Effects of absorbing aerosols on accelerated melting of snowpack in the Tibetan-Himalayas region

WILLIAM K.M. LAU

Laboratory for Atmospheres, NASA/GSFC, Greenbelt, MD 20771 (william.k.lau@nasa.gov)

The impacts of absorbing aerosol on melting of snowpack in the Hindu-Kush-Tibetan-Himalayas (HKTH) region are studied using NASA satellite and GEOS-5 GCM. Results from GCM experiments shows that a 8-10% in the rate of melting of snowpack over the western Himalayas and Tibetan Plateau can be attributed to the aerosol elevated-heat-pump (EHP) feedback effect (Lau *et al*. 2008), initiated by the absorption of solar radiation by absorbing aerosols accumulated over the Indo-Gangetic Plain and Himalayas foothills. On the other hand, deposition of black carbon on snow surface was estimated to give rise to a reduction in snow surface albedo of 2 - 5%, and an increased annual runoff of 9-24%. From case studies using satellite observations and re-analysis data, we find consistent signals of possible impacts of dust and black carbon aerosol in blackening snow surface, in accelerating spring melting of snowpack in the HKHT, and consequentially in influencing shifts in long-term Asian summer monsoon rainfall pattern.

Small-scale processes and mantle source heterogeneity recorded in melt inclusions from the Mid-Atlantic and Gakkel ridges

MURIEL LAUBIER* AND CHARLES H. LANGMUIR

Earth and Planetary Sciences, Harvard University, Cambridge, MA 02138, USA
(*correspondence: laubier@eps.harvard.edu)

Melt inclusions sample magmas that are less homogenized than lavas and provide new insights on magma generation, transport and mantle heterogeneity. Remarkably, at mid-ocean ridges few exhaustive studies of individual areas have taken place for olivine-hosted inclusions, to constrain to what extent major and trace elements provide coherent signal that reveals mantle composition and processes. We are carrying out such studies of ridges with very different spreading characteristics, from the FAMOUS segment (Mid-Atlantic Ridge) and the ultra-slow spreading Gakkel Ridge (Arctic Ocean). One aim is to test the hypothesis that melt inclusions record melts from various depths in the melting column, such that the most depleted melts are also high in Si and low in Fe.

188 new melt inclusions from 14 samples in the FAMOUS area display a large variability in major and trace elements that extends that of the lavas to more depleted compositions. Among them, high-Al, low-Si melts, found both as melt inclusions and lavas, are characterized by a strong depletion in the most incompatible elements and distinctively low MREE/HREE ratios. Although high-Al melts show evidence of assimilation of crustal plag-bearing cumulates, their trace element signature requires a distinct residual mantle formed by previous melt extraction in the garnet field. The low Si contents of the most depleted inclusions suggest that they reflect deep source processes, and not the ‘top of the melting column’.

The Gakkel Ridge is the slowest spreading ridge on Earth, and should have a tens of km thick lithosphere that would be expected to influence melt inclusion compositions. The robust western volcanic zone has a continuous magmatic ridge, the sparsely magmatic zone consists largely of peridotite, and the eastern volcanic zone consists of isolated volcanoes. Large geochemical variations in the lavas along the ridge and within segments indicate small extents of melting (F), melt focusing and mantle source heterogeneity. Melt inclusion work will be reported on samples from all domains. The comparison between slow and ultraslow spreading ridges will constrain the changes in the melting dynamics, transport and sampling of mantle heterogeneity between the two environments.