



The investigation of Mongolian dust storm source areas and their spatiotemporal migration by the remote sensing data analyses

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Ongoing desertification and the consequent generation of dust storms in Mongolia rank among the most significant environmental disasters not only locally but also throughout nearby East Asian countries for public health and socio-economic activities. Nonetheless, the lack of robust, accurate information about source areas of dust storms and their migration severely complicates efficient counter-efforts by international and local authorities. In response, we initiated the comprehensive monitoring and interpretation scheme of Mongolian dust storm source area employing mid- to high-resolution satellite images, unmanned aerial vehicles (UAVs) and ground surveys.

We first conducted time series analyses of Moderate Resolution Imaging Spectroradiometer (MODIS) bidirectional reflectance distribution function (BRDF) and vegetation index products covering a full Mongolian territory and a decadal period. The Empirical Orthogonal Function (EOF) analysis of Enhanced Vegetation index (EVI) and Protrusion coefficient (PC) extracted from the MODIS imagery reveals 1) the candidate areas as dust storm hot spots are mainly populated along the southern Mongolian basins; 2) the transition zone between the desert and the green area has been steadily migrated over the past decade.

We thus hypothesised that intense dust storms usually originate from aeolian sediment transportation pathway such as the Eastern Gobi fault zone and that source areas of dust storms have extended towards north-eastern Mongolia. Although the change of the surface characteristics such as aerodynamic local roughness length of the hot spot area was obviously noticed, specific factors of such change remained unclear from the results of satellite image analyses. Therefore, this study will be further carried out to the following approaches for identified dust storm hotspots. First, the micro scale surface characterization by sub centimeter scales UAV stereo campaign and secondly the interferometric synthetic aperture radar (InSAR) phase coherence analyses on undergoing aeolian surface erosion. Then we expected to elucidate the relationship of climatic factors (e.g. wind direction and speed, soil moisture and precipitation), as well as anthropogenic activities (e.g. recently intensified mining), with the generation of dust storms. As the outcomes of our first phase of research, the time series analyses of satellite products, the footprint of surface erosion and characteristics discerned from InSAR and the UAV campaign are presented with our interpretation of climatic and anthropogenic factors.