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Response of the upper ocean circulation to tropical Atlantic interannual modes

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The scarcity of in-situ measurements and the variability among individual events has limited our understanding of the drivers and impacts of the tropical Atlantic Ocean circulation. Here we investigate the response of the surface and subsurface ocean circulation to the two main modes of tropical Atlantic Variability (TAV): the Meridional Mode (MM) and Equatorial Mode (EM). For this purpose, we use three oceanic reanalyses and an interannual forced-ocean simulation covering the period 1982-2018. The developing phase of the MM is associated with a spring intensification of the North Equatorial Countercurrent (NECC), the Equatorial Undercurrent (EUC) and the north South Equatorial Current (nSEC) in the eastern equatorial margin. It also triggers Rossby waves that reach the western boundary and are reflected as equatorial Kelvin waves that weaken the ocean surface and subsurface transports and cause anomalous warm equatorial conditions in boreal summer. During the developing spring-summer phase of the EM, the westward surface zonal transport is considerably reduced with no clear impact at subsurface levels. During the fall EM decaying phase, the reflected Kelvin wave reverses the zonal pressure-gradients at the equator and the westward equatorial nSEC is reinforced. This is accompanied by a weakening of the EUC that suggests an additional off-equatorial forcing. Our results reveal that the ocean circulation responds to both MM and EM, endorsing the key role played by the propagating zonal waves in connecting the tropical and equatorial ocean transports.

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