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The Quasi-biennial Oscillation and annual variations in tropical ozone from SHADOZ and HALOE

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Abstract. We examine the tropical ozone mixing ratio perturbation fields generated from a monthly ozone climatology using 1998 to 2006 ozonesonde data from the Southern Hemisphere Additional Ozonesondes (SHADOZ) network and the 13-year satellite record from 1993 to 2005 obtained from the Halogen Occultation Experiment (HALOE). The long time series and high vertical resolution of the ozone and temperature profiles from the SHADOZ sondes coupled with good tropical coverage north and south of the equator gives a detailed picture of the ozone structure in the lowermost stratosphere down through the tropopause where the picture obtained from HALOE measurements is blurred by coarse vertical resolution. Ozone perturbations respond to annual variations in the Brewer-Dobson Circulation (BDC) in the region just above the cold-point tropopause to around 20 km. Annual cycles in ozone and temperature are well correlated. Above 20 km, ozone and temperature perturbations are dominated by the Quasi-biennial Oscillation (QBO). Both satellite and sonde records show good agreement between positive and negative ozone mixing ratio anomalies and alternating QBO westerly and easterly wind shears from the Singapore rawinsondes with a mean periodicity of 26 months for SHADOZ and 25 months for HALOE. There is a temporal offset of one to three months with the QBO wind shear ahead of the ozone anomaly field. The meridional length scales for the annual cycle and the QBO, obtained using the temperature anomalies and wind shears in the thermal wind equation, compare well with theoretical calculations.

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