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Impact of ENSO variability on the Pacific Equatorial Undercurrent (EUC) sources: A modeling approach depending on the horizontal resolution

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As the most powerful source of climatic variability in the Pacific Ocean, the El Niño Southern Oscillation (ENSO) deeply impacts the equatorial oceanic currents. The Pacific Equatorial UnderCurrent (EUC) is a powerful jet flowing eastward and shoaling with the thermocline in the eastern Pacific, bringing cold waters in surface that retroact with the atmosphere. Its transport has thus been found to follow significant variations at ENSO timescale, with an increased (decreased) transport in La Niña (El Niño) phases. However, the EUC mean properties also vary more slowly due to extratropical forcing. This process is able to modify the heat and mass transports of the subducted waters that feed the EUC. By changing the mean equatorial oceanic conditions, this is suspected to modulate in return the ENSO signal.

The EUC sources have very different origins: contributions come from both hemispheres, in part from the Low-Latitude Western Boundary Currents (LLWBCs) and the remaining from the interior ocean. Each source follows different pathways and is characterized by particular properties which differently influences the properties of the downstream equatorial undercurrent and the cold tongue upwelling. The question of the location of the different EUC sources is thus of crucial importance.

In this poster, we investigate the links between the ENSO variability and the partitioning of the EUC sources. For this purpose, we use a set of five simulations made available by the DRAKKAR project ranging from a 2° laminar resolution to a turbulent 1/12° partly resolving the meso-scale processes. Increasing models horizontal resolution is largely thought to improve the quality of the resulting simulated currents, in terms of dynamics as of variability. Results show that if some distinct elements appear in terms of mean transit times, little variations are found in terms of partitioning within the different simulations.

However, we show that the partitioning between the EUC sources evolves at an interannual timescale. For this purpose, we utilize two extreme events: the 1997-1998 El Niño and the 1999-2000 La Niña. The El Niño episode is found to coincide with a perceptible decrease in the WBCs sources as the La Niña is marked by a striking increase of the inner ocean sources. This is an unanticipated result as the total WBCs transports are known to follow inverse trends, with an increased (decreased) transport in El Niño (La Niña) phases.