

Sources of Seasonal Variability in Tropical UT/LS Water Vapor and Ozone: Inferences from the Ticosonde Dataset

Henry B. Selkirk^{1,2}, Mark R. Schoeberl³, Holger Vömel⁴, and Anne R. Douglass²

¹*GESTAR/USRA, Columbia, MD, USA*

²*NASA Goddard Space Flight Center, Greenbelt, MD, USA*

³*Science and Technology Corporation, Columbia, MD, USA*

⁴*NCAR Earth Observations Laboratory, Boulder, CO, USA*

We present an analysis of joint balloon sonde profiles of water vapor and ozone made at Costa Rica from 2005-2011 using compositing techniques, tracer-tracer diagrams and back-trajectory methods. Our analysis reveals important seasonal differences in structure in the upper troposphere and lower stratosphere. Water vapor amounts in boreal winter at Costa Rica are much lower than expected from local ice saturation temperatures. The boreal summer data show both higher average water vapor amounts and a much higher level of variability than the winter data. To understand this seasonal contrast we consider three sources of tracer variability: wave-induced vertical motion across strong vertical gradients ('wave variability'), differences in source air masses resulting from horizontal transport ('source variability'), and changes induced along parcel paths due to physical processes ('path variability'). The winter and summer seasons show different mixes of these three sources of variability with more air originating in the tropical western Pacific during winter.