Cortical generators of 2 types of slow waves: a MEG study

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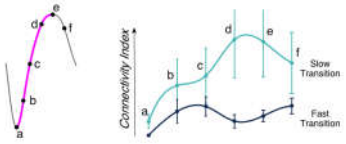
Introduction

- **Context:** Recently it's been shown that sleep slow waves are functionally separated into slow and fast switcher (threshold = 1.2 Hz). The slow switchers displays a wider connectivity network than the faster ones in the sensor space.



→ **What is missing?**
No one studied the source space functional connectivity of these waves.

- **Objective:** Use simultaneous EEG/MEG recordings to detect and localise these oscillations to validate these observations in the source space.
- **Hypothesis:**
  - Cortical sources of the slower SW are more extended than the faster ones.

Method

- **Participants (N=24)**
  12 young (20-30 y.o., M=22.92; SD=3.55) All subjects underwent 2 polysomnographic nights and an MRI scan.

- **Sleep recordings**
  Simultaneous MEG/EEG recording
  275 CTF channels & 56 scalp electrodes
  Sleep for max. 90 mins
  Sleep stages scored by an expert sleep technician

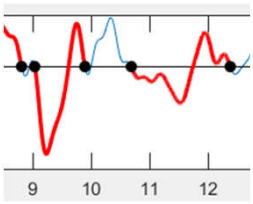
- **Slow waves detection (Fz)**
  NREM epochs filtered from 0.16 - 4 Hz
  Negative duration from 0.125 - 1.5 seconds
  Age and sex -adapted amplitude criteria.

	Standard criteria	Sex-adapted criteria	
		Young	
		Men	Women
Peak-to-Peak SW Amplitude	75 µV	74 µV	77 µV
Negative SW Amplitude	40 µV	39.5 µV	41 µV

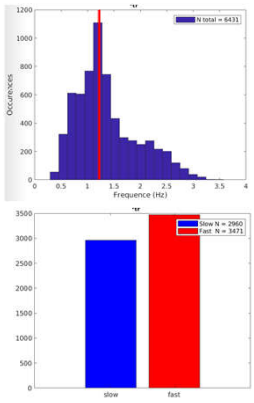
Method & Results

- **Slow wave groups**
  Slow and fast switchers divided by mean of the transition frequency and a Gaussian Mixture Model (GMM):

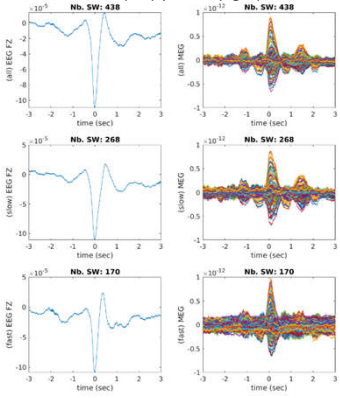
$$F_{tr} = \frac{1}{2 * T_{depolarization}}$$



Young subjects transition frequencies on electrode Fz

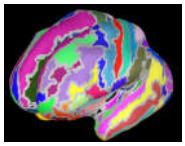


Group averages
EEG Fz (left) | MEG (right)



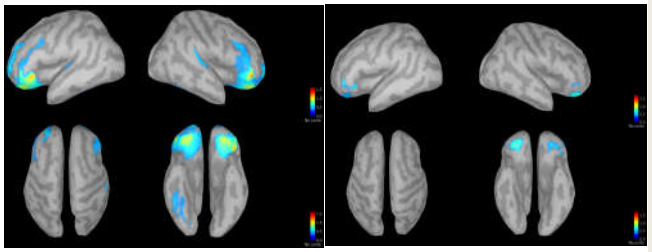
Source Localization

1. wavelet-Maximum Entropy on the Mean
2. Project source maps on the Destrieux atlas
3. Z-normalize wrt hyperpolarization
4. Project on the MNI template, Colin27



Slow switcher average (Depolarization)

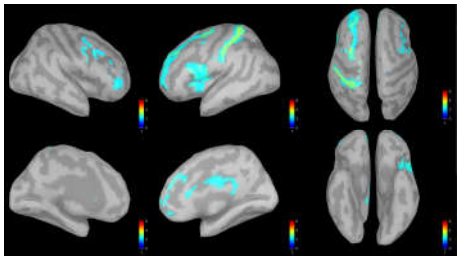
Fast switcher average (Depolarization)



Results & Discussion

- **Multiple comparison problem**
  Non-parametric cluster-based permutation N=100

Fast-Slow contrast (Young)
Depolarization p = 0.0396



- As expected the significant Fast-Slow contrast in young subjects shows a more extended source map for the slow switcher than the fast switcher
- Our next steps are to look at the functional connectivity using the weighted-Phase Lag Index (wPLI) and the effect of aging.

References

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Acknowledgments

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