Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05869, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05869
EGU General Assembly 2008

Using Entropy to examine the mixed region between the Troposphere and the Stratosphere

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The troposphere and stratosphere each have distinct chemical signatures associated with ozone and water vapour. In the troposphere the concentration of ozone is low and water vapour is high, while in the stratosphere the reverse is true. Many previous studies have used the tracer-tracer relationships between ozone and water vapour to examine stratosphere-troposphere exchange. In particular, it is possible to measure the extent of mixing by examining how the tropospheric and stratospheric signatures have merged. This work uses tracer-tracer information and these chemical characteristics to identify mixed, partially mixed and unmixed regions. The number of observations in each class is then used to derive entropy which is a measure of the extent of mixing. The entropy measure we use was first described by Patmore and Toumi (2006) and can be used to quantify the location and size of the chemically mixed region at the boundary between the stratosphere and troposphere.

This study uses ozone and water vapour data from two instruments; High vertical resolution data from ozonesondes/hygrometers at Lauder, NZ and Boulder, USA and low vertical resolution global data from the Atmospheric Infrared Sounder (AIRS) on the AURA satellite. Entropy provides a method for investigating the processes by which mixing occurs. Examination of the chemical concentrations in tracer-tracer space also allow the potential to identify stratosphere-troposphere and troposphere-stratosphere transport. Entropy shows seasonal and short term variation along with a relationship to the location of the jet stream.

Patmore and Toumi, 2006, An entropy-based measure of mixing at the tropopause,

Quarterly Journal of the Royal Meteorological Society, 132(619), 1949-1967, doi:10.1256/qj.05.84