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The influence of boundary layer dynamics on chemistry: A comparison of an Arctic and Antarctic location

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Boundary layer conditions (such as depth, seasonal and diurnal variations) have been shown to influence concentrations of trace gases in the near-surface atmosphere in polar locations. In this study we investigate the different parameters controlling the relationship between boundary layer depth (BLD) and atmospheric nitrogen oxide (NO_x) concentrations at South Pole and GEOSummit Station, Greenland. Both locations are characterized by shallow boundary layer depths, although GEOSummit Station experiences diurnal variations in BLD during the summer months while South Pole undergoes sustained periods of very low BLDs and highly stable conditions. It has been demonstrated previously at South Pole that sustained very low BLDs correspond to heightened NO_x values, and NO_x shows a linear relationship to BLD during these times. In contrast, at GEOSummit station, recent work has shown no relationship between BLD and NO_x values during a one month period in the mid-summer. We investigate the possible causes and contributing factors to these very different NO_x responses to measured BLD using documented results from South Pole and recent measurements of NO_x and BLD at GEOSummit Station.