Frequency specific neurovascular coupling varies as a function of sleep stage

Abstract: synchronous fluctuations in neuronal membrane potentials are measurable using scalp EEG, and are thought to underlie changes in BOLD activity through neurovascular coupling. In particular, multiple studies have linked decreases in alpha rhythm amplitude, and increases in gamma rhythm amplitude to increases in BOLD signal in humans. This has led to the hypothesis that the relationship between electrophysiological signals and BOLD is frequency specific, with BOLD more tuned to alpha and gamma than other frequency bands. However, the majority of these studies have been carried out either in the eyes closed resting state, which magnifies the alpha rhythm, or using stimuli that induce strong gamma band responses. The metabolic burden of the brain does not cease during sleep, which gives rise to a rich new spectral profile of human brain activity, and a notable absence of the alpha and gamma rhythms during certain sleep states. Using sleep data acquired over two separate nights in 24 healthy human subjects, we examined how frequency specific neurovascular coupling varied as a function of sleep stage, and in comparison to waking. We find that during \_\_\_ sleep stages the BOLD signal was better explained by \_\_\_ frequency bands, and during \_\_\_ sleep stages, BOLD signal was better explained by \_\_\_ frequency bands. We also related \_\_\_ features of the BOLD signal (ALFF, REHO, Variance, connectivity, etc) to power in different bands. These results suggest that bleh.

Results:

Figure 1: reproduce commonly found EEG-BOLD alpha/gamma coupling during wakefulness. EEG-BOLD cross correlations for different EEG frequency bands.

Figure 2: show transitions in coupling from wakefulness to stage 1, and from stage 1 to 2, 2 to 3, etc.

Figure 3: relate spectral content of EEG signal to features of BOLD signal such as connectivity, ALFF, REHO, etc.