

Southern Intertropical Convergence Zones – annual and interannual variation

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The Intertropical Convergence Zones (ITCZ) north of the equator in the eastern Pacific and the Atlantic Oceans and their seasonal meridional migrations have been well observed from space, mostly through cloudiness and rainfall. The existence of similar zonal oriented convergence zone south of the equator during the boreal spring in the Pacific was first identified as long band of cloudiness more than three decades ago. By definition, ITCZ should be examined through surface wind convergence, but surface wind convergence are largely not available in the past because of the poor resolution of wind maps computed from routine ship reports. Spacebased scatterometers have provided continuous improvement in accuracy and spatial resolution in the past decade, leading to recent identification of a southern ITCZ in the western Atlantic during boreal summer. Further investigation, using improved scatterometer winds, shows that weaker convergence zones exist south of the equator in the eastern Pacific and across the entire Atlantic through almost the whole annual cycle. They are largely driven by a mechanism different from that for the stronger ITCZ. The stronger ITCZ lies over the warmest water where the meridional wind component changes sign, from southerly to northerly. Such wind convergence is associated with deep convection and rain. The weaker ITCZ occurs over cooler water. It is caused by the deceleration of surface winds as they blow from warmer water towards the colder upwelling water near the equator. Over the cold water, the wind speed reaches the local minimum because of the increase in stability and wind shear in the inversion capped boundary layer. The weaker convergence zone is located just before the winds reach the local temperature and wind speed minimum, and at the place where the meridional gradient of the meridional wind component reaches the local maximum. In the Atlantic, the stronger ITCZ is always north of the equator. In the eastern Pacific, the northeast trades are seen crossing the equator and meeting the southeast trades at the southern ITCZ in boreal springs of La Nina episodes. During years of exceptional strong equatorial upwelling, winds are found to blow north and south from the equator to meet the northeast and southeast trades at the double ITCZ in the eastern Pacific.