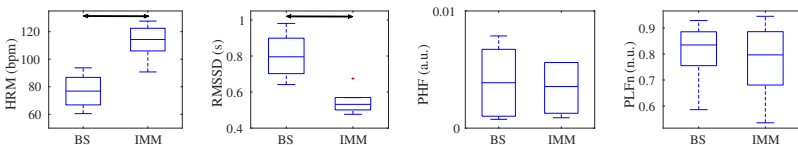


Autonomic Nervous System Response During Scuba Diving Activity

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Objective: Diving is an activity characterized by an increase of pressure on human body. During the dive, the Autonomic Nervous System (ANS) reacts to maintain homeostasis. The most used non-invasive technique to measure ANS response is the analysis of Heart Rate Variability (HRV), extracted from the electrocardiogram (ECG). In this work, HRV indices are computed to analyze the ANS response during a scuba diving activity, where divers performed physical tasks. **Approach:** ECG signals from 6 subjects from a diving unit of the Spanish Army were recorded in a reservoir immersion. Two different stages were analyzed: baseline stage, where subjects remained seated outside the water; and immersion stage, where subjects performed physical activity in a non-controlled environment during the dive. Four time-domain and four frequency-domain parameters were computed from HRV signal. In particular, the smoothed pseudo Wigner-Ville distribution was used for the time-frequency analysis. **Main results:** Statistically significant differences between stages were found in two time-domain parameters: an increase of the mean heart rate and a decrease in the root mean square of the successive normal beats during the immersion stage. However, frequency-domain parameters did not show any significant difference between stages (see Figure). **Conclusion:** Whereas time-domain parameters reflect a sympathetic activation during the immersion, caused by the predominance of the physical activity and the stress of the challenging environment, frequency-domain parameters are not able to capture it. Further studies are needed to draw more robust conclusions by increasing the number of subjects and exploring alternative methods to compute the ANS frequency content taking into account the intrinsic non-linear dynamics and the influence of respiration in HRV analysis.



Boxplots of the most relevant time-domain and frequency-domain parameters from baseline (BS) and immersion (IMM) stages.