount of synchronization in the time-frequency decomposition that account for ERPs

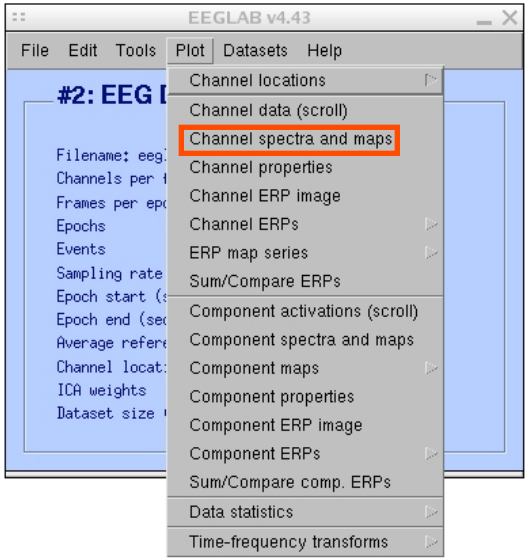


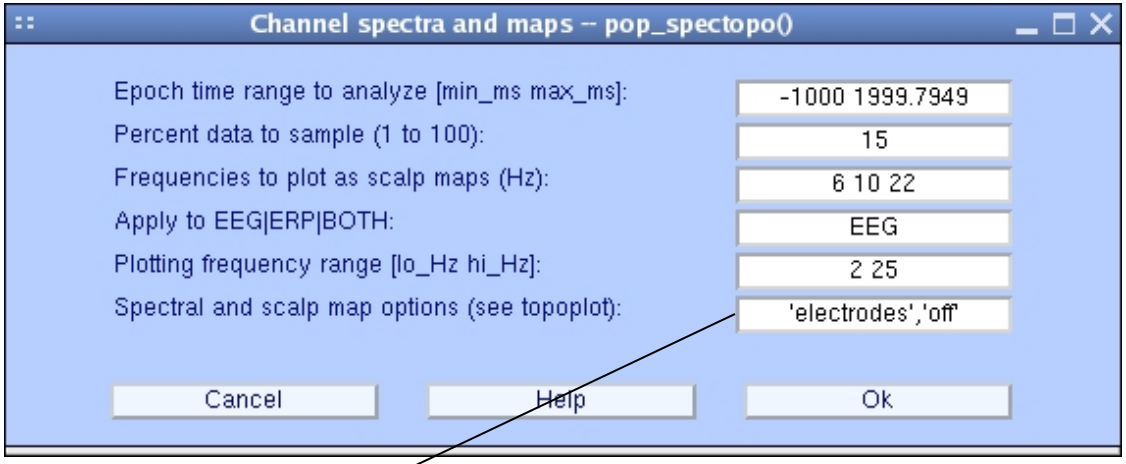
Advanced time-frequency functions

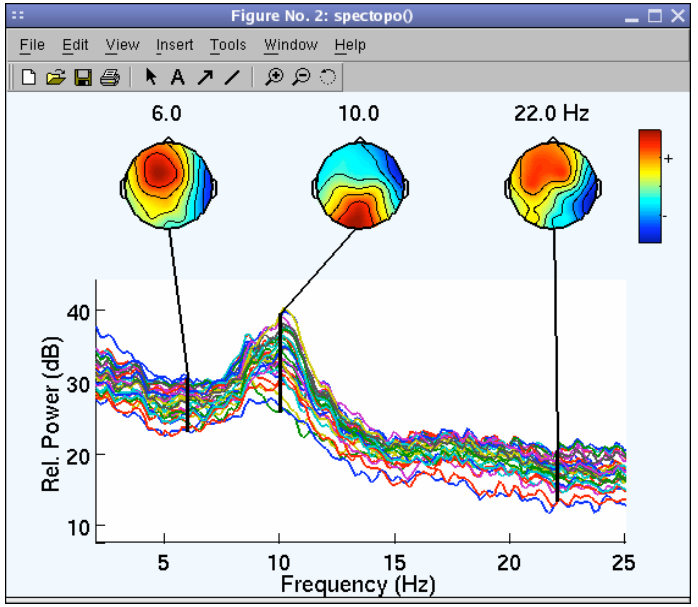
- Tftopo(): allow visualizing time-frequency power distribution over the scalp



Plot data spectrum using EEGLAB







'winsize', 256 (change FFT window length)
'nfft', 256 (change FFT padding)
'overlap', 128 (change window overlap)

Exercise

- **ALL**

  Start EEGLAB, from the menu load *sample_data/eeglab_data_epochs_ica.set* or your own data (epoch, reject noise if not done already)

- **Novice**

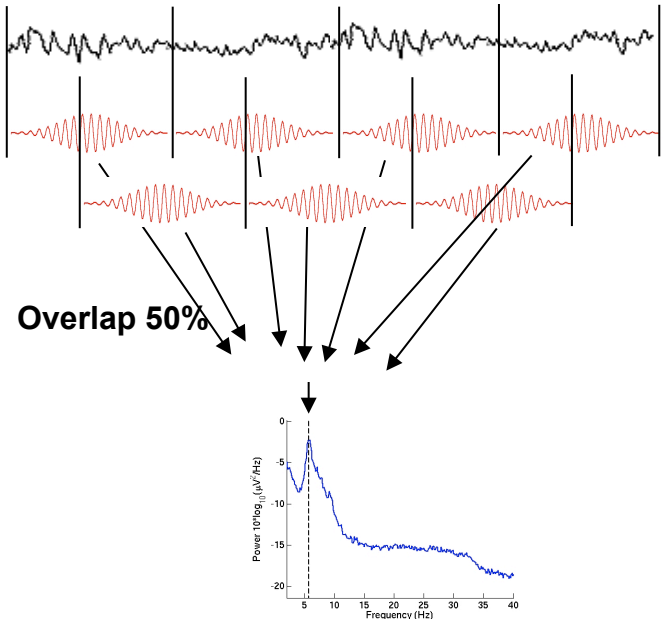
  From the GUI, Plot spectral decomposition with 100% data and 50% overlap ('overlap'). Try reducing window length ('winsize') and FFT length ('nfft')

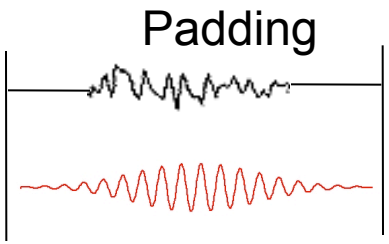
- **Intermediate**

  Same as novice but using a command line call to the *pop_spectopo()* function. Use GUI then history to see a standard call ("eegh").

- **Advanced**

  Same as novice but using a command line call to the *spectopo()* function.





Exercise - newtimef

- **Novice**

  From the GUI, pick an interesting IC and plot component ERSP. Try changing parameters window size, number of wavelet cycles, padratio,

- **Intermediate**

  From the command line, use newtimef() to tailor your time/ frequency output to your liking. Look up the help to try not to remove the baseline, change baseline length and plot in log scale. Enter custom frequencies and cycles (4 slides back).

- **Advanced**

  Compare FFT, the different wavelet methods (see help), and multi-taper methods (use timef function not newtimef). Enter custom frequencies and cycles. Look up newtimef help to compare conditions. Vizualise single-trial timef-frequency power using erpimage.