MECHANISMS OF STRATOSPHERIC OZONE TRANSPORT

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Two (beta)-plane planetary wave models are used to study ozone transport in the stratosphere. In the first model, ozone transport is calculated for steady, dissipative planetary waves using the Eulerian, Lagrangian-mean, and residual circulations. A Lagrangian model of parcel dynamics is used to interpret planetary wave-photochemistry interaction. In chemically active regions the mean field ozone changes are found to be significant only where there are large gradients in chemical sources and sinks along particle trajectories. The largest changes in the mean field are found in the lower stratosphere and are due to the Lagrangian-mean advection. In the second model, ozone transport is calculated for the combined diabatic and time dependent planetary wave circulations. Both circulations are instrumental in the formation of the polar spring ozone maximum. The diabatic circulation transports ozone into the lower stratosphere, and planetary waves transport large amounts of ozone northward during sudden and final warmings. Using the transport mechanisms revealed in these models, a scenario is deduced to explain observed large scale ozone transport phenomena.