

# MODELING THE ANNUAL CYCLE OF CARBON MONOXIDE IN THE MARTIAN ATMOSPHERE.

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## Introduction

We have modeled the annual cycle of carbon monoxide in the atmosphere of Mars using simplified production and destruction mechanisms allied to a transport code embedded in the NASA Ames Mars general circulation model (MGCM). The details of the scheme are given in *Joshi et al.* [2002].

We find that for most of the year, CO vertical and meridional gradients are small, as expected. The vertical gradient of CO is almost zero during northern winter, consistent with the intense circulation present during this season.

A buildup of CO does occur in the winter polar vortex in southern winter ( $L_s = 90$ ). Depth-averaged mixing ratios change from  $7 \times 10^{-4}$  in the northern hemisphere to  $11 \times 10^{-4}$  in the winter polar vortex. We ascribe this buildup to the fact that destruction of CO is inhibited

in any vertical column above the polar cap, to account of the fact that CO is destroyed mainly by OH, which is produced from  $H_2O$ , which is present in very small amounts in these regions.

There is an asymmetry between southern winter and northern winter ( $L_s = 270$ ), where small gradients of CO are maintained. This is due to the much greater horizontal and vertical mixing present in the northern mid-latitudes at this time, which is associated with a strong meridional circulation, as well as transient baroclinic eddies.

The build-up of CO in southern winter agrees with recent spectroscopic observations quite well. The match with observations is encouraging, given the relative simplicity of the CO production/destruction mechanisms.

Reference: Joshi MM, Haberle RM and Clancy RT, 3D transport calculations of carbon monoxide in the Martian atmosphere, *Submitted to Icarus, 2002*.