The intra-annual variability as a potential driver for the mean deep circulation in the tropical oceans

Audrey Delpech\textsuperscript{1}, Claire Méneguen\textsuperscript{2}, Frédéric Marin\textsuperscript{1}, Sophie Cravatte\textsuperscript{1}, and Yves Morel\textsuperscript{1}

\textsuperscript{1}LEGOS (Laboratoire d'Etudes Géophysiques et d'Océanographie Spatiale), Toulouse, France
\textsuperscript{2}Ifremer, Brest, France

The deep tropical ocean circulation is dominated by systems of vertically and meridionally alternating zonal jets, known as the Equatorial Deep Jets (EDJs) and Extra-Equatorial Jets (EEJs) respectively. The energy sources and physical mechanisms responsible for this circulation are still poorly understood. Recent studies have suggested the importance of intra-annual equatorial waves to transfer their energy to the EDJs.

In this study, we use idealized numerical simulations forced with a wave-like surface momentum flux to investigate how intra-annual variability can be relevant to the formation of the EEJs. It is shown that the amplitude of the jets, their meridional scales and their vertical and latitudinal extensions are sensitive to the period and wavelength of the forced wave. Short intra-annual waves with periods around ~70 days and wavelength ~300 km are found to reproduce the observed circulation most realistically. Focusing on the dominant barotropic mode, the underlying physical processes are detailed. A spectral analysis reveals that the energy transfer between the forced waves and the jet-structured circulation is compatible with a decay instability occurring in waves triadic interactions.

In parallel, a statistical analysis is performed on observations of the 1000m-velocities inferred from Lagrangian Argo floats drifts to document the amplitude and scales of the deep intra-annual variability in the tropical Pacific and Atlantic oceans. It gives evidence for the presence of short intra-annual waves that share common properties with the most unstable waves found for the EEJ generation.