



Decadal variability of the tropical lower stratosphere: Secondary Influence of the El Niño - Southern Oscillation

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A decadal variation of tropical lower stratospheric ozone and temperature has previously been identified using available long-term satellite data records (1979 - present) that correlates positively with the 11-year solar activity cycle (e.g., Soukharev and Hood, JGR, 2006). This zonal mean variation may be caused mainly by decadal changes in the upwelling branch of the meridional (Brewer-Dobson circulation) resulting from direct effects of solar UV variability on the upper and middle stratosphere. However, the El Niño-Southern Oscillation (ENSO) also influences lower stratospheric ozone / temperature. It is therefore legitimate to ask whether ENSO variability can contribute to this apparent solar cycle variation, either accidentally because of the short measurement record (e.g., Marsh and Garcia, GRL, 2007) or physically because solar variability affects ENSO. The latter possibility is rendered more plausible by published observational and climate model studies indicating a tendency for cold ("La Niña") events to occur near solar maxima (e.g., H. van Loon et al., JGR, 2007). Here, we present multiple regression analyses of available data records to compare differences in results obtained with and without including an ENSO term in the statistical model. In part because of the dominance of the quasi-biennial wind oscillation in the tropical lower stratosphere, only very minor changes in annual and zonal mean solar regression coefficients are obtained when an ENSO term is included. However, when coefficients are calculated as a function of longitude and season, significant differences do emerge. Conditions for evaluating whether these differences have an accidental or physical origin are discussed.