

ENSO Variability of the Southern Hemisphere Ozone Croissant, Ozone Hole and Polar Stratospheric Clouds

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In the Southern Hemisphere during May-November monthly mean ozone exhibits a maximum near 50S which has come to be known as the ozone croissant (OC). Extending from the Southern Indian Ocean (SIO) past Australia into the Pacific, it reaches maximum zonal asymmetry during October. The ozone hole is usually displaced off of the pole away from the OC toward the Atlantic sector. The structure of the OC is intimately linked to the structure of the ozone hole, polar vortex temperatures, and polar stratospheric clouds (PSCs). It is also an integration of hemispheric transport, which can reflect tropical influences, including that of the El Nino Southern Oscillation (ENSO). TOMS ozone, POAM PSCs, and 3D assimilated ozone distributions were employed. First the pathway by which ozone is transported from the subtropics into the OC is discussed. Ozone exits the subtropics, descending on the poleward side of stalled wave two ridges into synoptic troughs in the upper troposphere. This occurs preferentially in the SIO due to the presence of the monsoon anticyclone over Australia, which interacts with travelling extratropical planetary wave two, causing it to stall, making ozone available for entry into the OC. There is a strong relationship between ENSO and variability of these SH general circulation features. During La Nina the polar vortex is stronger and displaced more off the pole, the OC is more zonally focussed, and there are more PSCs and colder temperatures in the polar vortex above 16 km. During El Nino the polar vortex is weaker, more centered on the pole, midlatitude ozone is arranged in an annulus, and there are fewer PSCs and warmer temperatures in the polar vortex above 16 km. A dynamical explanation is suggested for this interannual variability which contrasts the strong longitudinally-focussed outflow from Indonesia during La Nina with the more longitudinally-extensive outflow events during El Nino.