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Aerosol black carbon at an urban site-Srinagar, northwestern Himalaya, India:
Seasonality, sources, meteorology and radiative forcing

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1 **Aerosol black carbon at an urban site-Srinagar, Northwestern**
2 **Himalaya, India: Seasonality, sources, meteorology and radiative**
3 **forcing**

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8
9 **Abstract**

10
11 Black carbon (BC) mass concentration was measured first-time at a high altitude urban site-
12 Srinagar (1600 m asl), in northwestern Himalaya, India using an Aethalometer during 2013 to
13 study temporal variations (monthly, diurnal and seasonal), meteorological influences, source and
14 its radiative forcing. Diurnal variations with two peaks (at 8-10 h and 20-23 h) and two dips (at
15 13-17 h and 0-3 h) were observed throughout the year with varying magnitude. November and
16 April showed the highest (13.6 $\mu\text{g}/\text{m}^3$) and the lowest (3.4 $\mu\text{g}/\text{m}^3$) mean monthly BC
17 concentration respectively. Seasonally, autumn displayed the highest (9.2 $\mu\text{g}/\text{m}^3$) and spring the
18 lowest (3.5 $\mu\text{g}/\text{m}^3$) mean BC concentration. Annual average BC concentration was quite higher (6
19 $\mu\text{g}/\text{m}^3$) than those reported for other high altitude stations. Wind speed, Minimum temperature
20 and total precipitation showed a clear negative correlation with BC ($r = -0.63, -0.51$ and -0.55
21 respectively), while as, the evening relative humidity showed positive correlation ($r = 0.56$).
22 During autumn, spring and winter seasons, the main source of BC at Srinagar is the biomass
23 burning, while during summer season, equal contribution of BC is from fossil fuel and biomass
24 burning. Back trajectory simulations revealed that, except summer, westerly air masses are the
25 dominant winds, transporting BC from central Asia, west Asia, south Asia, Africa and some parts
26 of Europe to Srinagar adding to its local sources. Clear-sky short wave radiative forcing of
27 atmosphere due to BC was highest (58.2 Wm^{-2}) during autumn which leads to the increase in

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