CORRESPONDENCE

Comments on "Experimental Evidence for Interhemispheric Transport from Airborne Carbon Monoxide Measurements"

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Newell and Gauntner (1979) have interpreted CO measurements in the tropical upper troposphere as evidence of interhemispheric mixing of air across the equator. Their interpretation is based on a 40 ppbv difference in average CO mixing ratios between the Atlantic and Pacific tropics, as well as isobaric trajectories deduced from upper air data. Newell and Gauntner readily concede to uncertainties in their trajectory calculations over the data-sparse oceans. Although these uncertainties limit the strength of their case, we do not dispute the general concept of interhemispheric transport of CO. Rather, we feel that a better interpretation of these same data is possible in terms of surface generation of CO by vegetation, and rapid transport to the upper troposphere by deep convection.

Newell and Gauntner apparently overlooked a recently proposed source of CO, involving the oxidation of non-methane hydrocarbons released by vegetation (Zimmerman *et al.*, 1978). If this scheme is an important CO source, as estimates indicate, one could expect CO generated at the earth's surface (or CO-producing compounds) to be transported vertically by deep convection to the upper troposphere. Fig. 1 shows the latitudinal distribution of the same data analyzed by Newell and Gauntner, from the Global Atmospheric Sampling Program (Holdeman *et al.*, 1979). Concurrent surface observations fixed the location of the Intertropical Convergence Zone (ITCZ) at 8–10°N on both Pan Am round-the-world flight legs. Also shown are the latitude ranges over which aircraft measurements of light-scattering particles and condensation nuclei, as well as satellite observations, indicate that intense convection was present (Pratt and Falconer, 1979). A local region of high CO concentration, experienced from 3 to 10°N over Nigeria and the Gulf of Guinea, corresponds closely to that portion of the flight during which particles associated with the ITCZ were also encountered.

All available meteorological evidence is consistent with the possibility that CO generated over the dense vegetation of equatorial Africa was carried to flight level by deep convection. Southeast winds measured by the aircraft's inertial navigation system (Fig. 1) indicated flow from over the continent (rather than the oceanic trajectory determined by Newell and Gauntner). In contrast, CO was uniform across the ITCZ convection over the open Pacific, which was apparently of comparable intensity to that over Africa.

On the African leg, tropical mixing ratios were approximately equal (90 ppbv) outside the zone 3 to 10°N, in both the Northern and Southern Hemispheres. Wind data (Fig. 1) indicates that these mixing ratios were measured in air flowing from over the Atlantic Ocean. Although we have no explanation for the much lower CO over the Pacific (~65

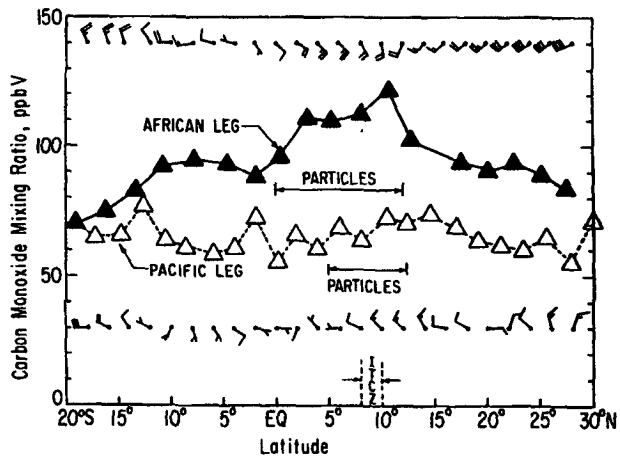

FIG. 1. Tropical tropospheric mixing ratios of CO observed over Africa on 29 October and over the Pacific Ocean on 30 October 1977. Adjacent wind data was obtained from the aircraft inertial navigation. Text describes source of particle and ITCZ information.

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ppbv), the latitudinal symmetry on both legs seems inconsistent with evidence of cross-equatorial transport. If our interpretation of these data is correct, we would expect to find similar occurrences of elevated CO associated with zones of intense convection over vegetated tropical regions. Tropical convection and biological CO production could work in concert to provide the equatorial upper troposphere with CO, whose presence might be attributed to long-range transport. CO registrations from the middle and upper tropical troposphere will have to be carefully evaluated with respect to other tracers of surface air, before the relative importance of either long-range quasi-horizontal transport or vertical transport of CO can be determined.

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