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Distinct wind convergence patterns in the Mexico City basin due to the interaction of the gap winds with the synoptic flow

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Abstract. Mexico City lies in a high altitude basin where air quality and pollutant fate is strongly influenced by local winds. The combination of high terrain with weak synoptic forcing leads to weak and variable winds with complex circulation patterns. A gap wind entering the basin in the afternoon leads to very different wind convergence lines over the city depending on the meteorological conditions. Surface and upper-air meteorological observations are analysed during the MCMA-2003 field campaign to establish the meteorological conditions and obtain an index of the strength and timing of the gap wind. A mesoscale meteorological model (MM5) is used in combination with high-resolution satellite data for the land surface parameters and soil moisture maps derived from diurnal ground temperature range. A simple method to map the lines of wind convergence both in the basin and on the regional scale is used to show the different convergence patterns according to episode types. The gap wind is found to occur on most days of the campaign and is the result of a temperature gradient across the southern basin rim which is very similar from day to day. Momentum mixing from winds aloft into the surface layer is much more variable and can determine both the strength of the flow and the pattern of the convergence zones. Northerly flows aloft lead to a weak jet with an east-west convergence line that progresses northwards in the late afternoon and early evening. Westerlies aloft lead to both stronger gap flows due to channelling and winds over the southern and western basin rim. This results in a north-south convergence line through the middle of the basin starting in the early afternoon. Improved understanding of basin meteorology will lead to better air quality forecasts for the city and better understanding of the chemical regimes in the urban atmosphere.

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