## Potential impacts of aircraft emissions on the air quality near the ground: Importance of heterogeneous chemistry and nitrate radicals

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Recent studies [Barrett, 2008 and 2010] suggest that current aviation emissions above the planetary boundary layer may adversely impact local air quality at the surface throughout the world, particularly affecting the amount of small particles less than 2.5 Im in diameter. To further examine this hypothesis, the effects of present and future aircraft emissions from various altitude ranges have been investigated with an emphasis on boundary layer air guality related to concentrations of NOx, O3 and aerosols. Our goal is to determine how significantly aviation emissions affect the boundary layer and the sensitivity of these impacts to possible different future chemical environments. Aircraft emissions near cruise altitudes decrease NOv in urban areas of the Northern Hemisphere in the winter. Heterogeneous reactions and NO3 radical play an important role to remove NOx from the atmosphere. As a result, the O3 increase by aviation emissions in the winter is less than in summer. On the other hand, aviation emissions might result in more aerosols, especially ammonium nitrate (NH4NO3), during cold seasons. Overall, we find that the effects of upper tropospheric aviation emissions on boundary layer air guality are not significant, but our analyses indicate that the future chemical environment could affect the magnitude of these impacts. Aviation impacts on NOx and O3 in the boundary layer can be affected by different vertical distributions of aerosols in the future. In addition, the distribution of background NH3 near the surface plays an important role in determining the NH4NO3 increase due to aviation. Further sensitivity simulations with different ground emission scenarios of ammonia in the future show the close relationship of the background concentration of ammonia distribution with the aviation induced aerosol increase near the ground.