Ozone Atmospheric Concentrations and Atmosphere/Ocean Fluxes During the TexAQS 2006, STRATUS 2006, GOMECC 2007, GasEX 2008, and AMMA 2008 Cruises

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Ozone ambient concentrations and atmosphere-ocean fluxes were measured on five cruises on board the NOAA Research Vessel Ronald Brown during 2006 to 2008. The cruises shown in Figure 1 resulted in ~3000 hours of open ocean ozone observations. The lowest ozone mixing ratios were measured in the Southern Atlantic during GasEx, with levels consistently in the 15–25 ppbv range. A similar narrow ozone mixing ratio distribution was observed in the South Pacific STRATUS cruise, but here ozone levels were approximately 10 ppbv higher, mostly in the 25–35 ppbv range. The STRATUS data collected during October 2008 on average appear ~5 ppbv higher than published oceanic data from Southern Hemisphere island locations. A wide range of ozone concentrations were measured during the GOMECC and TexAQS cruises. During southerly winds ozone was in the 20-30 ppbv range while concentrations reached 40-70 ppbv during winds coming from the coast. Similar observations were made during AMMA. In the outflow of urban areas reaching as far as ~100 km off the coast ozone levels were up to three times above background levels. These findings are in accord with previous ship-borne experiments in these and comparable regions, which have shown that ozone photochemical production continues to occur for several days in pollution outflow over the ocean. Ambient ozone concentrations measured on board the ships will be compared with land-based ozone measurements from the NOAA GMD surface ozone network.

The median of 10-min oceanic ozone deposition velocities (vd) results ranged from 0.009 cm s^{-1} to 0.034 cm s^{-1}. These directly-measured ozone deposition values are at the lower end of previously reported data in the literature for uptake to ocean water. Data illustrate a positive correlation (increase) of the oceanic ozone flux with wind speed, sea surface temperature, and biogeochemical conditions in the ocean surface microlayer, albeit the behavior of these relationships appears to differ during these cruises.

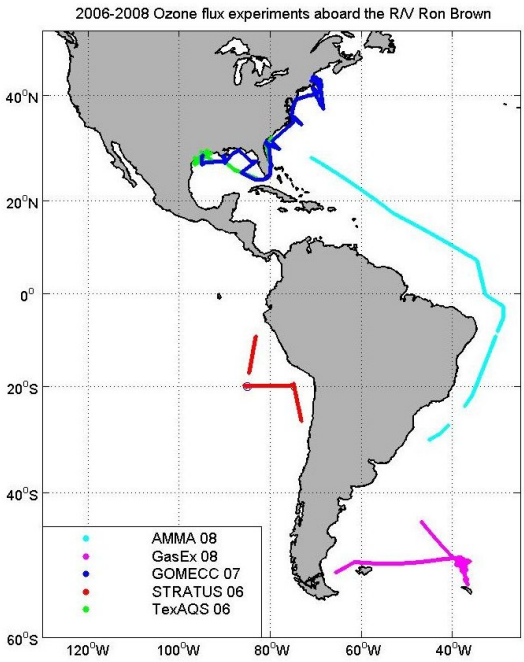

Figure 1. Tracks of the five ocean cruises with deployment of the ozone flux experiment.