Characteristics of aerosol and meteorological parameters during the dust event of 15 April 2015 over Beijing, China

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Dust season is prevalent every year during spring season (March-May) affecting the northeastern parts of China. On 15 April 2015, the capital of China, Beijing was hit by the worst dust storm event in decade. The China Meteorological Administration issued a yellow sandstorm alert, the third-most serious danger level, where visibility was reduced below 1,000 meters and air pollution increased. The concentration of PM_{10} in some areas of Beijing exceeded more than 1,000 $\mu g/m^3$, which is considered hazardous for people's health. Multi-satellite sensors are capable of monitoring transport and providing optical information about the dust and changes in atmospheric parameters associated with the transport of dust. The back trajectory clearly shows the source and dust track, 48 h before reaching Beijing. The source of air mass over Beijing is originated from Inner Mongolia and the border of China and Mongolia regions. The track of the dust storm reaching Beijing is from northwest. The detailed aerosol properties including aerosol size distribution (ASD) and single scattering albedo (SSA) from AERONET, and meteorological parameters including CO volume mixing ratio (COVMR), H_2O mass mixing ratio (H_2OMMR), relative humidity (RH), and O_3 volume mixing ratio (O_3VMR) from Atmospheric Infrared Sounder (AIRS) are analyzed in detail.

The ASD in coarse mode shows dominance over fine mode, indicating presence of mineral dust particles during dust storm events. The SSA increases with higher wavelength on the dusty days, and is found to be higher compared to the days prior to and after the dust events, indicating the presence of scattering and larger size particles.

During the dusty days, COVMR decreased from the surface upto mid altitude compared with the non-dusty days. An increase in the H_2OMMR is observed during the dusty days at the higher altitudes equivalent to the pressure levels 500 and 700 hPa. The mid altitude RH is also observed to decrease at the pressure levels 700 and 925 hPa during dusty days. With the onset of the dust storm event, the RH is obviously lower at the surface level. Airborne dust particles could cause significant radiative heating at shorter wavelengths and cooling at longer wavelengths, which in turns influence the temperature profile in the atmosphere. The change of temperature will cause the pronounced changes in RH at the mid altitude. In addition, dust may contain more hygroscopic chemical component, as a result RH is reduced due to the absorption of water by dust aerosols. O_3VMR concentrations enhanced at the increasing altitudes (at the low pressure levels) and decreased near the surface at the pressure levels 500-925 hPa due to dust storms. The detailed characteristics of atmospheric parameters along the track of dust events from the source will be presented. A comparative study of aerosol parameters associated with the dust events at other parts with different environmental settings will be also discussed.

Keywords: Dust storm, AERONET, AIRS, Beijing

Land Cover Mapping in an Urbanized Volcanic Area: Taal, Philippines

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Despite the hazards, the population within active volcanic areas has been increasing. Urbanization in these areas result to changes in land cover and increase of communities at risk. Thus, an accurate understanding of land cover in volcanic areas is necessary. Satellite remote sensing and geographic information systems have been used for land cover mapping for resources and land use planning. However, there are not so much studies concentrating on volcanic areas, especially in the developing countries. High quality reference data also contribute to better classification. This study seeks to map the land cover of Taal volcanic area in Batangas province, Philippines. It is one of the 12 Decade Volcanoes of the world having a reputation for being dangerous and worthy of study, and where the tourism industry has been progressing. LANDSAT 8 OLI/TIRS 2016 satellite image and ground truth photos were utilized for the analysis. The International Geosphere-Biosphere Programme (IGBP) system was used to categorize the land cover types. The Maximum Likelihood Classification algorithm was facilitated for the classification and accuracies were also calculated. The percentage of land cover classes will be presented, focusing on the urban or built up areas and its proximity to the hazard zones of the volcano.

Keywords: Volcano, Hazards, Land Cover

Snow Cover Spatio-temporal Patterns in the Tibetan Plateau based on Long Term Satellite Data

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Snow cover is an important parameter in investigations of climate, surface radiation budget and hydrology cycle. The Tibetan Plateau (TP) is one of the coldest places on the earth. In global scale, the long term characteristics of snow cover on the TP can support the analysis of the climate of our country and the Asian summer monsoon, even the global changes. In regional scale, it has great significance for the water supply of pastoral ecosystem, snow damage forecasting and flood forecasting. In the study, we developed an alternative approach with dynamic thresholds to produce snow cover products (1982-2012). Based on these products we analyzed the spatial and temporal variability in snow cover in the TP. The results are as follows: (1) Based on LTDR data and digital elevation model, we built a snow inversion model. The classification algorithm correctly identified the snow class at all stations in 93.9% of the cases. The classification quality reached a very good level (K=0.765). (2) For the entire TP, the monthly mean snow cover area (SCA) exhibited a bimodal distribution, with the maximum cover (29.4%) occurred in March, and the minimum cover (6.3%) in September. The SCA shows a steady decreasing trend from March to August and a steady increasing trend from September to next January. For the spatial variation, the four semi-arid ecological zones exhibited the same variation trend, while the humid/semi-humid ecological zone shows a clearly time leg.(3) According to YSCA statistic data, we found 1982,1984,1990,1997, 1998, 2003 and 2007 were abnormal snow cover year which can be associated to the former study. For the entire TP, the high snow cover occurred in 1982, 1997 and 2007, while vale values happened in 1984, 1990, 1998 and 2003. We divided the study period into two parts for the analysis over the all nine Eco-geographic regions (EGR). Comparing each EGR, we found HID1, HIC1, HIC2, HIB1 have a good agreement in the variation trend. We calculated annual SCD anomalies and showed the result as two terms according to YSCA variation characteristics. The central area of the TP was more changeable. This area was distributed around Tanggula mountains (Mts), also four Eco-geographic regions: HIC1, HIB1, the west both HID1 and HIC2. Nyainqtanglha Mts, Himalayas Mts and the west of Kunlun Mts had snow covers in most years, whereas the Qaidam basin and the southern Tibet valley (the deep valley between Himalayas and Gandise) exhibited were snow-free in most years. (4) Based on snow cover onset date and snow cover melted date for the completion of the TP, we found that snow phenology did not show zonal characteristics on latitude. Besides, snow cover begins or finishes melting from the hinterland of the Qinghai-Tibet Plateau to other areas. (5) Regressed YSCA with air temperature and precipitation, the relativity with temperature was negative in HIC1, HIB1, HIC2 and HIIA/B1 in snow-fall season (autumn and winter) and the relativity with precipitation was positive in HIC1, HID3, HIC2, HIB1, HIIC2 and HIIA/B1 in winter while the relationship of both temperature and precipitation is insignificant in spring probably due to relative high temperature in the snow-melt season. (6) By the comparison of snow distribution characteristics of each ecological zone, the results showed: Qinghai-Tibet Plateau Tanggula and its adjacent areas, the four semi-arid ecosystems partition, had the similar inter-annual fluctuation. These areas also showed a significantly negative correlation with temperature and a positive correlation with precipitation. It should be pointed that these areas included the source of the Yangtze River and the Yellow River (the Sanjiangyuan region), and the main grazing area, therefore, the research results exhibited a great benefit for the flood and snow disaster prediction.

Keywords: the Tibetan Plateau, snow cover , spatio-temporal patterns

吹雪の稠密観測を目指した低価格視程計の性能評価
Performance evaluation of low-cost poor-visibility meter for hyper-densely observation of blowing snow

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In our previous study, we developed a low-cost poor-visibility meter (~\500,00) for hyper-densely observation of blowing snow. Our developed instrument works as a reduced intensity of light when snow particles block off. We used semiconducting laser for the light source (~\500). The laser beam is reflected three times by using mirrors and it enables us to make compact instrument with enough length of light path. Our developed system has a capability of extending a hyper-densely observation in real-time using wireless network. Our study aims performance evaluation of the low-cost poor-visibility meter for hyper-densely observation of blowing snow in the condition of artificial and natural one. We have checked the correlation between the reduced laser intensity taken by our system and the visibility recorded by conventional video camera simultaneously; the visibility corresponds to the pixel intensity obtained from the movie (1frame 1/30sec, 8-bit). Natural (Artificial) blowing snow was measured in Sapporo City (Cryospheric Environment Simulator of the Shinjo Branch, Snow and Ice Research Center, National Research Institute for Earth Science and Disaster Prevention in Shinjo city). The wind velocity was 10-15m/s and temperature was from -4℃ to -15℃. We have performed theoretical analysis for the relation between the laser intensity and the poor visibility based on our original formulation. The resultant value for the correlation coefficient in artificial blowing snow was 0.95. In conclusion, we have conducted the performance evaluation of the low-cost poor-visibility meter for hyper-densely observation of blowing snow, having a potential of hyper-densely monitoring on wireless network, and have made sure the practicability.

キーワード：吹雪、防災、機器開発
Keywords: Blowing snow, Disaster Prevention, Instrument Development

Development for polarization monitoring method of black ice area on roads

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The fatal accidents on the frozen road including black ice occupy about twenty-five percent of all the traffic accident. The melted snow and raindrop frozen in snow area, black ice is sheeted on the road by large temperature differences in the morning and the evening. The partially frozen road due to black ice looks like just a wet road, causing the difficult identification of black ice. In several previous studies the polarization dependence of brightness was useful to identify the road surface. However, they can predict only in point, not in area. Here, we developed method for monitoring a area with or without black ice in extensive.

The polarization experiment was performed for water and ice surface (1) in the flat trays and (2) on the rough asphalt mat. Then, we took the photo by camera which attached polarization filter (figure1). The light source placed in front of camera, and both incident under same degrees to the center of case. It is an ideal condition to see the polarization effect between water and ice. We cut the area of photo where was the strong reflection caused, and compared. Next we used asphalt mat made of same raw materials as real popular asphalt road. The light source and camera placed same position and degrees. We made similar situation like wet road and icy road to be distinguished eventually.

The result of first experiment which to take the photo of flat water surface and icy one, we could find the differences between water and ice(figure2). The brightness value of flat water surface is uniform and indicated almost the same value. On the contrary, the brightness value of ice surface is not uniform because of rough surface. It means our method which use the polarization and brightness value is useful, in order to distinguish flat water surface to ice surface. Secondly, verified the result of experiment by using asphalt mat. According to our hypothesis based on first experiment, we thought the result would be different between wet and icy mat surface condition. The result was almost as the hypothesis. We could see the differences of brightness between wet mat and icy mat.

In conclusion, the new combined method between polarization and brightness is conducted to distinguish wet mat with icy one. The polarization degree is highly depends on the incident angle of light source and receiver, camera for instance. Therefore we have to divide the area according to the incident angle of light sauce, then we statute each brightness value which able to separate wet and ice in respective small area. In order to distinguish wet road and icy road at the wide area, we plan to gather the angle-sensitive data to incident angle and azimuth among light souse, objective and camera.

キーワード：ブラックアイスバーン、偏光
Keywords: Black ice, polarization

Risk Prediction of Sudden Oak Death (SOD) in China under Different Trends of Future Climate Change

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Sudden Oak Death (SOD) is one of the most serious plant diseases in the west coast of the United States and Europe. In the USA, SOD is mainly found in California and Oregon, and in Europe they occurred in UK, Spain, German and France. SOD is caused by *Phytophthora ramorum* (P. ramor). The spores of the SOD can be transmitted by water, wind and soil to other host plants. SOD have more than 100 kinds of host plants and most of them can be found in China (e.g. Viburnum, Lonicera, Photinia serrulata). China has similar environment and climate conditions to those of SOD epidemic areas. If SOD broke out in China, it will cause ecological disaster and huge economic losses. Therefore, it is necessary to predict the potential risk of SOD in China.

The Maxent model is a machine learning method that estimates the distribution of species through the distribution of the maximum entropy. In the 5th assessment report, the IPCC identified four possible trends of future climate change scenarios based on greenhouse gas (GHG) emission patterns, namely RCP26, RCP45, RCP60 and RCP85. In this study, Maxent model, meteorological data of 2000 and two types of climate change trends (RCP45, RCP85) were used to predict the potential risk of SOD in China. Then statistical analysis of the results were obtained.

The results showed that the risk area is mainly concentrated in the central and southern regions of China. In 2050, compared with 2000, the whole of China's low risk area will be decreased (-22.31% in RCP45, -42.72% in RCP85), but high risk area will be increased (193.41% in RCP45, 245.90% in RCP85). In 2070, compared with 2050, the whole of China's low risk area will be decreased by 8.57% in RCP45 and increased 97.52% in RCP85, high risk area will be increased 26.06% in RCP45 and decreased 25.65% in RCP85.

Potential risk area of SOD mainly concentrated in 8 provinces of Guangdong, Guangxi, Hunan, Hubei, Jiangxi, Anhui, Zhejiang, and Fujian. Under the first trends of future climate change (RCP45), from 2000 to 2070, almost all provinces with low risk areas will be decreased while high risk areas will be increased. Compared with 2000, the increase of high-risk areas in the central provinces is higher than that of the southern provinces, for example, Guangdong provinces and Guangxi province increased by 123.35%, 126.15% in 2050, and increased by 191.89%, 158.34% in 2070, but Jiangxi province and Anhui province increased by 717.86%, 236.66% in 2050, increased by 756.88%, 291.20% in 2070. Under the second trends of future climate change (RCP85), from 2000 to 2070 almost all provinces with low risk areas will be decreased first and then increased, while high risk areas are increased first then decreased. In all trends of future climate change, Jiangxi, Hunan, Fujian and Zhejiang provinces all have high risk of SOD outbreak.

Keywords: Sudden Oak Death, Maxent, Future climate scenario, China

