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The long-range transport of atmospheric aerosols from South Asia to Himalayas

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High levels of carbonaceous aerosol exist over South Asia, the area adjacent to the Himalayas and Tibetan Plateau. Little is known about if they can be transported across the Himalayas, and as far inland as the Tibetan Plateau. To resolve such scientific questions, aerosol samples were collected weekly from August 2009 to July 2010 at Qomolangma (Mt. Everest) Station for Atmospheric and Environmental Observation and Research(QOMS, 4276 m a.s.l.). In the laboratory, major ions, elemental carbon, organic carbon, levoglucosan, water-soluble organic carbon, and organic acids were analyzed. The concentration levels of OC and EC at QOMS are comparable to those at high-elevation sites on the southern slopes of the Himalayas (Langtang and NCO-P), but 3 to 6 times lower than those at Manora Peak, India, and Godavari, Nepal. Sulfate was the most abundant anion species followed by nitrate. The dust loading, represented by Ca2+ concentration, was relatively constant throughout the year. OC, EC and other ionic species (NH_4^+, K^+, NO^- and SO_2^-) exhibited a pronounced peak in the pre-monsoon period and a minimum in the monsoon season, being similar to the seasonal trends of aerosol compo-sition reported previously from the southern slope of the Himalayas. The strong correlation of OC and EC in QOMS aerosols with K+ and levoglucosan indicates that they mainly originated from biomass burning. Molecular distributions of dicarboxylic acids and related compounds (malonic acid/ succinic acid, maleic acid/fumaric acid) further support this finding. The fire spots observed by MODIS and backward air-mass trajectories further demonstrate that in pre-monsoon season, agricultural and forest fires in northern India and Nepal were most likely sources of carbonaceous aerosol at QOMS. In addition to large-scale atmospheric circulation, the unique mountain/valley breeze system can also have an important effect on air-pollutant transport.With the consideration of the darkening force of carbonaceous aerosols, our finding has important implication for this climate-sensitive area, where the glacier melting supplies water for billions of people downstream