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Satbyul Kim et al., J Earth Sci Clim Change 2017, 8:10(Suppl)
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Health vulnerability assessment of heatwave and projections of future impacts under climate change in South Korea

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Heatwaves are well known to be associated with increases in mortality and the burden of heat-related illness in the population. The health effects due to heatwaves appear differently depending on the population characteristics and regions. However, there is limited regional information available to guide the public health adaptation plan and climate change decision-making. Therefore, regional health vulnerability of heat waves is assessed in this study. Health vulnerability related to heatwaves is determined based on three components; climate change exposure, sensitivity, and adaptive capacity. Vulnerability index (VRI) for each region was calculated based on values of variables identified for three components with weights and was mapped for entire Korean peninsula from the 2000s to 2010s, applying RCP 8.5 scenario. Assessment units are 232 local governments and results units are 16 aggregated areas. The contribution analyses of VRI were performed to grasp attributable variables. Climate change vulnerabilities related to heat waves showed large regional variations. The VRI of the region with the highest value was 0.2081, while the lowest was 0.0419. The contribution of three components, climate change exposure, sensitivity and adaptive capacity, were 0.28, 0.28 and 0.33, respectively. Sensitivity was the highest in region M because of the large distribution of vulnerable populations, and adaptive capacity was the highest in region A where health-related infrastructure is well built. The overall vulnerability is predicted to be increasing over time. It varies by region; however, currently vulnerable areas appear to stay or be more vulnerable in the future. Vulnerable areas are mostly distributed southern part of South Korea in the 2000s and tend to be gradually moving northward in the future. Socio-demographic characteristics and healthcare access conditions are important to lower the vulnerability of heat waves. Mapping for Results visualizes the locations of relatively vulnerable regions for better monitoring of climate impact, sensitive subpopulation distribution, and adaptive capacity.

Biography

Satbyul Kim received her PhD from Seoul National University. Her research focuses how human health is affected by weather and air pollution. Her research interests also include impacts of climate change on human health, with a particular focus on vulnerability assessment.

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Coastal erosion in the Yasawa Islands, Fiji: Human error - Not sea level rise

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We studied several sites of coastal erosion in the Yasawa Islands of Fiji. Before arriving in Fiji, we examined satellite images on Google Earth and identified specific sites for investigation. From the day of our arrival on Navotua Island the local residents were curious about our activity and wanted to know if they were in danger of a rising sea. We were told of three isolated instances of severe erosion that was being blamed on SLR. We were subsequently able to investigate NanuyaLailai and Long Sandy Beach, both on Matacawalevu Island, and Yagetta Village on Yagetta Island.The reasons for the erosion at NanuyaLailai and Long Sandy Beach were obviously due to sea walls and jetties. At NanuyaLailai there is no beach at high tide and the new sea wall was still under construction. Long Sandy Beach is located across a short, narrow channel from Goat Island. Long Sandy Beach has both a sea wall in front of the main lodge and two rock groins projecting into the channel. The groin to the west caused a gyre of the current to form that cut into the beach, washing away much of the sand. The second groin, to the east, blocks sediments from depositing on the beach. As at NanuyaLailai, there is little to no dry beach at high tide.Yagetta Village presented a totally different problem as there are neither groins or sea walls on the beach. Yagetta Village is in a small cove and from the satellite images we could see a large, unconsolidated mass of sediments to the NE of the village. There was no obvious cause of their beach erosion, which occurred very quickly and several years prior to Cyclone Winston in 2016. During interviewing the village chief, he happened to mention that they used to have thousands of sea cucumbers (*Holothuriascabra*, sand-fish) carpeting the shallow offshore waters. Their beach began to vanish after they began wholesale harvesting of these animals to sell to Japan and China. We concluded that the sand-fish, which secrete a sticky substance from their skin that causes sediments to adhere to them and which burrow into the sand at night, were stabilizing the offshore sediments and preventing beach erosion. In their absence, there is no longer anything preventing the sediments from being entrained and moved away from the village beach.We concluded that the erosion we investigated had nothing to do with SLR but everything to do with human error in either trying to barricade the beach with rock structures or through ignorance of the importance of *H. scabra* to sediment stability.

Biography

Pamela Matlack Klein received her MS degree from Oceanographic Center of Nova Southeastern University, Dania, Florida, in 1983. She subsequently assisted in the founding of the Coastal Education and Research Foundation and the *Journal of Coastal Research*. Currently she writes a weekly newspaper column and is part of the Portuguese Sea Level Project and the Fiji New Sea Level Project.

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A study on the minimization of concrete sludge and CO_2-Carbonization using lime-water

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Now a day, past several decades of rapid economic growth development of Korea, the various kinds of types and quantities of waste are rapidly increasing even in the consideration of reconstruction of the urban city. This study is making efforts to improve waste recycling for environmental protection concerning of Cop21. Firstly, face on the weathering problem of concrete materials for old buildings considering of producing the WBM (waste building materials). Especially the USW (used concrete waste) consists of over 60% in the WBM. When we recycled USW, it must be passing through the comminution stage. At that time, the fine particles are around 20 to 30 volumes % and mixed with water and many kinds of organic things as wood, plastic etc. The classification and dewatering processes are required to use efficiently slurry generated from recycling processes of construction wastes. The classification tests with 2-inch hydro cyclone were performed using two samples; as-received one and re-dispersed one in water after filtration, the median diameter of underflow product decreased with increasing the pressure, and the diameter was 31.10 at 0.3 MPa with 5% pulp density. The dewatering efficiency increased with increasing pulp density, the water content of underflow product was 48.8% at 0.3 MPa with 8% pulp density. The basic characteristics analysis and pH neutralization experiments were carried out to use of slurry generated from recycling processes of construction wastes. Muscovite and carbonate minerals were main minerals of fine particles, and carbonate minerals increased as particle size was decreased. The neutralized the high pH (about 12) of the sludge supernatant using acid was not efficiency. But, it was could possible that using CO2 gas to neutralize under pH 8.5. And by the XRD analysis, it showed the possibility of the recovering highly purer CaCO3 precipitates.

Biography

Heeyoung Shin completed his PhD in Mechanochemical characteristics of the fine particle during the grinding from Hanyang University, South Korea in 2000. He is currently project manager as Rare-earth mineral beneficiation from beach-sand and Coal Modification Process using LRC. He spent three years as a Research Coordinator in KIGAM branch office on Sophia Antipolis& Orleans science town in France. He took a pleasant experience of a wide eye view of research trends in developing country in the development of appropriate technology project. He carried out several International Cooperative Research Projects in the field of mineral processing in China, Indonesia, Japan, Indonesia and Vietnam.

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Stable carbon isotopes of CH_4 emission from three typical rice fields in China

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[2]University of Chinese Academy of Sciences, China

Little is known about the stable carbon isotopes of CH_4 emission ($\delta^{13}CH_4$emitted) from permanently flooded rice field and double-rice field. CH_4 fluxes and corresponding $\delta^{13}CH_4$emitted under various field managements (mulching, water regime, tillage, and nitrogen (N) fertilization) were simultaneously measured in three typical Chinese rice fields, a permanently flooded rice field in Ziyang City, Sichuan Province, Southwest China, a double-rice cropping field in Yingtan City, Jiangxi Province, Southeast China, and a rice-wheat rotation field in Jurong City, Jiangsu Province, East China, from 2010 to 2012. Results showed different seasonal variations of $\delta^{13}CH_4$emitted from the three fields during the rice-growing season. The values of $\delta^{13}CH_4$emitted were negatively correlated with corresponding CH4 emissions in seasonal variation and mean, indicating the importance of CH_4 production, oxidation and transport associated with isotopic fractionation effects to theδ13CH4emitted. Seasonal variations of $\delta^{13}CH_4$emitted were slightly impacted by mulching cultivation, tillage and N application but highly controlled by drainage. Meanwhile, tillage and N application, especially mulching cultivation, played important roles in mean CH_4 emissions and corresponding $\delta^{13}CH_4$emitted, resulting in low emissions with high values of $\delta^{13}CH_4$. Totally, mean values of $\delta^{13}CH_4$emitted from the three fields were similar, mostly ranging from −60% to −50%, which is in good agreement with previously published data from India and America. The results demonstrated that seasonal variations of $\delta^{13}CH_4$emitted mainly depended on the changes in CH_4 emission from paddy fields and further indicated that the methanogenic pathways, fraction of CH_4 oxidation, and transport isotope fractionation influenced by field managements had important effects on $\delta^{13}CH_4$emitted.

Biography

Guangbin Zhang major study was the processes of CH_4 emission from rice fields with the stable carbon isotope technique combining with microbes (methanogens and methanotrophs) analyses. Recently, he had carried out field experiments to study the mechanism of CH_4 emission from a special kind of rice fields that are permanently flooded with highest fluxes in southeast of China. In addition, pot and incubation experiments were performed to investigate the effect of nitrogen fertilization on production, oxidation and emission of the CH_4 by measuring the stable carbon isotopes, methanogens and methanotrophs. Meanwhile, integrated effects of nitrogen fertilization and straw application on N_2O emission from paddy soils were observed. He is very interested in Soil Ecology, Microbiology, Biogeochemistry, Environmental and Soil Chemistry, and his focus is on the cycling of C and N in the agricultural ecosystem and the responses to global climate change (CO_2 concentration and temperature enrichment).

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Glacial-interglacial SST variations and phytoplankton community changes in a core sediment the East Sea (Japan Sea), S-Korea

Sangmin Hyun and **Bareum Song**
Korea Institute of Ocean Science and Technology, South Korea

A high-resolution organic geochemical study of core E09-08 was conducted to evaluate glacial-interglacial climatic and oceanic changes over the last 500 kiloyears (kyr). The analysis revealed distinct fluctuations during glacial-interglacial periods. In particular, the alkenone-based sea surface temperature (SST) showed typical glacial-interglacial variation, implying glacial-interglacial scale climatic changes in the East Sea. The SST ranged from 8 to 24°C during marine isotope stages (MIS) 8 and 9. n-Alkanes, terrestrial plant biomarkers, also showed distinct glacial-interglacial fluctuations. In general, the total concentration of n-alkanes increased during glacial periods and it decreased during interglacial periods with varying magnitude (Fig. 1). Also, average chain length (ACL) shows glacial-interglacial fluctuation, glacial increase and interglacial decrease except for MIS12, generally correspond to the pattern of total n-alkane fluctuation. Therefore, climate changes during the glacial-interglacial period can alter the n-alkanes concentration. Additionally, marine algal-derived biomarkers of Cholesterol, Brassicasterol and Beta-sitosterol exhibited distinct fluctuation that was especially larger during MIS6 and 8, suggesting that phytoplankton productivity has fluctuated in accordance with climatic changes over the last 500 kyr. This implies that phytoplankton productivity has fluctuated in accordance with the climatic changes since the last 500 kyr. Further, these climatic changes may affect the phytoplankton community in East Sea, in particular during MIS 6 and 8.

Biography

Sangmin Hyun has been studied on Marine Geological fields since he worked at Korea Institute of Ocean Science and Technology(KIOST) in 1997. Main research activities include 1) studying the paleoclimatology and paleoceanography by the GC/MS and biomarkers such as alkenones and n-alkane. In particular, he is interested in low-latitude hydrology and oceanographic changes which is related with global-scale changes.

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Maria da Assuncao Araujo, J Earth Sci Clim Change 2017, 8:10(Suppl)
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PSMSL and GPS data for European stations: Some conclusions

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Satellite altimetry doesn't seem an adequate approach for evaluating sea level changes in coastal areas. The tide gauge trends available at Permanent Service for Mean Sea Level (PSMSL) only give relative sea level information. The calculated trends are strongly affected by the length of the series. On the other side, possible land movements taking place at tide gauge location must be evaluated. Fig. 1A was constructed from the GPS trends for European stations available at SONEL site. There is a clear influence of postglacial isostatic rebound in Scandinavia and northern England. To the south, almost all the stations have negative GPS signals. These subsiding processes will accentuate post-Little Ice Age (LIA) sea level rise. There are some exceptions in southern Europe, where neotectonic movements may produce a localized uplift and GPS trends are quite different on nearby stations (southern Spain: Huelva, Tarifa, Ceuta, fig. 1A). The real "eustatic" component must be understood as the difference between relative sea level changes (tide gauge data) and vertical GPS velocities. The results obtained by this process for all European stations produces an average of 0,996 mm/year. This seems quite plausible and it is similar to the values calculated by Mörner. At SONEL site there are maps showing the combined result of PSMSL with the GPS data for some selected stations. Fig. 1B shows the results for Iberia. For the elaboration of these maps, the ideal situation should be a tide gauge coupled with a GPS station exactly at the same place, or within a very small distance [4]. However, sometimes, the GPS data are obtained from points at a significant distance from the tide gauge stations (10,75km for Huelva, 10,28km for Cadiz). So, the maps of SONEL site must be used with care and some criticism.

Biography

Maria da Assuncao Araujo is working as a Professor in the Geography Department, Porto University, Portugal. Her main interests are in Geomorphology, Quaternary studies, Neotectonics, littoral Geomorphology and Geomorphologic heritage. She completed her PhD from Porto University, 1991 and her thesis is about the geomorphologic evolution of littoral platform at Porto region. Her research on Quaternary marine deposits has evolved into a more recent interest in sea level changes and the interference of neotectonics in coastal development. She has published numerous papers on sea level changes, coastal platforms, and the geomorphology of the Iberian Peninsula. She also presented papers at several international conferences.

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Associations of temperature variation and mortality in seven Japanese prefectures

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Purpose: Few studies have investigated the mortality effects of temperature variation (TV) in Japan. In this study, we used the newly proposed indicators of inter- and intra-day TVs to assess the TV-mortality associations and compare the associations with the contribution of mean daily temperature.

Methods: We collected daily data for temperature and mortality during 1972-2012 from seven major prefectures in Japan, i.e., Hokkaido, Yamagata, Tokyo, Kanagawa, Aichi, Osaka, and Fukuoka. We performed a quasi-Poisson regression analysis combined with a distributed-lag non-linear model. We separated the effect of inter- and intra-day TVs into cold- and heat-related, by calculating only those below and above the minimum mortality temperature (MMT), respectively. The inter-day TV was defined as the relative change in temperature between the current and previous day. The intra-day TV (diurnal temperature range (DTR)) was calculated as the difference between the daily maximum and minimum temperature.

Results: All prefectures showed significant increases in mortality risk associated with mean daily temperature, with a relative risk (RR) reaching 1.148 (95% confidence interval (CI): 1.108, 1.190) for heat in Aichi and 1.462 (95% CI: 1.295, 1.650) for cold in Yamagata. In contrast, inter- and intra-day TVs were mostly insignificant and the effect size was small, with less than 2% risk. DTR was adversely associated with mortality on hot days in Tokyo (RR 1.014; 95% CI: 1.004, 1.025), and Kanagawa (RR 1.014; 95% CI: 1.000, 1.029), and on cold days in Tokyo (RR 1.005; 95% CI: 1.001, 1.010).

Conclusions: We found that the association between mortality and temperature variation is generally small compared with mean daily temperature, although further research is necessary.

Biography

Chaochen Ma is currently pursuing his PhD in University of Tsukuba, Japan. His major is on environmental epidemiology with an interest in the associations of temperature and mortality or mobility, and quantify the effect.

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Impacts of rising sea water temperature on underwater acoustic propagationin the upper layer of the East Sea of Korea

Sehan Lim and **Minki Cheon**
Naval Academy, South Korea

The temperature of the sea is constantly rising due to global warming. In the case of the East Sea of Korea, sea water temperature has risen about 1 over the past 100 years. The rise in sea water temperature in the upper layer is larger than that of the lower layer, and the rise will accelerate more and more over the year. The factors influencing sound velocity in underwater are seawater temperature, salinity, and pressure, which is especially affected by sea water temperature (as seawater temperature rises by 1 , sound velocity is about 3 faster). Thus, the change in seawater temperature causes the change in sound velocity which has mainly effect on underwater acoustic propagation pattern. Underwater sounds are widely used in various fields of the ocean such as echo depth sounder, oceanographic survey, resource exploration, biological signal and noise measurement, navigation, communication. In the Navy, it is used in the acoustic-based naval weapon systems those are a passive and active sonar, torpedoes, mines and etc. The study shows how the rise of sea water temperature caused by global warming affects the underwater acoustic transmission in the upper layer of the East Sea of Korea.

Biography

Sehan Lim is working as anAssociate professorin Department of Oceanography ofRepublic of Korea Naval Academy. He graduated from Korea Naval Academy and completed his PhD from School of Earth and Environmental Science in Seoul National University of Korea. His research areas are meso-scale ocean circulation, mixed layer depth and underwater acoustics.

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Adaptation measures in the process of land consolidation in the Czech Republic

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When introducing adaptation measures in a certain watershed, agro-technical soil management and organizational practices themselves are mostly unable to increase retention capacity substantially. For that reason, it is necessary to apply a complete system of soil conservation measures. In places with high slope length technical and biotechnical soil erosion control practices (primarily of linear character) are necessary. These technical measures are broad base channels, hedges, grassed infiltration belts, ridges with green growing, windbreaks, etc. These biotechnical measures together with the implementation of adjusted and grassed courses of concentrated surface runoff (grassed waterways) create an appropriate network of new hydro lines in the watershed. Biotechnical line elements of soil erosion control serve as permanent barriers or obstacles for water runoff and are designed in order to determine, by their location, the ways of land management. Biotechnical and technical soil conservation measures cannot be applied without respecting property rights. Therefore, it was found suitable to design the system of the soil and water conservation in the process of land consolidation in the Czech Republic. There is a dynamic process of land consolidation that is managed by a 'Land Settlement Board' together with the regional administration, which aims among others at facilitating easier application of landowners' property rights and more efficient land management. The Plan of Common Facilities is a part of Land Consolidation process it is one of the important tools for implementing adaptation measures especially soil and water conservation measures. Recently, the process of complex land consolidation in the Czech Republic has provided a unique opportunity for improving the quality of the environment and sustainability of crop production through better soil and water conservation.

Biography

Miroslav Dumbrovsky is a Professor and Deputy Head of Department of Landscape Water Management in Brno University of Technology and works in the field of Soil and Water Conservation and Land consolidations. He also works on research projects in field of water retention, erosion, land consolidation and soil degradation.

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Alejandro Chamorro et al., J Earth Sci Clim Change 2017, 8:10(Suppl)
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Investigating climate change effects on climatological droughts events modelled as multivariate phenomenon in Hessen, Germany

Alejandro Chamorro and **L Breuer**
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Meteorological droughts, seen as a deficiency of precipitation in a certain period, may have large impacts on human activities and environment. As droughts are characterized by several variables, a better understanding is achieved by analysing it as a multivariate phenomenon. In the present study, we examine meteorological droughts by means of the standardized precipitation index (SPI) and derive from this drought duration and severity. The joint dependency of these characteristics is modelled by a copula function which relates their univariate distribution in a functional relationship. Recurrence intervals as a function of joint duration-severity model and marginal models are built. The analysis covers the observation period 1971-2000 as well as the near future 2021-2050. For this last period, we use downscaled regional climate model (RCM) projections from EURO-CORDEX for three representative concentration pathways (RCP 2.6, 4.5 and 8.5). Comparison between these two periods is carried out to examine the variation in the pattern and the magnitude of drought events in the Fulda catchment, Germany. Results suggest changes in the duration-severity relationships for the different return periods given by changes in the pattern as well as in the magnitudes of duration and severity. These changes depend on the RCM and the RCP considered. We found strong variability in the number of drought events with an increase of up to 4 events and a decrease of up to 8 events comparing future with a present period. Concentration pathway RCP 8.5 shows a clear negative tendency in the number of events, but also more severe events. In this scenario, projected severity increased up to 40% and duration up to 20% by higher return periods which occur in most of the cases were analysed.

Biography

Alejandro Chamorro has a major in Fluid Dynamics and Hydrology. He is working in the University of Giessen, Germany, and is Guest Lecturer in the topics of Atmosphere Dynamics and Hydrology. Currently he is investigating the dynamics of unusual and extreme hydro-climatological events in the context of climate change. Temporal appearance-disappearance patterns as well as drought characterization in several regions are studied for the historical and projected (future) period. In the present study, the changes in the patterns of drought structure are investigated considering various RCM and RCP.

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Temperature effects on acetaminophen toxicity using medaka

Chisato Kataoka, Takahiro Sugiyama, Hikaru Kitagawa and **Shosaku Kashiwada**
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Acetaminophen (n-acetyl-p-aminophenol, AAP) is one of the most widely used over-the-counter drugs for relief of fever and headaches due to its analgesic and antipyretic properties, and a major ingredient in cold/flu remedies. AAP is generally considered safe for human; however, effects of AAP on aquatic organisms is unknown. Release waste including AAP into aquatic environment can pose an ecological risk. Fish is major organisms in aquatic ecosystems and their habitats are classified by temperature. Their physiological activity should be affected by temperature. Hence, toxic effects of AAP on fish will be temperature-dependent. We employed medaka (Oryzias latipes) as a model to see temperature effects on APP toxicity because they have a wide range of temperature-tolerance (4^0C to 35^0C). Medaka larvae were exposed to 50 mg/L of AAP under 15^0C, 25^0C (optimum temperature) or 30^0C for 4 days. Another group of medaka larvae was exposed to 0 mg/L of AAP under same condition as a control. On day 4, full body length of larvae, heart rate (beats/15 s), and relative ATP value were measured. Full body length of larvae and relative ATP value at 30^0C were significantly decreased by AAP exposure, and heart rate at 15^0C was significantly decreased by AAP exposure compared with each temperature control. Then, another group of medaka was exposed to an increased concentration of AAP (150 mg/L) under the same condition. On day 4, the exposed medaka was subjected to hematological analysis and histological analysis. Hematological analysis revealed AAP exposure increased ratio of a deformed red blood cell with increasing temperature. In addition, red blood cells distributed in gills were notably decreased by AAP at 30^0C. Histological analysis of liver showed AAP exposure increased ratio of vacuole with increasing temperature. These data suggested increased temperature caused enhancement of AAP toxicities in medaka larvae.

Biography

Chisato Kataoka is a PhD candidate of Toyo University and received award of Research Fellow of Japan Society for the Promotion of Science. Her research includes Nanotoxicology, Ecotoxicology, Immunotoxicology and intestinal bacteria using medaka fish (Oryzias latipes). She has been working on fish toxicology of nanomaterials including silver nano-colloid and carbon nanotubes since 2013. She has published four papers and one review paper. Through her intensive studies, recently she has received best student presentation awards in international meetings (Aquatic Animals Models of Human Diseases Conference, and Pollutant Responses in Marine Organisms). Her affiliated academic societies are Society of Environmental Toxicology and Chemistry(SETAC), and The Japanese Society of Environmental Toxicology (JSET).

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Emission reduction of non-degradable and non-CO_2 greenhouse gas: Efficient destruction of CF_4 in an excess enthalpy combustor

Dae Keun Lee, Seung Gon Kim and **Dong-Soon Noh**
Korea Institute of Energy Research, South Korea

Background: CF_4 (tetrafluoromethane) being widely used as a cleaning and etching agent in semiconductor or display industry has a large global warming potential. In addition, it is chemically stable so that it is hardly decomposed even below 1600 by thermal methods. As it is usually utilized together with other explosive or toxic gases, it is diluted to around several thousands of ppm by N_2 before being disposed of. This excessive dilution makes it difficult to destruct the waste gas effectively. In this study, we developed an energy-efficient method of CF_4 destruction in an excess enthalpy combustor.

Experiment: An excess enthalpy combustor is a sort of two-section porous medium burner; two silicon carbide honeycombs with different cell sizes but with the same cylindrical shape were axially stacked. The emulated waste gas (CF_4, N_2) and the fuel-oxidant (CH_4, O_2) were fully premixed before being supplied to the combustor. A reaction front of combustion was stabilized around an interface between two honeycombs and the CF_4 inlet and outlet concentrations were measured by FTIR to determine a destruction efficiency of CF_4.

Findings: As a representative result presented in Fig. 1 shows, 94.6% of CF_4 was destructed and chemically transformed to HF, CO_2, and H2O when the inlet CF_4 concentration was 2,150 ppm with the fuel usage of 18 LPM. This fuel usage in the destructing unit volume of CF_4 is much less than that of commercial abatement systems by about 30%. In addition, our combustor attained much higher CF_4 destruction efficiency than the commercial systems.

Conclusion: Our excess enthalpy combustor was found to have an advantage in reducing the greenhouse gas emissions, not only of CF_4 but also of CO_2 via reduced fuel usage.

Biography

Dae Keun Lee is a Principal Researcher at Korea Research Institute of Energy Research (KIER). He received his PhD degree from Korea Advanced Institute of Science and Technology (KAIST). His major concerns are fundamental understanding and practical applications of thermo-chemico and fluid dynamics, especially including combustion, by using mathematical and experimental methods.

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Nitrogen recovery of temperate desert ecosystem enhanced with precipitation and nitrogen deposition increase

Xiaoqing Cui[1], **Ping Yue**[2] and **Xuejun Liu**[1]
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Arid regions have been undergoing global climate change and widespread reactive nitrogen (N) deposition. And N retention as a critical ecosystem function, our understanding about its response to climate and N deposition change is limited especially in the desert ecosystem. Here, we use double-labeled $^{15}NH_4{}^{15}NO_3$ fertilizer (30 and 60 kg N ha^{-1} yr^{-1}) to tracer N fate and N residual under ambient (no water addition) and enhanced precipitation (60 mm water addition) condition in a temperate desert ecosystem in Northwest China. The N retention of plants showed a significantly different response to water and nitrogen addition between years. Soil as the largest pool of N retention, N addition significantly enhanced the N retention of topsoil layer. The whole ecosystem recovery significantly differed between years, in the dry year it was less than 10% and in the wet year, it reached 75% averagely. What's important, the residual N can be up taken by plants when precipitation was enough next year. The two-year accumulated ecosystem recovery could be raised up to 58%. The whole ecosystem recovery significantly enhanced with water addition and had no significant relationship with water addition. So, in future climate and nitrogen deposition change scenario, the plant-soil ecosystem recovery will significantly increase in the temperate desert.

Biography

Xiaoqing Cui has majors in Plant Nutrition and Ecology. She has good expertise in evaluating the ecological impact of climate and nitrogen deposition on desert ecosystem. She has quantified nitrogen fate in a *Haloxylon ammodendron* dominated desert ecosystem. This is of significant importance in evaluating the nitrogen fluxes in arid desert ecosystem under future climate and anthropogenic activity, which is useful for updating nitrogen cycle model in arid regions.

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Climate change prediction based a long short-term memory neural network

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Climate change has been an important global issue since it threatens ecosystems due to its unpredictability. During decades, numerical prediction models, such as MM5, WRF, CALMET, UM, have been developed and popular to predict climate change of regions at which climate data cannot be observed. These numerical models first deal with world-sized terrestrial data, and then they predict regional climate by integrating analyzed data. However, such a numerical prediction model need to be used with caution in an area where has high terrain complexity. The purpose of this study is to design a climate change prediction model based a deep neural network by using real observed climate data for the local area. There are many different types of neural networks that can be applicable to this study. After a deliberate investigation on the structure of deep neural networks, the proposed prediction model is eventually constructed based on a long short-term memory (LSTM) network which is a type of recurrent neural network (RNN). This is because RNN is more proper to climate data than a simple DNN due to time-series characteristics of climate data. The proposed model can predict weather data in advance up to 24 hours. To this end, the model is trained using actual weather data that are collected on an hourly basis for 36 years (from 1981 to 2016). A preprocessing step is applied to select data that more influence weather prediction and to normalize them for the best-fit to LSTM. The performance of the proposed LSTM-based model is measured in terms of the root-mean-square error (RMSE) between the actual temperature and it is predicted one. Consequently, the RMSE is below 1.1 degrees for 24-hours prediction, which is lower or comparable to the DNN-based model. In this study, a recurrent neural network, LSTM, is incorporated to construct a prediction model. This approach is new because the LSTM network is suitable to climate data that has time-varying characteristics. Although the proposed model is evaluated on temperature data here, it can be applied to any kind of climate data such as humidity, wind speed, and rainfall.

Biography

Inyoung Park is a PhD student in School of EECS, Gwangju Institute of Science and Technology, South Korea. She received a BS degree in Computer Application from Bangalore University in 2015. Her current research focuses on speech signal processing and climate change modeling based on deep neural networks.

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Inter-annual variation of aerosol pollution in East Asia and its relation with strong/weak East Asian winter monsoon

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Aerosol has become one of the major air pollutants in East Asia, and its spatial distribution can be affected by the East Asian monsoon circulation. By means of the observational analysis and the numerical simulation, the inter-annual variation of wintertime aerosol pollution in East Asia and its association with strong/weak East Asian winter monsoon (EAWM) are investigated in this study. Firstly, the MODIS/AOD records during 2000-2013 are analyzed to reveal the inter-annual variation characteristics of aerosols. It is found that there is an increasing trend of AOD in East Asia over the last decade. The areas with obvious increasing AOD cover the Sichuan Basin (SCB), the North China Plain, and most of the Middle-Lower Yangtze River Plain in China. Secondly, the EAWM index (EAWMI) based on the characteristic of circulation are calculated to investigate the inter-annual variations of EAWM. The NCEP reanalysis data are used in EAWMI calculation and meteorological analysis. Nine strong and thirteen weak EAWM years are identified from 1979 to 2014. Finally, the effects of strong/weak EAWM on the distribution of aerosols in East Asia are discussed. It is found that the northerly wind strengthens (weakens) and transports more (less) aerosols southward in strong (weak) EAWM years, resulting in higher (lower) AOD in the north and lower (higher) AOD in the south. The long-term weakening trend of EAWM may potentially increase the aerosol loading. The weakening of EAWM should be another cause that results in the increase of AOD over the Yangtze River Delta (YRD) region, the Beijing-Tianjin-Hebei (BTH) region and SCB but the decrease of AOD over the Pearl River Delta (PRD) region. Using the Regional Climate-Chemistry coupled Model System (RegCCMS), we further prove that the intensity of EAWM has great impacts on the spatial distribution of aerosols. More obvious changes occur in lower atmosphere, and the change pattern of aerosol column content in different EAWM years is mainly decided by the change of aerosols in lower troposphere.

Biography

Min Xie received the B. S. degree in 2001 and the Ph. D. degree of Meteorology in 2007 from Nanjing University. He worked as a research assistant in the Hong Kong Polytechnic University in 2007 and 2009, and a postdoctoral research fellow in the University of Hong Kong during 2010 to 2012. Now he is an associate professor in Nanjing University. His research interests include interaction between air quality and climate change in regional scale, natural emission of trace gases in China, meso- and micro-scale modeling on atmospheric environment, and regional environmental impact assessment and planning, etc. He published several papers in these fields.

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Use of «MLCM3» software for flash flood modelling and forecasting in changing climate

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Accurate and timelyflashfloodsforecasting, especially, in ungauged and poorly gauged basins, is one of the most important and challenging problems. In changing climate and variable anthropogenic impact on river basins, as well as due to low density of surface hydrometeorological network, flash flood forecasting based on "traditional" physically based, or conceptual, or statistical hydrological models often becomes inefficient. The developing economy and population safety in changing climate make us to issue warnings based on reliable forecasts. For this purpose, a new hydrological model, MLCM3 (Multi-Layer Conceptual Model, 3rd generation) has been developed in the Russian State Hydrometeorological University. MLCM3 is a rainfall–runoff model with flexible structure and high level of "conceptualization". Model forcing includes precipitation and evaporation data basically coming from NWP model output. Water comes to the outlet through several layers; their number as well as two parameters (thickness and infiltration rate) for each of them, surface flow velocity (when the top layer is full of water) are optimized.The main advantage of the MLCM3, in comparison to the Sacramento Soil Moisture Accounting Model (SAC-SMA) and similar models, is that its automatic calibration is very fast and efficient with less volume of information. For instance, in comparison to SAC-SMA, which is calibrated using either Shuffled Complex Evolution algorithm (SCE-UA), or Stepwise Line Search (SLS), automatically calibrated MLCM3 gives better or comparable results without using any "a priori" data or essential processor resources.For the model calibration, the multi-scale objective function (MSOF) proposed by Koren is used. Other types of objective functions also can be used, such as mean square error, Nash-Sutcliff criterion, and criterion. The presented work was funded by the Government of the Russian Federation (Grant No. RFMEFI58316X0059; the code of the application "2016-14-585-0005-002) for research under supervision of the leading scientists at Russian State Hydrometeorological University.

Biography

Daria V.Sokolova, DinhKha Dang and Vadim A. Kuzmin have experience in forecasting and modeling of rainfalls in conditions of a changing climate. A method has been developed for presenting the results of the background forecasting of rain floods due to the fact that the applicant developed a new software "MLCM3" based on the developments of the RSHU and improved in the project "Development of methodological bases and management technologies Water resources of river systems insufficiently illuminated by hydrometeorological observations (on the example of the Mekong river basin).

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Future warming shifts climatic suitability of native Himalayan tree species

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Statement of the Problem: Climate change (CC) issue attracts attention of global community since the last couple of decades due to its detrimental consequences on social and ecological sectors. CC impacts are forecasted to disrupt most of the global ecosystems, with high altitude regions to become a worst sufferer. Mountains of such elevated regions are fragile ecosystem, and are subject to high impacts from the projected CC, that could affect distribution of existing native vegetation resulted from future unsuitable climate. As a result, vegetation can migrate or shift into areas having climate they can fully tolerate to maintain their growth and survival. The purpose of this study is to model nine native highland plants viz. *Abies spectabilis, Betula utilis, Quercus semecarpifolia, Juniperus indica, Tsuga dumosa, Acer campbellii, Rohododendron campanulatum, Ephedra gerardiana, cassiope fastigiata* so as to visualize the likely landscape of the Himalaya under future warming climate. Methodology & Theoretical Orientation: Analysis was done using CLIMEX niche modeling technique. Two global climate models, CSIRO-MK 3.0 (CS) and MIROCH-H (MR) were used under IPCC A1B and A2 emission scenarios for the year 2050 and 2100. Findings: Climatic suitability of the nine species contracts in areas that are currently suitable while expands in areas that are currently unsuitable. Currently around 1.09 million sq. km. area is climatically suitable. An addition of 0.68 and 0.35 million sq. km. will become suitable by 2050 and 2100 respectively. Cold stress is the main limiting factor for overall expansion of climatic suitability in the region. Conclusion & Significance: Existing climatic suitability of the nine high land native species will substantially shift towards north in the Tibetan Plateau. Such climatic suitability shift could impacts existing nature conservation activities and availability of water and food security in the region. Formulation and implementation of suitable adaptation strategies is necessary to offset such negative implications.

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Cost-effective prioritization of conservation efforts in agricultural landscape under a changing climate

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Habitat fragmentation from human-based activities is the major source of biodiversity loss and ecosystem degradation that compromises an ecosystem's ability to provide the services needed by society to sustain itself and prosper. Climate change may exacerbate biodiversity loss and ecosystem degradation by directly altering natural habitats' ability to host biodiversity and provide ecosystem services and by indirectly changing the frequency and intensity of hazards across landscapes. To prevent biodiversity loss and ecosystem degradation from habitat fragmentation, landscape managers and environmental agencies set conservation goals within a conservation planning approach. My dissertation project aims to improve society's understanding of climate change´s impacts on conservation planning. Specifically, using a cost-effectiveness approach to find the optimal sequential selection of alternative conservation mechanisms with different temporal horizons across a landscape with both natural and working lands. I am currently parameterizing the model in an ecoregion of the Pacific Northwest of the United States.My current research contributes to the conservation planning literature by proposing a framework that incorporates economic optimization methods to examine how alternative mechanisms interact when aiming for cost-effective conservation strategies for identified goals. My research also contributes to the dynamic resource economic literature by incorporating the potential impacts of climate change into a dynamic optimization framework when planning conservation efforts. Lastly, it will contribute to conservation planning through its emphasis on integrating biological, biophysical, economics and planning into one framework that provides information on the tradeoffs among conservation efforts in a cost-effective approach. This research may be useful for landscape managers to attain conservation goals on landscapes or in ecoregions by providing information on tradeoffs among conservation mechanisms in static and dynamic settings.

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A formula for time valuing CO_2 emissions from buildings

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It is argued that substantial reductions of both operational and embodied CO_2 emissions from new buildings are required to help meet climate change objectives.Although it is generally reported that total operational emissions over the lifetime of a building are greater than embodied emissions, they are built up of relatively low annual emissions, typically occurring over anything between 30 and 120 years, whereas the majority of embodied emissions occur at the start of a building's life during the production of materials and components and building construction. Thus building emissions, and in some cases absorptions, as with sequestered CO_2 during the production of biogenic materials such as wood, occur at various times throughout the building life cycle. Therefore, an important issue that needs to be addressed is the time value of these emissions, in other words do emissions that occur now have the same global warming impact as emissions that occur in the future. Or conversely, are emissions avoided now more beneficial than emissions avoided in the future.If emissions can be time valued, it can help decision making when it comes to comparing mitigation measures which have benefits that occur at different times. A formula for time valuing CO_2 emissions is developed, which can be used to compare the impact of options such as building construction using low impact construction materials but with relatively high operational impact and building construction using high impact construction materials but with relatively low operational impact.

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Drought highlights over Africa under climate change using Standard Precipitation Evapotranspiration Index (SPEI)

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This paper assesses the impact of climate change on drought in Africa and selects the vulnerable areas to drought by using Standard Precipitation Evapotranspiration Index (SPEI) as a index for drought monitoring under current and future climate. The paper evaluates a specific set of climate models over Africa on the historical years based on the reanalysis climate data (Era-Interim) and on the future years based on the moderate future scenario RCP4.5 of CMIP5 climate models. Results of this study refer to the characteristic of drought over Africa using the Stander Precipitation Evapotranspiration Index (SPEI) at time scale 12 for month of Dec. during the study period. Results concluded that the first decades were less drought area and the drought increased with time. Frequency of drought (SPEI values ≤ -1) increased in last decades. There are most difference between extreme drought and wet events while the severe and moderate classes were closer. The assessment of the drought impact in Africa needs to determine several systems (water resource, natural vegetation and crops) to quantify the impact of drought in terms of both system's resistance and resilience, to produce drought impact curve for each system and region.

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Climate change impact on inland fisheries: Vulnerability assessment, adaptation and potential mitigation measures

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India is the second largest producer of fish contributing 5.43 percent to the global fish production and is also the second major producer of fish through aquaculture. But in recent years, climate variability manifested by increased temperature, erratic and unseasonal rains, occurrence of droughts, and a regional increase in severe storm incidence in coastal states have adversely impacted the fisheries, aquatic biodiversityand livelihood. The impacts are also evident for freshwater fisheries and fishers of the River Ganga and the water bodies in its plains and deltaic areas. Therefore, any adverse effects of climate change will have great implication on regional food security especially in the eastern Indo-Gangetic states. It is thus imperative to understand the vulnerability, adaptation and mitigation strategies of the sector in dealing with the impacts. The studies on inland fisheries of ICAR –CIFRI, India showedconsiderable geographic shift of several warm water fish species into the colder stretch of the River Ganges. The reproductive and spawning behaviour of the Indian major carps has been impacted and a consequent decline in fish spawn availability has been noticed in Ganges basin. Additionally, effect of drought revealed that rainfall deficits of 29% and 27% during breeding months (March- September) affected 92% fish spawn hatcheries in two selected districts of West Bengal.

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Decomposition analysis of factors influencing emissions and their impact on mitigation targets

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The historic Paris agreement was based on the strong commitment of 196 member countries to mitigate emissions. These human induced emissions are on rise due various reasons including electricity production, transportation, manufacturing and production of goods and services, and agriculture. Hence, a deeper understanding of the driving forces pertaining to energy related CO_2 emissions is very important in formulating future mitigation policies. This paper aims at identifying these factors that have influenced the changes in the level of CO_2 emissions over last two decades. By means of decomposition method, the observed changes are analysed in terms of four factors affecting the emissions - energy intensity, structural changes, emission intensity and economic activities. One of the popular Index Decomposition Analysis (IDA) method Log Mean Divisia Index (LMDI) is used, to decompose factors of emission, due to its theoretical foundation, adaptability, ease of use and results interpretation with zero residual. The paper aims to study major economic sectors of four highest CO_2 emitting developed countries (U.S, Japan, Germany and Canada) as well as four highest CO_2 emitting developing countries (China, India, Russia, South Korea). The analysis is to be based on empirical data ranging from 1990-2014, which will decompose emissions based on sectoral (industry, services and agriculture) trends. It will further develop an understanding of how these changes in drivers, influencing emissions, will impact the mitigation targets committed by countries in their respective INDCs.

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Study on carbon sequestration potential of grassland protection and construction techniques in key ecological type area from northern China grassland

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Statement of the Problem: Under the background of global climate change, the carbon source/sink problem of terrestrial ecosystems has become one of the hot issues in international ecological research. As the largest terrestrial ecosystem, the China's grass land is mostly used for grazing, and unreasonable grazing is considered to be the main incentives lead to last degradation of grassland ecosystem. However, the study on the evaluation of the carbon sequestration potential of the grassland ecosystem in northern China is still relatively less. Therefore, this study is focused on the influence of the conservation and construction techniques (enclosure, clipping and grazing) in main ecological type area from northern China on carbon density, carbon budget and carbon sequestration potential in vegetation-soil ecosystem. Methodology & Theoretical Orientation: Based on random block control experiment, the protection and construction techniques, such as enclosure, clipping and different grazing intensity, were established in different ecological type area, including typical steppe, meadow steppe, desert steppe and sandy steppe, to study the influence on carbon storage in grassland vegetation-soil ecosystem. And the key technical solutions of carbon sequestration potential, carbon increasing potential and enrich carbon sink in different grassland type area are put forward. Findings: The order of carbon sequestration potential in different kinds of grassland is meadow steppe (30.57 kg/m^2)> typical steppe(18.51kg/m^2)>desert steppe(15.84 kg/m^2) >sandy steppe(2.58 kg/m^2); the carbon increase amplitude is meadow steppe(0-25.31 kg/m^2)> typical steppe(0-3.87 kg/m^2)> sandy steppe (0-1.45 kg/m^2); and the carbon increasing potential is typical steppe (1.26 kg/m^2)> desert steppe (0.31 kg/m^2)>sandy steppe (0.20 kg/m^2).In addition, years of enclosure in meadow steppe benefits the carbon sequestration system, but moderate grazing and utilization is good for carbon sequestration in typical steppe, desert steppe and sandysteppe.

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Effects of rainwater harvesting on sunflower growth and optimization of the ridge-furrow ratio with different precipitation in the semi-arid region, Northern China

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The ridge-furrow rainwater-harvesting system (RFRHS) has been an important agricultural practice for improving dependable production and adapting to the warming and drying climate in semi-arid regions.However, the optimum RFRHS is not universal for different crop and precipitation conditions. To determine the optimal sunflower RFRHS under different precipitation conditions in semi-arid regions in Northern China, a 3-year field experiment with 7 treatments was conducted from 2013~2015 in Wuchuan county. This study included 3 ridge-furrow ratio (Rrf) (1.0 m: 1.0 m (R1), 1.0 m: 0.5 m (R2) and 0.5 m: 1.0 m (R0.5)) treatments with film-mulching ridge (M1) and no-mulching ridge (M0), and a flat plot without mulching as the control treatment (CK). The results showed that the film-mulching treatments (M1R1, M1R2 and M1R0.5) effectively promote sunflower growth, soil water storage (SWS) and the actual grain yield (Ya). They increased the available precipitation and improved the SWS, hundred-grain weight and Ya by 0.4%~13.8%, 4.5%~70.2%, and 15.6%~107.5% compared to the CK in 2013~2015, respectively. The results also showed that the optimal Rrf was reduced with increasing precipitation, and there was no need to apply the sunflower RFRHS when the precipitation was more than 588.7mm. The optimum Rrf interval for rainy, normal and dry years was 0.16~0.71, 0.71~1.34 and 1.34~2.77 respectively in Wuchuan County. Considering the actual production condition and the precipitation conditions in Wuchuan, we suggest that M1R0.5 can be promoted in this region. All in all, the study proved that the RFRHS could improve the crop production than the traditional cultivation, especially in arid years, but did not consume more water. So the RFRHS would make positive contribution to sunflower production in the semi-arid regions in Norther China under the warming and drying climate.

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Carbon dioxide emission from infrastructure construction on forest lands in Moscow region

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The paper presents the experimental results on the changes in carbon stocks of ecosystems due to the infrastructure construction on forest lands in the Moscow region. Investigated 11 plots in different parts of the region, those included the construction of roads and electricity transmission lines. Average carbon stocks of soil pool, litter, deadwood and living biomass (aboveground and underground parts) pools of the original forest ecosystems are estimated as 40.5±6.9; 2.9±2.0; 17.2±2.1 and 160.7±77.1 t C ha-1, respectively. Total carbon stocks of forest ecosystems are 221.3±56.0 t C ha-1. The average carbon stocks of the final ecosystems correspond to 26.8±8.2 t C ha-1, of which 24.6±9.0 are in the soil, 0.2±0.2 – in the litter and 2.1±1.0 t C ha-1 – in the living biomass pool. During the construction of roads, the soil carbon stocks reduced (on average by 30.6±4.4 t C ha-1). During the construction of the electricity transmission line, losses of soil carbon were not observed. Taking into account the part of the area under paved roads (where there is a complete removal of soil cover), the losses of the carbon stocks of the initial forest ecosystems averaged to 171.2±41.6 t C ha-1 in total, with losses in soil, litter, deadwood and living biomass pools as follows: 13.6±5.2; 2.8±1.7; 17.2±2.5 and 137.7±51.8 t C ha-1, respectively. Thus, the CO2 emission into the atmosphere from the construction of infrastructure on forest lands in the region is equal to 627.7±152.5 t ha-1 in average.

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Adaptive responses for impacts of climate change in rice paddy

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Statement of the Problem: Small Island states like Zanzibar remains vulnerable to the impacts of natural hazards and climatic extremes. The common impacts of climate change and variability include sea level rise, shoreline erosion, and increased sea surface temperature, ocean current oscillation changes, violent storms, coral reef bleaching, droughts and floods.These impacts affect food availability and accessibility. As a result Agricultural sector in Zanzibar has continually experienced dismal performance such that become impossible to bring sufficient numbers of rural poor above the poverty line. Note that food poverty as high as 41% of the rural population. This situation implies that about one third of rural poor are living on less than US$ 1 a day; also indicates large disparity between urban and rural poor. Various ways have been attempted by policy makers, researchers and farmers at their farm levels to reduce the negative impacts of climate change The farmers now use a scale of priority of rice varieties that provide high economic value. Best varieties for farmers should be resistant to pests and diseases at meantime save water and improve paddy productivity. At the policy level; the Government has set tremendous national adaptation action plans to encounter weather variability in favor of agriculture. Note that agriculture is a strategic sector to support food security, employment and household income. Center of attention of the policy makers is to intensify irrigation scheme and subsiding agricultural inputs. These policy measures were underlined to reduce difficulties that farmers should face towards climatic agricultural related impacts. Take into account that rice is a main staple food for larger section of the population. Finally at technical level; improved rice varieties, innovation, awareness and dissemination were key areas laid by scientists.

Conclusion & Significance: System Rice Intensification (SRI) methodology has increased rice yield from 5.1 to 7.6 tons/ha, less water by 45%, less fertilizer, agrochemical inputs and five improved rice varieties introduced. These particular evidence based lessons have been drawn here in Zanzibar as adaptive response to the impact of climate change..

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