

Brown Carbon in the Continental Troposphere: Distribution, Sources and Radiative Impact

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Little is known about the optical significance of brown carbon (BrC), including the importance relative to black carbon (BC) and influence on direct radiative forcing by aerosols. The vertical profile of BrC affects its radiative forcing, yet the distribution of BrC in the free troposphere is largely unknown. In this study, BrC absorption was directly measured in solvent extracts of particulate filters obtained from aircraft sampling over the continental USA during summer. BrC was observed throughout the tropospheric column (up to 13 km) and its prevalence increased relative to BC with increasing altitude, indicating contributions from secondary sources. Closure analysis showed good agreement between light absorption from BC plus BrC relative to measured total aerosol absorption. A radiative transfer model indicated that BrC absorption reduced top of atmosphere aerosol forcing by ~20% suggesting that it is an important component of direct aerosol radiative forcing in the background continental troposphere.