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Editorial

Earth Observations and Societal Impacts 2015

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"Study links polluted air in China to 1.6 million deaths a year," what a shocking news as reported by Dan Levin of The New York Times on August 13, 2015. The news was started with the fact that "outdoor air pollution contributes to the deaths of an estimated 1.6 million people in China every year, or about 4,400 people a day, according to *a newly released scientific paper*" (http://nyti.ms/1TxzQD0). Air pollution is an issue of global concern, not only because of impact on the health of the human beings, but also due to contribution to the climate change. However, some questions remain unanswered in the news report. The cited "a newly released scientific paper" is indeed a draft of a paper and has not yet passed the peer review of a journal. It was found that the number of the deaths was based on a theoretical calculation. Then, it raises a question, is the theoretically estimated number of deaths correct? The question can be answered by earth observation (EO), which has been recognized to play a vital role in the sustainable development of the globe. "EO involves the very close investigation and measurement on the Earth and the derived results from the direct or indirect observations and measurements are the crucial information used to construct the supporting policies for the environments, post-disaster managements, etc." [1–5].

The International Conference on Earth Observations and Societal Impacts (ICEO&SI; http://www.iceo-si.org.tw/), hosted by Taiwan Group on Earth Observations (http://tgeo.org.tw/) in partnership with other academic institutions, provides a forum for international experts and scholars specialized in earth observations and social science to discuss and communicate the topic of climate change, environmental disasters, and ecological impacts in order to bring up appropriate suggestions and corresponding strategies of human being. More than 200 papers were presented in the ICEO&SI 2014 and 2015. Five of them are turned into this special issue as one of the academic fruits and ordered according to topic: air pollution/aerosol, global warming, and global change. The main scientific findings are briefly introduced below.

The South China Sea, the largest marginal sea of the Pacific in Southeast Asia, is abundant with marine resources. A vast amount of aerosol, attributed to varied emissions (e.g., dust, anthropogenic, and biomass burning) from the Asian continent, has widely impacted on the ecosystem of the sea. Spatial and temporal analysis of distribution of atmospheric aerosol over the South China Sea has been investigated. Specifically, the satellite-derived aerosol optical depth data were used to investigate the distribution of coarse aerosol (e.g., dust or ocean spray) and fine aerosol (e.g., biomass burning or anthropogenic pollution) over the study area. Variation of coarse aerosol particles as derived from satellite remote sensing data was in agreement with *in situ* observations, with the high value occurring in spring. In addition, China and the Indo-China Peninsula are the probable source regions of coarse aerosol particles. Furthermore, temporal amplitudes of coarse aerosol particles modes show that the average amplitude during La Niña events is larger. The significant EOF modes of fine aerosol particles refer to the fact that the high value occurs annually and semiannually. The spatial distribution of each mode and other studies also

evidence the fact that the biomass burning, respectively, occurs in the Indo-China Peninsula during March and April, but from August to October in Sumatra and Borneo. The results also show that average amplitude of fine aerosol particles is larger during El Niño events.

Outdoor air pollution has been known as one of the risk factors that affect human health. PM_{10}, particulate matter less than 10 μm in aerodynamic diameter, is one of the indicators to evaluate the air pollution. The authors used a geostatistical approach method, which is based on spatiotemporal multi-Gaussian Kriging method for time-series mapping of PM_{10} concentrations. This method was applied to a case study in Seoul, Korea. The result indicates that the developing method is useful for interpretation of air pollution and can be used for decision-making. However, to enhance the major findings of this study, two issues should be addressed in future work. First, several auxiliary variables such as the proximity to major roads and weather data should be integrated within the framework of this study. This may generate more reliable PM_{10} concentration mapping results. Second, the multi-Gaussian approach may not be appropriate for datasets with a strong positively skewed distribution, which is often observed in air pollutant concentrations. Thus, the extension of the conventional spatial indicator approach to the space-time domain and the comparison with the multi-Gaussian approach should be included in future work.

One of the major issues of today's research on global warming is how (and when) the pattern of ocean circulation will evolve, with even catastrophic scenario of major changes in the near future. Global markers of this climate evolution are particularly useful, as local markers are often confusing or unreliable. The authors demonstrate in this special issue that the study of the evolution of rainfall is a reliable proxy at large temporal and spatial scales to follow this evolution. From 50 years of homogenised rainfall data (1960–2009) over the island of Taiwan, they are able to separate the spatial (topography induced) and temporal (atmosphere/ocean) forcing. By using Empirical Orthogonal Functions (EOF), they identify the signatures of the monsoon and ENSO events, and they demonstrate that the climate variability associated with ENSO is distinct from the climate variability over other regions of East Asia. They finally isolate in the rainfall data a north-south pattern approximately in phase with the Pacific Decadal Oscillation.

From climatological perspective the year 2015 is significant in terms of the development of a strong El Niño event. To describe the oscillation between the El Niño (warm) phase and the La Niña (cold) phase, the El Niño Southern Oscillation (ENSO) term is used. El Niño and La Niña events lead to a major shift in weather patterns across the Pacific and as a consequence often produce significant impacts on population, economy, and so forth. The impacts vary for different geographical regions. The 2015 El Niño event is already significant, and further strengthening of El Niño conditions later this year remains a possibility as indicated by climate models. Not surprisingly, numerous studies of ENSO impacts in different geographical regions have been conducted, highlighting importance of research efforts in improving our understanding of ENSO and its variability. In this issue, impact of two types of ENSO, canonical ENSO and ENSO Modoki, on rainfall over Taiwan has been investigated, based on analysis of monthly mean rainfall data obtained from the Taiwan Central Weather Bureau. Correlations between rainfall data and values of Niño 3.4 and ENSO Modoki index are established and it is shown that the seasonal rainfall over various regions of Taiwan is different depending on the effects of two-type ENSO. In canonical El Niño episode, the rainfall increases in winter and spring while it reduces in summer and autumn. On the contrary, the rainfall increases in summer and autumn but reduces in winter and spring in El Niño Modoki episode. The rainfall variations in different types of ENSO are mainly caused by the monsoon and topography.

Climate change is a topic of interest for the scientific communities. Tibetan Plateau is one of the highest plateaus in the world. It plays an important role in East Asian and global climate because of its high evaluation and complex surface conditions. Using the field stations at the Tibetan Plateau, the authors found that the diurnal variations of land surface temperature and air temperature are various in different seasons underlying surfaces. The diurnal variation is greater in spring but less in summer and autumn. Furthermore, the diurnal variation in the area with drier underlying surface is more obvious than that with moist surface. The variations of land surface temperature, air temperature, wind speed, and soil moisture are also related to ENSO events. The values of land surface temperature, air temperature, and wind speed are lower than the mean values, but the soil moisture values are greater than the averaged value in La Niña year, while they are converse in El Niño year. Besides the influence of ENSO events, the warming rate at the northern Tibetan Plateau is greater than that in the global areas.

In this special issue, the most recent developments and ideas in air pollution/aerosol, climate variability and change, and their impacts on different regions in the Asia-Pacific are presented. For scientists, engineers, and various end users of remote sensing and climate data as well as related products (including those derived using GIS), findings of the studies presented here could serve as valuable references. In context of providing solid solutions for the societal needs, our continuous efforts in delivering new scientific results in earth observations contribute to addressing various environmental issues and developing effective climate change adaptation strategies.

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