**Four regimes dominate air quality along the eastern slopes of the Rocky Mountains:**

* Nocturnal drainage flows that follow the South Platte River from the southwest to the northeast through Denver. The nocturnal drainage jet structure (Neff et al., 1990), because of a nearly laminar layer that forms between 100m and 200m, may result in the trapping of urban surface emissions in a thin layer below the jet and may isolate elevated emissions (from point sources) in the air flow above the wind maximum: This drainage system extends well into northeastern Colorado during summer (Toth and Johnson, 1985), including regions with significant ammonia sources.

***Implications for CO2 observations:*** At the BAO these drainage winds are generally from the southwest or west and do not originate from major urban areas. In these cases, comparison of CO and CO2, particularly at nighttime, should allow distinguishing combustion versus biogeochemical sources.

* Thermally and/or dynamically driven northeasterly winds (upslope, toward the foothills), often associated with a shallow front-like or surge structure only a few hundred meters deep, that can transport cool air from the lowlands of the South Platte, northeast of Denver, southwestward into the foothills. During the Brown Cloud Study, these winds were most likely to occur during the afternoon but were also observed at many other times of the day and night (Crow, 1973; Neff, 1990; Neff et al. 1990) and sometimes as a result of mesoscale eddies that form along the Front Range (e.g. Levinson and Banta, 1995). These upslope and recirculating flows enable aged aerosol and/or precursor gases such as ammonia to return to Denver and may contribute to a rapid degradation of visibility (Sloane et al., 1990). The stability of the shallow air mass limits vertical mixing and allows further buildup of pollution. When alternating with a nocturnal drainage wind, they may lead to a day-to-day recycling of the same airmass.

***Implications for CO2 observations:*** Under these conditions, urban sources are likely to dominate boundary layer CO2 behavior. When below the 300 m level, only the 30-m and 100-m levels may show these urban influences.

* Moist, cool northeasterly upslope winds, usually in response to lee cyclogenesis southeast of Denver and/or cold, surface high pressure developing over the Great Plains to the northeast of Denver, sometimes result in snowfall along the base of the mountains, but also in fogs and low clouds. Such conditions can support rapid chemical transformations, such as SO2 to sulfate, that depend on the presence of clouds (McHenry and Dennis, 1994). A related area that merits further investigation is melting and evaporation into the shallow boundary layers that often follow snowstorms.

***Implications for CO2 observations:*** During the initial phase of these upslope conditions, urban residue may dominate; as the upslope continues, cleaner air from the plains may change the CO/CO2 behavior significantly.

* Downslope westerly winds that usually are strongest near the foothills west and north of Denver and which are associated with falls of pressure along the foothills, contributing to shallow upslope flows along the Platte River. Warm westerly winds several hundred meters aloft and light, cool easterly winds near the surface enhance the low-level temperature inversion creating strong trapping conditions unless there is a strong differential acceleration of the wind across the inversion layer. During the Brown Cloud field study, the inversion often proved remarkably resistant to erosion by the strong westerly winds above it.

***Implications for CO2 observations:*** Because of the position of the BAO, closer to the foothills, it usually is dominated by high winds from the mountains which should show minimal urban influence. However, sometimes the boundary between the clean mountain air and the polluted air masses over the plains may oscillate back and forth through the BAO site as the mountain wave phase shifts. These will provide interesting cases for analysis over the coming winter.