

Mon. Jul 13, 2020

[J] Oral | U (Union) : Union

2:15 PM - 3:45 PM JST | 5:15 AM - 6:45 AM UTC | Ch.1

[U-24] COVID-19, the Earth's Environment and Disaster

convener:Jun Matsumoto(Department of Geography, Tokyo Metropolitan University), Yukihiro Takahashi(Department of CosmoSciences, Graduate School of Science, Hokkaido University), Akira Wada(Tokyo Institute of Technology), Manabu D. Yamanaka(Research Institute for Humanity and Nature / Professor Emeritus of Kobe University), Chairperson:Jun Matsumoto(Department of Geography, Tokyo Metropolitan University)

2:18 PM - 2:30 PM JST | 5:18 AM - 5:30 AM UTC

[U24-01] Population density, personal distance and social distancing in the anthroposphere: Implications from the COVID-19 disaster

★Invited Papers

*Manabu D. Yamanaka¹, Kozan Osamu¹, Kaoru Sugihara¹ (1.Research Institute for Humanity and Nature)

2:30 PM - 2:42 PM JST | 5:30 AM - 5:42 AM UTC

[U24-02] COVID-19 Epidemics and Mobility: Toward New Healthy Living Space

★Invited Papers

*Tomoki Nakaya¹ (1.Tohoku University)

2:42 PM - 2:54 PM JST | 5:42 AM - 5:54 AM UTC

[U24-03] Post COVID-19 and the society in harmony with nature

★Invited Papers

*Hiroya Yamano¹ (1.National Institute for Environmental Studies)

2:54 PM - 3:06 PM JST | 5:54 AM - 6:06 AM UTC

[U24-04] **Preparing for compound disasters of infectious disease and natural hazards**

★Invited Papers

*MASAKO YONEDA^{1,2}, Akira Wada³ (1.Science Council of Japan, Keio University, 2.Japan Academic Network for Disaster Reduction, Representative Director, 3.Tokyo Institute of Technology)

3:06 PM - 3:18 PM JST | 6:06 AM - 6:18 AM UTC

[U24-05] Post corona society and human geoscience

★Invited Papers

*Akihiko Kondoh¹ (1.Center for Environmental Remote Sensing, Chiba University)

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Introduction

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[U24-01] Population density, personal distance and social distancing in the anthroposphere: Implications from the COVID-19 disaster

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[U24-05] Post corona society and human geoscience

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Discussion

Population density, personal distance and social distancing in the anthroposphere: Implications from the COVID-19 disaster

*Manabu D. Yamanaka¹, Kozan Osamu¹, Kaoru Sugihara¹

1. Research Institute for Humanity and Nature

Since the creation of organisms on the earth, the viruses have been concerning the mutations and evolutions of species, which selected multicellularity, gregariousness, and sociality as humans have. Infection at animal groups has extended viruses' possibility of survival, reproduction and evolution, which results in their coexistence with selected animal species including humans. In particular spatially varying environment with sufficient fresh (river and rain) water around the coastline makes various organisms survive. The coastal regions with biodiversity are suitable for fishery, agriculture and traffic for humans. Not viral but bacterial epidemics forced European to colonize Asian coastal regions and exploited their bioresources. The uneven distribution of human population is essential in the present pandemic, and should be studied also from earth-system and -environmental viewpoints.

We found out that the total cases (a sum of infected, recovered/deceased numbers) of COVID-19 in Japanese 47 prefectures, Indonesian 34 provinces, European 54 countries and US 55 states/territories are principally proportionate to the population density (see Figure), of which the inverse square root corresponds to "mean personal distance" (MPD). For the whole humans over the global land, MPD is $(7.7 \text{ billion} / 150 \text{ million km}^2)^{-1/2} \approx 140 \text{ m}$, which is similar to an Indonesian peatland. However, Asian megacities such as Tokyo (12 m) and Jakarta (8 m) have a very short MPD, which is only a few times of so-called social (or physical) distance (1~2 m) for contagious infections. This infection process is similar to aerosol/cloud formation, which should be studied by biometeorology or environmental medicine.

The proportionality factor increases gradually up to $\sim 1 \text{ km}^2$ corresponding to an area where everyone would be eventually infected. The value is somewhat larger in Indonesia than in Japan, and seems to be much larger ($\sim 10^2 \text{ km}^2$) for the states of US. In Europe smaller countries ($< 100,000 \text{ km}^2$) are similar to US, while larger countries (Italy, Spain, France, UK, Germany and Russia) are far larger than the common regression line. Variabilities are due to possible evolutions of virus, medical collapse, number of test, shopping area of necessities, and so on. These features are not inconsistent with an important fact that only 20% super-spreaders are responsible for transmission.

The SIR model predicting the infection for closed ('lockdown') people does not concern the spatial size, and its nonlinear governing equations do not yield a simple solution ($I + R$) for the final number of infected people. This study provides the final size experimentally, and accumulations of similar studies should improve the model and our understanding of pandemic infection processes.

The implications of "social distancing" techniques for sustainability are discussed on the population-area diagram. The risk of megacity due to its broadness without empty spaces should be suppressed by reconstruction of urban functions with a "townier social distance" around 1 km. Otherwise decentralization such as in Tokugawa Japan, which led development of industries and human resources, should be reestablished with the modern computer network. These strategies may contribute to general disaster prevention.

Figure. Total cases (= infected + recovered + deceased) of COVID-19 in (a) Japanese 47 prefectures, (b) Indonesian 34 provinces, (c) US 55 states (+ district = territories) and (d) European 54 countries (classified by WHO) every day during March 18-31 (violet), April 1-30 (blue) and May 1-31 (green), plotted in terms of "mean personal distance" (MPD, defined by the inverse square root of population density) on log-log diagrams. A slant dashed line indicates a -2 power law of MPD (that is, a proportionality to the population density), and shifts upwards/downwards with increasing/decreasing the area where everybody infected.

Keywords: COVID-19, Anthroposphere, Population density, Personal distance, Social distancing, Decentralization

COVID-19 Epidemics and Mobility: Toward New Healthy Living Space

*Tomoki Nakaya¹

1. Tohoku University

The relationship between human health and mobility, which underlies our daily lives, is one of the major research topics in health geography. Here, I intend to consider the impact of the COVID-19 epidemic in terms of human mobility. First, what spatial movements of people underlay and could control the epidemic of COVID-19? Various restrictions on movement (such as border control, requests for self-isolation, and lock-down) were implemented as measures to control the epidemic in various society; suppression of mobility to maintain health. With the wide-availability of mobile big data associated with the spread of smartphones, the relationship between human mobility, person-to-person contact and the trend of the COVID-19 epidemic has been discussed on an unprecedented scale throughout the world. The reduction size of the movement of people under the epidemic in Japan will be summarized from mobile big data sets. Second, how did the COVID-19 epidemic affect human health through reduced mobility and lifestyle change? A social survey conducted with my collaborators revealed that the worsening economic conditions of individuals were associated with fewer outings, fewer exercise, more sitting time, and worsening mental health, with disparities between occupational groups. Third, what impact do they have on the daily living space in the post-COVID-19 epidemic? Or how should our living space be changed? A new way of life that restricts access to public space and avoids human-to-human contact poses many challenges mainly to metropolitan areas that are highly dependent on public transport system and are extremely dense with the rich opportunities of contacts. On the other hand, health research in urban spaces related to human mobility (in particular, studies on walkability) has shown that maintaining infrastructure including public transport by keeping the density of people's dwellings and opportunities for activities has public health value as well as reducing environmental loads. Face-to-face contacts also have functions that cannot be substituted by telecommunication in building social relationships and creativity. With the development of positioning information services that contribute to both surveillance and mobility support, there is an unprecedented opportunity to reexamine the scope of mobility and social contact needed, and hence the space design that supports our health and reduces health disparities.

Keywords: Human mobility, contact, health disparities, mobile big data, geography

Post COVID-19 and the society in harmony with nature

*Hiroya Yamano¹

1. National Institute for Environmental Studies

I present two perspectives after overcoming COVID-19 in terms of establishing the society in harmony with nature. The first includes the holistic "One Health" approach to achieve healthy environment, animal and human, through biodiversity conservation and management. The second includes to establish "regional circular and ecological sphere" to make sustainable use of regional resources such as natural capital and ecosystem services. As the transformative change (e.g., remote work and shrinking transport) is progressing rapidly, now may be the time to plan to incorporate these perspectives into social/economic recovery in the post COVID-19 society.

Keywords: post COVID-19, society living in harmony with nature, One Health, novel emerging infectious disease, biodiversity conservation, regional circular and ecological sphere

Preparing for compound disasters of infectious disease and natural hazards

*MASAKO YONEDA^{1,2}, Akira Wada³

1. Science Council of Japan, Keio University, 2. Japan Academic Network for Disaster Reduction, Representative Director, 3. Tokyo Institute of Technology

Japan Academic Network for Disaster Reduction (58 academic societies) announced "An urgent message to citizens: Preparing for compound disasters of infectious disease and natural hazards".

From summer to autumn in Japan, heavy rainfalls, heatwaves and typhoons often bring dangerous effects on our daily life. Damaging earthquakes occur almost every year. While protecting ourselves from this virus, we need to be vigilant against incoming natural hazards. We need to find different ways in evacuation considering the high risk of virus infection.

Considering after Corona, there is no magic wand that can both prevent disasters and prevent infectious diseases. Japan's population is expected to be half in 100 years. As the population changes from increasing to decreasing, it is important to change the policy of land use and move the town to areas where the risk of natural disasters is low.

Keywords: compound disasters, natural hazards, the risk of infection in evacuation, after Corona, decrease in population, the policy of land use

Post corona society and human geoscience

*Akihiko Kondoh¹

1. Center for Environmental Remote Sensing, Chiba University

The role of human geoscience as a discipline of human-nature interface, is to present a sustainable society based on the holistic understandings of earth society and the transdisciplinarity.

After Budapest declarations in 1999, we in Japan experienced Great East Japan Earthquake and currently pandemic of new corona, we have to proceed to practical stage for sustainable society. The pandemic provides us a great trigger to transformation.

Keywords: post corona society, human geoscience, Sustainable Development Goals, Future Earth, transdisciplinarity, human dimensions