3.2 TEMPERATURE OF THE THERMOSPHERE

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The globally averaged vertical temperature contrast (exospheric temperature minus mesopause temperature) in planetary thermospheres depends on heating by absorption of solar EUV energy, energy loss through infrared radiation by polyatomic molecules and energy transfer by thermal conduction between the regions of energy deposition and loss. On the basis of such a description, Strobel and Smith (1973) estimated a vertical temperature contrast for the thermosphere of Titan $\sim$90°K for CH_4/H_2 mixing ratios $\sim 10^{-3}$. Interpretation of current observational data suggests that the CH_4/H_2 mixing ratio $\gtrsim 1$. As a consequence the separation distance between energy deposition and loss is substantially less and we would expect vertical temperature contrasts <10 degrees. Complications do arise however for the thermosphere of Titan. Light constituents such as H_2 can readily escape from its atmosphere and the flow velocities can be large (Hunten 1973). It is quite possible that the light constituents could undergo significant adiabatic cooling and hence have temperatures significantly less than the background atmosphere. In addition, a large relative velocity difference between the light constituent and the background atmosphere can result in considerable energy transfer between the gases and frictional heating of the gases. It is highly probable that H_2 and CH_4 will not be in thermal equilibrium in the thermosphere for large H_2 escape rates.