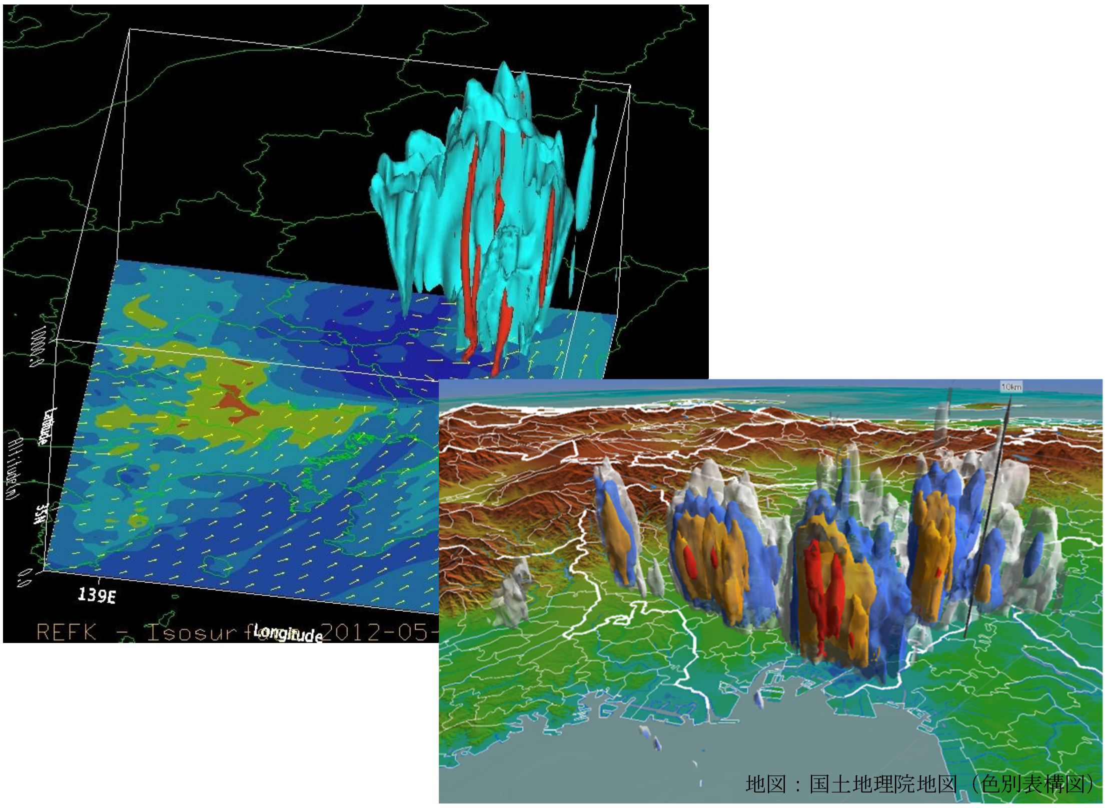
Second International Workshop on Tokyo Metropolitan Area Convection Study for Extreme Weather Resilient Cities
(TOMACS/RDP)

Abstracts



Date: 26-27 November, 2014

Venue: Tokyo Big Sight, Room 608

Organizers : National Research Institute for Earth Science and Disaster Prevention, Meteorological Research Institute

Cosponsered by World Meteorological Organization

November 26 (Wednesday), 2014	
9:30-10:00	**Registration** (Room 608)
10:00-10:15	**Opening remarks** Tsuyoshi Nakatani (Principal Investigator of TOMACS)
10:15-11:40	**Session 'Observation 1'** (Chair: A. Adachi, MRI) (Room 608)
	Observation of the Phased Array Radar(PAR) and system simulation of the MP-PAR *Tomoo Ushio, Hiroshi Kikuchi, Wu Ting, Shigeharu Shimamura, Tomoaki Mega, Masakazu Wada, Fumihiko Mizutani and Nobuhiro Takahashi (*Osaka University)
	Propagation of gust front observed by the surface dense observation network on August 11, 2013 *Keiko Norose, Fumiaki Kobayashi, Hirotaka Kure and Toshiaki Morita (*NDA)
	Cumulonimbus turret observation using 95GHz W-band Cloud Radar in Boso Peninsula, Japan Taro Kashiwayanagi, Fumiaki Kobayashi, Takumi Okubo, Mika Yamaji, Akihito Katsura, Toshiaki Takano and Tamio Takamura (*Chiba University and Japan Radio Co., Ltd.)
	Measurement of wind velocity over ocean using an unmanned aerial vehicle *Ryohei Misumi, Hiromu Seko and Hirofumi Sugawara (*NIED)
	A polarimetric analysis of the 24 June 2014 Tokyo hailstorm *Hiroshi Yamauchi, Ahoro Adachi, Yoshinori Shoji and Eiichi Satoh (*MRI)
11:40-13:10	**Lunch Break**
13:10-14:50	**Session 'Observation 1', continued and 'Nowcast'** (Chair: H. Yamauchi, MRI) (Room 608)
	Estimation of Rainfall Rate from Polarimetric Radar Measurements at Attenuating Frequency Based on the Self-Consistency Principle *Ahoro Adachi, Takahisa Kobayashi and Hiroshi Yamauchi (*MRI)
	Orographic Precipitation Observation in Jeju Island, Korea (2014) *Dong-In Lee, Byung-Gul Lee, and Jong-Kil Park (*Pukyong National University)
	High resolution nowcasting and social experiments Daniel Schertzer (Université Paris-Est)
	The Toronto Pan American 2015 Games Urban Forecasting Project. Paul Joe (Environment Canada)
	Analysis of Tokyo Severe Weather Using the Canadian Radar Decision Support System Paul Joe (Environment Canada)
14:50-15:10	**Coffee Break**

15:10-16:00	**Session 'Nowcast'** (Chair: Ryohei Misumi, NIED) (Room 608)
	Comparison of rainfall nowcasting derived from STEPS model and JMA forecast datasets *Shakti, P.C., Ryohei Misumi, Tsuyoshi Nakatani, Koyuru Iwanami, Masayuki Maki and Alan Seed (*NIED)
	High-resolution Precipitation Nowcasts Makoto Nishijima (JMA)
	Development of Nowcasting System of High Winds using X-Band Radar Network. Minoru Inoue and Motohiro Honma (DPRI)
16:00-16:20	**Session 'Social Experiment'** (Chair: Ryohei Misumi, NIED) (Room 608)
	The Significance and Issues of Social Experiments in the X-band MP Radar Information. Isao Nakamura (Toyo University)

November 27 (Thursday), 2014	
9:30-10:00	**Session 'Observation 2'** (Chair: H. Seko, MRI) (room 608)
	A Study on Optimum GPS/GNSS Receiver Network for the Monitoring of Severe Local Storms *Yoshinori Shoji, Wataru Mashiko, Hiroshi Yamauchi and Eiichi Sato (*MRI)
	Introduction of Convective Cloud Area Detection and Next Generation Satellite "HIMAWARI-8" *Yasuhiko Sumida, Takahito Imai and Kouki Mouri, (*Meteorological Satellite Center, JMA)
10:00-11:30	**Session 'Data Assimilation'** (Chair: Y. Shoji, MRI) (room 608)
	Assimilation of rain estimated by multi-polarization radar for the tornadoes outbreak on 6 May 2012 *Sho Yokota, Masaru Kunii, and Hiromu Seko (*MRI)
	Radar data assimilation using X-band multi-parameter radar network around Tokyo metropolitan region, Japan-3DVAR with Incremental Analysis Update for a tornadic storm observed around Tsukuba on 6th May 2012 – *Shingo Shimizu, Koyuru Iwanami, Shin-ichi Suzuki and Takeshi Maesaka (*NIED)
	Assimilation Experiments of Refractivity Data Obtained by JMA-Operational Doppler Radar Hiromu Seko (MRI)
	Observing system impact studies down to the grey zone with the WRF-NOAH-MP-HYDRO model: Potential applications to TOMACS Volker Wulfmeyer (University of Hohenheim)
	Intercomparison testbed of convective scale data assimilation systems for a TOMACS observed rainfall event *Kazuo Saito, L. Duc, T. Kawabata, S. Yokota, S. Origuchi, T. Tsuyuki and H. Seko (*MRI)
11:30-13:00	**Lunch Break**
13:00-14:30	**Session 'Urban Weather'** (Chair: N. Seino, MRI) (room 608)
	Observations and urban simulations for TOMACS heavy rainfall cases *Naoko Seino, Hirofumi Sugawara, Ryoko Oda, and Toshinori Aoyagi (*MRI)
	Relationship between rainfall distribution, surface wind and precipitable water vapor during heavy rainfall occurred in central Tokyo in summer *Yoshihito Seto, Hitoshi Yokoyama, Haruo Ando, Nobumitsu Tsunematsu, Tsuyoshi Nakatani, Yoshinori Shoji, Kenichi Kusunoki, Masaya Nakayama and Hideo Takahashi (*MRI and Tokyo Metropolitan University)
	Modeling of the 26 August 2011 extreme precipitation event over Tokyo with Canada's subkm-scale Global Environmental Multiscale (GEM) model *Stéphane Bélair, Sylvie Leroyer, and Lubos Spacek (*Environment Canada)
	ARPS simulations of summer convection in Japan: skill scores for TOMACS domain and datasets *Augusto José Pereira Filho and Felipe Vemado (*Universidade de São Paulo)
14:30-14:50	**Coffee Break**

14:50-15:35	**Session 'Urban Weather'** (Chair: Y. Shusse, NIED) (room 608)
	Dallas Fort Worth Network, and the Urban Hazard Mitigation: Tornado, hail, flooding and high winds all in the same urban region *V. Chandrasekar and the full DFW Urban demonstration Network team (*Colorado State University)
	Early detection of baby rain cell aloft in a severe storm and risk projection for urban flash flood Eiichi Nakakita, Kosei Yamaguchi, Ryuta Nishiwaki and Hiroyuki Yamabe (*DPRI)
15:35-15:40	**Closing** (Kazuo Saito, MRI) (room 608)
15:40-15:50	**Break**
15:50-16:40	**Business meeting** (room 608)

DPRI: Disaster Prevention Research Institute Kyoto University

JMA: Japan Meteorological Agency

NDA: National Defense Academy of Japan

NIED: National Research Institute for Earth Science and Disaster Prevention

MRI: Meteorological Research Institute

Observation of the Phased Array Radar (PAR) and system simulation of the MP-PAR

Tomoo USHIO[1], Hiroshi KIKUCHI[1], Wu TING[1], Shigeharu SHIMAMURA[1], Tomoaki MEGA[1], Masakazu WADA[2], Fumihiko MIZUTANI[2], and Nobuhiro TAKAHASHI[3]

[1]Osaka University,
[2]Toshiba,
[3]National Institute of Information and Communications Technology

A new Phased Array Radar (PAR) system for meteorological application has been developed by Toshiba Corporation and Osaka University under a grant of NICT, and installed in Osaka University, Japan in 2012. The phased array radar system developed has the unique capability of scanning the whole sky with 100m and 10 to 30 second resolution up to 60 km. The system adopts the digital beam forming technique for elevation scanning and mechanically rotates the array antenna in azimuth direction within 10 to 30 seconds. The radar transmits a broad beam of several degrees with 24 antenna elements and receives the back scattered signal with 128 elements digitizing at each elements. Then by digitally forming the beam in the signal processor, the fast scanning is realized. After the installation of the PAR system in Osaka University, the initial observation campaign was conducted in Osaka urban area with Ku-band Broad Band Radar (BBR) network, C-band weather radar, and lightning location system. The initial comparison with C band radar system shows that the developed PAR system can observe the behavior of the thunderstorm structure in much more detail than any other radar system. The observed high temporal resolution images of the severe thunderstorm are introduced, showing the potential capabilities of the PAR system. The correlation coefficient of the reflectivity in PAR with C band radar ranges from 0.6 to 0.9 as a function of the distance from the PAR.

Propagation of gust front observed by the surface dense observation network on August 11, 2013

Keiko NOROSE[1], Fumiaki KOBAYASHI[1], Hirotaka KURE[2], and Toshiaki MORITA[2]

[1]National Defense Academy,
[2]Meisei Electric

On the evening of 11 August 2013, a severe thunderstorm passed over Takasaki and Maebashi city, Gunma prefecture, and produced gusty wind damages. The change of surface weather elements was recorded by the surface dense observation network “POTEKA” (Point Tenki Kansoku) when the gust occurred. The surface dense observation network POTEKA started in Gunma Prefecture from July 2013 (Maeda et al.2014), the compact weather stations were set up densely at primary schools and convenience stores. In this study, we follow the development and propagation of gust front and downburst through the analysis of features of pressure field observed by POTEKA. The temporal change of surface pressure, observed in the damage area, showed two times of pressure jump, such as a downburst and preceding gust front. According to the damage occurrence time and gust record at the meteorological observatory, the second pressure jump coincided to the time of both the damage and gust. The cause of the damage was concluded the downburst by using POTEKA data.

Cumulonimbus turret observation using 95GHz W-band cloud Radar in Boso Peninsula, Japan

Taro KASHIWAYANAGI[1,3], Fumiaki KOBAYASHI[2], Takumi OKUBO[2],
Mika YAMAJI[2], Akihito KATSURA[2], Toshiaki TAKANO[1], and Tamio TAKAMURA[1]

[1]Chiba University,
[2]National Defense Academy of JAPAN,
[3]Japan Radio Co., Ltd.

Simultaneous observations of cumulonimbus initiation using a 95GHz W-band cloud radar, an X-band radar, the MTSAT-1R rapid scan and photogrammetry were conducted during the summer in 2012 in Kanto Region, Japan to understand convection initiation and structure of cumulonimbus turrets.

During these observations, the vertical pointed cloud radar, which can detects high-resolution and high-sensitive reflectivity and Doppler velocity, was installed in the middle of Boso Peninsula, where cumuli and cumulonimbi frequently generate in mid-summer season. The X-band radar, which was installed at the National Defense Academy in Yokosuka, observed reflectivity and Doppler velocity horizontally above the cloud radar site. Daytime cloud images above Boso Site were also captured by still camera every one minute from Yokosuka site.

In this presentation, we show the analysis of the cumulonimbus turret generation above the W-band cloud radar on 30 August 2012. The W-band radar detected the first echo from the cumuli just 20 minutes before the first cumulonimbus turret generation. The reflectivity of the echo was about -35dBZe at 1.5 km ASL. A strong updraft of over 6m/s was observed at 1.8 km ASL when the initiation of the first cumulonimbus turret generation was captured still camera.

Measurement of wind velocity over ocean using an unmanned aerial vehicle

Ryohei MISUMI[1], Hiromu SEKO[2], Hirofumi SUGAWARA[3]

[1] National Research Institute for Earth Science and Disaster Prevention,
[2]Meteorological Research Institute,
[3]National Defense Academy

In TOMACS, an unmanned aircraft system (UAS) for boundary layer observation has been developed since 2012. The aircraft has a wingspan of 4.6 m and a weight of about 50 kg, and can fly up to the 5,000 m level at an air speed in 90 - 110 km h-1. Temperature and relative humidity are measured by Meisei RS-06G radiosonde installed under the wing, and wind velocities are calculated from the difference between the vectors of true air speed and the velocity relative to the ground. In presentation, we will show the preliminary results of UAS observation over Sagami bay, and comparison with pilot balloon observation.

A polarimetric analysis of the 24 June 2014 Tokyo hailstorm

Hiroshi YAMAUCHI[1], Ahoro ADACHI[1], Yoshinori SHOJI[1], and Eiichi SATO[1]

[1]Meteorological Research Institute

A severe heilstorm was observed in Tokyo, on 24 June 2014. The storm brought down 1 - 3 cm size hailstones with accumulation of more than 10cm in localized area. The storm is analyzed using volumetric PPI and RHI observations conducted by the MRI Advanced C-band Solid-state Polarimetric Radar (MACS-POL) every 2.5 minutes. The storm showed multicellular structure with slow propagation speed of 8.5 kmh^{-1}, persisted for over 2 hours. Polarimetric analysis reveals that hailstones were generated around the strong updraft region indicated by Zdr colomn and fell down to the ground in the downdraft region backward as viewed from the storm propagation direction. Groupels or ice crystals which were not grown to be hail flew up to the higher level and drifted forward to the storm propagation direction. Those light particles could fall down into warm inflow to be recycled to grow hail.

Estimation of rainfall rate from polarimetric Radar measurements at attenuating frequency based on the self-consistency principle

Ahoro ADACHI[1], Takahisa KOBAYSHI[2,1] and Hiroshi YAMAUCHI[1]

[1]Meteorological Research Institute,
[2]Central Research Institute of Electric Power Industry

A method for estimating rainfall rate from polarimetric radar at attenuating frequency was developed. The algorithm was developed based on the self-consistency principle but was expanded to take into account the attenuation effect by describing the interrelation between polarimetric measurements along the range profile. The proposed algorithm needs no external reference data such as 2DVD measurements for attenuation corrections because it retrieves the co-polar and differential specific attenuation from the interrelation among the polarimetric measurements.

The performance of this algorithm was evaluated by comparison with optical disdrometers and a weighing precipitation gauge. The evaluation of the algorithm showed fairly good agreement between the retrieved rain parameters including reflectivity, differential reflectivity and rainfall rate from actual C-band polarimetric radar data and those obtained by surface measurements. We have also confirmed that the proposed method is applicable for X-band polarimetric radar measurements.

Orographic precipitation observation in Jeju Island, Korea, 2014

Dong-In LEE[1], Byung-Gul LEE[2], and Jong-Kil PARK[3]

[1] Department of Environmental Atmospheric Sciences,
[2] Department of Civil Engineering,
[3] School of Environmental Sciences Engineering

To understand kinematic and thermal structures of orographic enhanced precipitation systems comprehensively, we performed intensive field observation around Mt. Halla in Jeju Island (33.21°N and 126.32°E, width 78 km and length 35 km) which is located at the southern part of Korea. We installed and arranged the observational instruments such as, AWS, radiosonde, 9 Parsivels, 2DVD, 3 ultrasonic anemometers, and 14 raingauges along the altitudes in Jeju Island (17 June - 15 July 2014). Each disdrometer site was located in a radial line from east to west, northwest to southeast, and northeast to southwest in Jeju Island. We analyzed microphysical properties and precipitation process using RDSD data and kinematic characteristics of precipitation by dual Doppler radar analysis using S-band radars in KMA which were located in Gosan (33.17°N 126.09°E) and Seongsan (33.23°N 126.52°E) in Jeju Island.

We analyzed two precipitation cases on 6 and 9 July 2014, which were originated from the Changma front and Typhoon Neoguri, respectively. In both cases, the accumulated precipitation was recorded over 100 mm. However, there is a marked difference in moving direction (case1-from west to east, case2-from southeast to northwest), rainfall distribution and amount of precipitation systems. From the DSD analysis, more precipitation was recorded from leeside than the frontal side of the mountain in case 1. Especially, occurrence of break up process was verified from frontal side, while coalescence process observed at leeside. On the other hand, in case 2, more precipitation was recorded in frontal side than the leeside side. Also the characteristic of microphysical process of collision-coalescence was definitely observed.

High resolution nowcasting and social experiments

Daniel SCHERTZER[1]

[1]Université Paris-Est

The European RainGain project to increase city resilience to floods has been rather focused until now on the scientific and technological issues of getting reliable high-resolution rainfall data.

It is now step by step considering their large scale use by a wide range of stakeholders, in particular with the help of platforms designed for a large dissemination of these data and related nowcasts. It already points out the necessity to revise the present social experiments that do not yet take into account the availability of this type of information.

The toronto Pan American 2015 games urban forecasting project

Paul JOE[1]

[1]Environment Canada

The city of Toronto will host the Pan and Parapan American Games in the summer of 2015. Given the current standard of expectations for safety and security of the public, Environment Canada is providing enhanced public weather services of venue severe weather warning and air quality forecasts. Following the scientific success of the SNOW-V10 Research Demonstration Project, an international World Meteorological Organization nowcasting project, a national science project is being developed to accelerate, align and showcase the internal research and development projects. Toronto lies along the northern shore of Lake Ontario and the initiation of convective weather is strongly affected by the presence of the lake breeze. A dense mesonet (55 stations collecting 1 minute data) and remote sensing system (that are planned to include multiple doppler lidars, rapid scan radars) is deployed to quantitatively measure the characteristics strength of the lake breeze in order to link the initiation of convection to the storm severity. An innovation of the high resolution NWP (250 m) mesonet is the deployment of black globe thermometers to measure and predict heat stress. This provides a new capability for the development of high impact weather-health weather services. Air quality is another focus is air quality which will be enhanced with a a 2.5 km resolution air quality model and verified by air quality observations. Both will be used by local health authorities in a demonstration and research mode.

Analysis of Tokyo severe weather using the Canadian Radar decision support system

Paul JOE[1]

[1]Environment Canada

The Canadian Radar Decision Support System (CARDS) is an advanced radar processing system used operationally in Environment Canada. It is designed to analyze many radar and produce automated products for use by a single severe weather forecaster. The products include automated detection of thunderstorm cells, mesocyclones, downbursts, bounded weak echo regions and many other products. The severe weather features are quantified and integrated in a fuzzy logic fashion to identify the most severe cells. The expertise of the forecaster is assumed and supported by diagnostic cell specific products that can be quickly examined to determine a refined severe weather warning. Examples of the use of the system will be presented with the TOMACS data.

Comparison of rainfall nowcasting derived from STEPS model and JMA forecast datasets

Shakti P.C.[1], Ryohei MISUMI[1], Tsuyoshi NAKATANI[1], Koyuru IWANAMI[1], Masayuki MAKI[2], and Alan SEED[3]

[1]National Research Institute for Earth Science and Disaster Prevention,
[2] Kagoshima University
[3] Bureau of Meteorology

Quantitative precipitation estimation and their nowcasting (very short–range forecasting) are important components to minimize or manage flash flood and its associated disasters since precipitation is the main input. There are different type of techniques are available for nowcasting of rainfall. In this research, we use Short Term Ensemble Prediction System (STEPS), one of the most advanced Quantitative Precipitation Forecast (QPF) systems currently available.

Multi parameter (MP) radar data (0.5-km-resolution) and Japan Meteorological Agency (JMA) radar rainfall data (1-km-resolution) of different periods over the Kanto region, Japan were used in STEPS to generate ensembles nowcasting of rainfall. We obtained 30 members of ensemble rainfall nowcasting for each time steps of the selected periods and performed the verification test. Different types of skill scores were tested between observed and forecasted data. Skill scores showed that STEPS gave a good forecast for less than one hour. More detail, STEPS nowcast and JMA forecasted rainfall data set were checked with gauged data to compare their performances. Detail statistical analysis carried out and results shows that an ensemble rainfall nowcasting from the STEPS model seems good with real time data, which could be interesting to use them in hydrological model.

High-resolution precipitation nowcasts

Makoto NISHIJIMA[1]

[1]Japan Meteorological Agency

The Japan Meteorological Agency (JMA) began to operate a new short-term precipitation forecast “High-resolution Precipitation Nowcasts" (HRPNs) in August 2014. HRPNs provide analysis and prediction of precipitation intensity and five-minute accumulation of rainfall along with prediction-error estimation with a spatial resolution of 250 m covering the period up to 30 minutes ahead every 5 minutes.

Observation data of precipitation derived from 20 Doppler radars operated by JMA, 38 X-band radars (XRAIN) managed by Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and almost 10,000 raingauges combined with atmospheric profile data based on windprofiler and radiosonde observation are used to analyze a three-dimensional structure of the precipitation area.

Forecasts of precipitation are calculated from analyzed values using not only kinetic techniques such as pattern-matching but also dynamical methods including one-dimensional vertical convection model and prediction of the development of new storm cells.

HRPNs images are displayed on the JMA's website designed to help users perceive the distribution and movement of heavy rainfall quickly. Computer-readable data are also provided to other organizations including private weather service operators.

Development of nowcasting system of high winds using X-band Radar network

Minoru INOUE[1] and Motohiro HONMA[1]

[1]Disaster Prevention Research Institute Kyoto University, Kyoto Univ.

In a transportation system or a construction site, damage caused by a high wind occurs frequently. For reduction of the high wind disasters, the improvement of the prediction technique of the high wind area is required, but it is difficult to predict the local high wind area by physical models with rapidly at present. The technique to predict the movement of the high wind area kinematically is considered as one of effective means to substitute for it. The purpose of this study is to develop a nowcasting system of high winds using the monitoring data of X-band radar network. The result of the example verification is shown and the summary of nowcasting system of high winds in the temporary operation is presented as follows.

The significance and issues of social experiments in the X-band MP Radar information

Isao NAKAMURA[1]

[1]Toyo University

1. Expanding the use of the information of X-band MP radar

The information of X-band MP radar is published in a web site of the Ministry of Land, Infrastructure, Transport and Tourism. And several services which predict the rainfall using this data have started. For example, Japan Weather Association launched the "rain clouds forecast by X-RAIN" in March 2014, and Japan Meteorological Agency started a "High-resolution Precipitation Nowcasts" from August 2014. Furthermore the Japan Weather Association has released the iOS app called "sky radar", which informs rainfall in advance through the "push notification" system of mobile phone.

2. The difficulty of usage of information for disaster prevention and the position of social experiments

However, to use this X-MP radar information efficiently, there are various problems. In fact, at the time of heavy rain in Hiroshima (2014), the information was not utilized enough while this system captured the heavy rain. The information for disaster prevention has three processes to use in a society; ①production of the information, ② processing and transmission and ③its utilization. All these processes are indispensable for the disaster prevention information working well in a society. Our research grope on the social experiments is responsible for the third process. For new disaster information, it is necessary to transfer the data with the needs of the user and to make the situations of the receivers easy to use it.The social experiments have been carried out in the four study fields on water related disaster preventions; ① Rescue Service (flood-fighting activities of the fire department),②Risk management (disaster management of flood and landslides of municipalities, safety management of the river park), ③ Social Infrastructure(service management of the railway company, site management of the construction company) and ④the Education and daily life of the people.

3. Some Findings

In the risk management field, we made a multi-purpose early warning equipment in order to evaluate advanced rainfall information. In the education field, we have started research work with students in high school. In the field of daily life, we confirm the specific needs of the information. People's main purpose is using it for daily life: adjusting the timing of going out or timing of washing, carrying umbrella and so on. We made a system which delivers the timing and the strength of the rain by e-mail.

A Study on optimum GPS/GNSS receiver network for the monitoring of severe local storms

Yoshinori SHOJI[1], Wataru MASHIKO[1], Hiroshi YAMAUCHI[1], and Eiichi SATO[1]

[1]Meteorological Research Institute

Precipitable water vapor (PWV) derived from a ground-based global navigation satellite system (GNSS) can be regarded as a representative value of the PWV within an inverted-cone-shaped space above each GNSS station. Therefore, the GNSS derived PWV is inherently difficult to capture local-scale water vapor distribution associated with hazardous cumulus convections.

Shoji et al. (2014) proposed a procedure for estimating the PWV distribution around ground-based GNSS stations on a scale of several kilometers and tested its performance for an F3 Fujita scale tornado that occurred in Ibaraki prefecture on 6 May, 2012. Their method succeeded to express strong horizontal PWV gradient that associated with the co-existence of a strong updraft and downdraft within an approximately 5-km radius.

In this study, in order to evaluate the new method, we calculated GNSS slant total delays (STDs) using a simulation result of a high-resolution (250 meter grid spacing) numerical simulation by Mashiko (2012), emulated GNSS analysis to retrieve PWV, and compared the accuracy of conventionally derived PWVs and those obtained from STDs using the new method.

The comparison results suggest the validity of the new method. By using the new method, PWVs around each GNSS station can be estimated with less than 1 mm RMS and 1.5 mm RMS within the distance from GNSS station of 2 km and 5 km, respectively.

References

Mashiko, W., 2012: Numerical Simulations of Supercell Tornadogenesis:The Structure and Evolution of Vortex Lines within Low-Level Mesocyclones and Tornadoes. *Proc. 26th Conference on Severe Local Storms*, Nashville, TN, U.S.A., 2.2.

Shoji, Y., H. Yamauchi, W. Mashiko, and E. Sato (2014): Estimation of Local-scale Precipitable Water Vapor Distribution Around Each GNSS Station Using Slant Path Delay. *SOLA*, 10, 29-33.

Introduction of convective cloud area detection and next generation satellite "HIMAWARI-8"

Yasuhiko SUMIDA[1], Takahito IMAI[1] and Kouki MOURI[1]

[1]Meteorological Satellite Center, Japan Meteorological Agency

The Japan Meteorological Agency (JMA) operates rapid-scan observation with 5-minute interval around Japan during summer daytime (Jun–Sep, 00-09UTC) by its geostationary meteorological satellite of MTSAT-1R. Rapid-scan observation can detect rapidly initiating/developing phenomena, temporal change of phenomena, short lifecycle phenomena and so on. From these rapid-scan data, JMA retrieves and distributes convective cloud information as nowcasting product to warn aviation users who are under a risk of severe disturbance.

JMA plans to launch the next-generation geostationary meteorological satellite of HIMAWARI-8 in October 2014 and will start its operation from 2015. HIMAWARI-8 carries the next generation visible-infrared radiometer of Advanced Himawari Imager (AHI) unit. The observational functions of AHI such as frequency, bands and spatial resolution will be highly improved. In particular AHI has the capability of high frequent scan; full disk scan with every 10 minutes, Japan area scan and target area scan with every 2.5 minutes, and regional area scan with every 30 seconds. Therefore the rapid-scan of HIMAWARI-8 is expected to have advantage to monitor occurrence of typhoon and meso-scale atmospheric phenomena such as convective initiation and development. The latest status of HIMAWARI-8 will be reported in this presentation.

Assimilation of rain estimated by multi-polarization radar for the tornadoes outbreak on 6 May 2012

Sho YOKOTA[1], Masaru KUNII[1], and Hiromu SEKO[1,2]

[1]Meteorological Research Institute
[2]Japan Agency for Marine Science and Technology

Three tornadoes were generated almost simultaneously on Kanto Plain on 6 May 2012. Southernmost one was one of the strongest tornado in Japan, estimated to be F3 in the Fujita scale. A low-level vortex associated with this tornado was captured by C-band multi-polarization Doppler radar in Meteorological Research Institute (MRI-radar). In this study, Doppler wind and rain estimated from reflectivity and specific differential phase observed by MRI-radar and high-resolution surface wind, temperature and relative humidity by Automated Meteorological Data Acquisition System (AMeDAS) and Environmental Sensor Network (ESN) were assimilated with a nested Local Ensemble Transform Kalman Filter (LETKF) system in the horizontal resolutions of 1875 m and 350 m. Using this LETKF analysis several minutes before the genesis of the tornadoes as the initial condition of the forecast with the horizontal resolution of 50 m, the simulated precipitation regions relating to the tornadoes became closer to the real positions than using the analysis without the assimilation of rain estimated by MRI-radar.

MRI-radar and ESN data are received from the 2nd Laboratory, Meteorological Satellite and Observation System Research Department, MRI and NTT DOCOMO INC., respectively. Our research is supported by Strategic Programs for Innovative Research (SPIRE) Field 3 as well as TOMACS.

Radar data assimilation using X-band multi-parameter radar network around Tokyo metropolitan region, Japan -3DVAR with incremental analysis update for a tornadic storm observed around Tsukuba on 6th May 2012

Shingo SHIMIZU[1], Koyuru IWANAMI[1], Shin-ichi SUZUKI[1], and Takeshi MAESAKA[1]

[1]National Research Institute for Earth Science and Disaster Prevention

National Research Institute for Disaster Prevention (NIED) has developed three-dimensional variational (3DVAR) assimilation system with 1 km resolution using X-band multi-parameter radars (MP-radar) since 2006 for the understanding of the physical mechanism behind heavy rainfall and severe wind, and for the detection and forecasting of hazardous weathers around Tokyo metropolitan region. Seven radars (four X-band MP radars, two X-band Doppler radars, and one C-band Doppler) have covered the Tokyo metropolitan region since 2011. Radial velocities from the seven radars every 5 min are assimilated by CReSS-3DVAR system (Cloud Resolving Storm Simulator 3DVAR) using incremental analysis update (IAU) scheme for the tornadic thunderstorm observed around Tsukuba on 6th May 2012. A strong low-level meso-cyclone associated with the tornadic storm was successfully simulated by the 3DVAR+IAU system.3DVAR cycling with IAU gave better vertical-vorticity forecast than 3DVAR cycling without IAU. The better forecast was attributed to the improvement in the spin-up and spin-down of vertical vorticity development in the rapid update cycle (RUC). Another outstanding characteristic of 3DVAR cycle with IAU is low computational cost. The 3DVAR+IAU system in RUC is well suited to the real-time forecast for tornadic storm.

Assimilation experiments of refractivity data obtained by JMA-operational Doppler radar

Hiromu SEKO[1,2]

[1]Meteorological Research Institute
[2]Japan Agency for Marine Science and Technology

Because low-level convergence of water vapor affects convection generations, forecast accuracy of local heavy rainfall is expected to be improved when horizontal distribution of low-level water vapor is obtained more accurately. We focused on radio waves of Doppler Radars that are returned from fixed structures. Because the radio waves are delayed by water vapor while passing atmosphere, we obtained refractivity, which is a function of temperature and water vapor, from the delay of radio waves. In this presentation, the temporal variation of refractivity observed by JMA's Tokyo Radar and the impacts of refractivity on the rainfall forecast are presented.

Observing system impact studies down to the grey zone with the WRF-NOAH-MP-HYDRO model: Potential applications to TOMACS

Volker Wulfmeyer[1]

[1]University of Hohenheim

The WRF-NOAHMP-HYDRO model system of the Institute of Physics and Meteorology (IPM) at the University of Hohenheim is introduced. The system consists of a land surface model (LSM) with separate energy balance closure for the soil and canopy layers. Recent refinements of vegetation dynamics and root growth significantly improved simulations of soil moisture and evapotranspiration simultaneously. The LSM can be coupled with sophisticated hydrological components for consistent simulations of lateral fluxes in the soil, runoff, and stream flow. An advanced simulation of the energy and water cycle requires an accurate model parameterization chain including land-surface exchange and atmospheric boundary layer (ABL) turbulence. Ensemble simulations are presented for optimizing the representation of entrainment processes in the convective ABL. This model system will be applied for the simulation of TOMACS IOPs, most likely starting with July 18, 2013. This IOP is imbedded in the first global latitude belt WRF-NOAH simulation with a grid increment of 3 km from July 1 – September 1, 2013 covering 20-65 N. Though no data assimilation (DA) was applied, excellent performance was achieved such as the simulation of the Taifun Soulik from July 10-12, 2013. The set up of WRF-NOAHMP for impact and process studies will be presented and discussed. Using several model domains with different resolutions down to 100 m and a 3DVAR or 4DVAR rapid update cycle in the outer domain, various model forecasts will be performed for studying the impact of new observing systems. Particularly, Doppler lidar, GPS, and polarization radar will be considered; for the latter a new model forward operator is currently under development at IPM. The grey zone and DA experiments will give insight in the model performance with respect to the simulation of convection initiation and localized convective systems as well as in the skill of quantitative precipitation forecasting over Japan.

Intercomparison testbed of convective scale data assimilation systems for a TOMACS observed rainfall event

Kazuo SAITO[1, 2], Le DUC[2,1], Takuya KAWABATA[1], Sho YOKOTA[1], Seiji ORIGUCHI[1] , Tadashi TSUYUKI[1] and Hiromu SEKO[1, 2]

[1] Meteorological Research Institute,
[2] Japan Agency for Marine Science and Technology

Convective scale data assimilation is a key factor to improve numerical model-based nowcasting and the very short range forecast for local high impact weathers such as local heavy rainfall. The variational method is widely used in the operational forecast centers for numerical weather prediction, while ensemble-based data assimilation schemes such as the ensemble Kalman filter are recently becoming popular in research communities. At the Meteorological Research Institute, both methods have been successfully applied to reproduce or forecast experiments for local rainfall events by deep convection and/or mesoscale convective systems relating to tornados, however, their relative advantages and shortcomings are still unclear for convective scale data assimilation, where nonlinearity is strong and sophisticated cloud microphysics may have a large impact.

A testbed of intercomparison experiment for convective scale data assimilation using a cloud resolving model with a horizontal resolution of 2 km has been proposed by a research program (HPCI Strategic Program for Innovative Research Field 3) to achieve ultra-high precision mesoscale weather prediction. A local rainfall event in the Tokyo metropolitan area occurred on 18 July 2013 was selected as a candidate of the experiment. In the presentation, design of the intercomparison experiment is introduced and some preliminary results are shown with several subjects.

Observations and urban simulations for TOMACS heavy rainfall cases

Naoko SEINO[1], Hirofumi SUGAWARA[2], Ryoko ODA[3], and Toshinori AOYAGI[1]

[1]Meteorological Research Institute, [2]National Defense Academy,
[3]Chiba Institute of Technology

During the 2011-2013 TOMACS IOP, atmospheric structure in several heavy rainfall events was captured by radiosonde soundings in the Tokyo metropolitan area. Numerical simulations are conducted for some of these events and the urban boundary-layer structure and its role for the formation and development of convective system is discussed.

Relationship between rainfall distribution, surface wind and precipitable water vapor during heavy rainfall occurred in central Tokyo in summer

Yoshihito SETO[1,2], Hitoshi YOKOYAMA[1], Haruo ANDO[1],
Nobumitsu TSUNEMATSU[1], Tsuyoshi NAKATANI[3], Yoshinori SHOJI[4],
Kenichi KUSUNOKI[4], Masaya NAKAYAMA[5] and Hideo TAKAHASHI[2]

[1]Tokyo Metropolitan Research Institute for Environmental Protection,
[2]Tokyo Metropolitan University,
[3]National Research Institute for Earth Science and Disaster Prevention,
[4]Meteorological Research Institute
[5]University of Tokyo

The relationship between rainfall distribution and the convergence of surface winds and water vapor were examined by using high-density data obtained from meteorological observations in central Tokyo. The convergence of surface winds was tended to be increased from several tens of minutes before the heavy rainfall occurs. Around the heavy rainfall area, increasing of precipitable water vapor (PWV) and water vapor concentration (WVC) index was observed at about the same time as increasing of convergence. From these results, the possibility to predict the occurrence of heavy rainfall is expected by using the surface wind and water vapor data obtained from high-density observation network.

Modeling of the 26 August 2011 extreme precipitation event over Tokyo with Canada's subkm-scale Global Environmental Multiscale (GEM) model

Stéphane BELAIR[1], Sylvie LEROYER[1], and Lubos SPACEK[1]

[1]Meteorological Research Division, Environment Canada

High-resolution atmospheric modeling systems with grid spacing of a few hundreds of km are now at the front line of short-range deterministic numerical weather prediction (NWP). In this context, 1-km and 250-m versions of Environment Canada (EC)'s Global Environmental Multiscale (GEM) model are being configured and tested over a few key urban areas. Such a system has been set-up and tested for the 26 August 2011 extreme precipitation case over Tokyo, as part of EC's participation to the international research and development initiative for the Tokyo Metropolitan Area Convection Study (TOMACS).

Preliminary results are encouraging, in the sense that GEM produces intense precipitation over the Tokyo area, at about the right time. Several deficiencies are however noted, related to the position of the intense urban precipitation (too much to the north), to the structural appearance of precipitation over some regions (possibly too grainy), and to the intensity of the precipitation in the accompanying front to the north. A series of sensitivity tests are currently being performed to assess the causes of these problems and to improve the simulation. Preliminary examination of these simulations indicate that the results are quite sensitive to some aspects of the model configuration (e.g., initial conditions, horizontal diffusion, land surface processes), while they are less sensitive to others (e.g., boundary-layer and subgrid-scale clouds). These results will be presented at the meeting, along with conclusions regarding how this TOMACS case contributed to the improvement of subkm-scale NWP with GEM.

ARPS simulations of summer convection in Japan: skill scores for TOMACS domain and datasets

Augusto JOSE PEREIRA FILHO[1] and Felipe VEMADO[1]

[1]Universidade de São Paulo

The ARPS system was used to simulate 24-hour control runs over a domain larger than Japan and over the TOMACS region at 2-km resolution during the months of July, August and September of 2011 and 2013. The ultra-dense surface network of raingauge was used to verify these control runs.

It will be shown features of the diurnal cycle of convection and circulation over TOMACS region as well as performance results by means of CSI, POD, FAR and BIAS. These preliminary results indicate an overestimation of precipitation, but with better scores for September. Some strategies for the next steps will be presented.

Dallas fort worth network, and the urban hazard mitigation: Tornado, hail, flooding and high winds all in the same urban region

V. CHANDRASEKAR[1] and the full DFW Urban demonstration Network team

[1]Colorado State University

The Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere (CASA) pioneered the concept of adaptive radar networks and demonstrated the value of small radar networks for severe weather and flood warning. Currently the CASA team is deploying and running an operational network in an urban metropolitan environment, to demonstrate all aspects of the X-band radar network, namely, technology, deployment feasibility, and end user interaction. The CASA team has deployed an adaptive network of X-band radars in the Dallas - Fort Worth metropolitan region with the mission of mitigating localized hazards, in urban region such us tornadoes, hail, and flooding, especially to address the vulnerability of the urban population. The Dallas - Fort Worth radar network provides data in real-time to the local stakeholders (including the National Weather Service and Emergency Management) on an operational basis. This presentation will introduce the CASA principles and show the engineering and operational principles of the Dallas - Fort Worth radar network, together with case examples illustrating the system's capabilities for tornado, hail, high winds and flood warning systems, all within one season.

Early detection of baby rain cell aloft in a severe storm and risk projection for urban flash flood

Eiichi NAKAKITA[1], Kosei YAMAGUCHI[1], Ryuta NISHIWAKI[2], and Hiroyuki YAMABE[3]

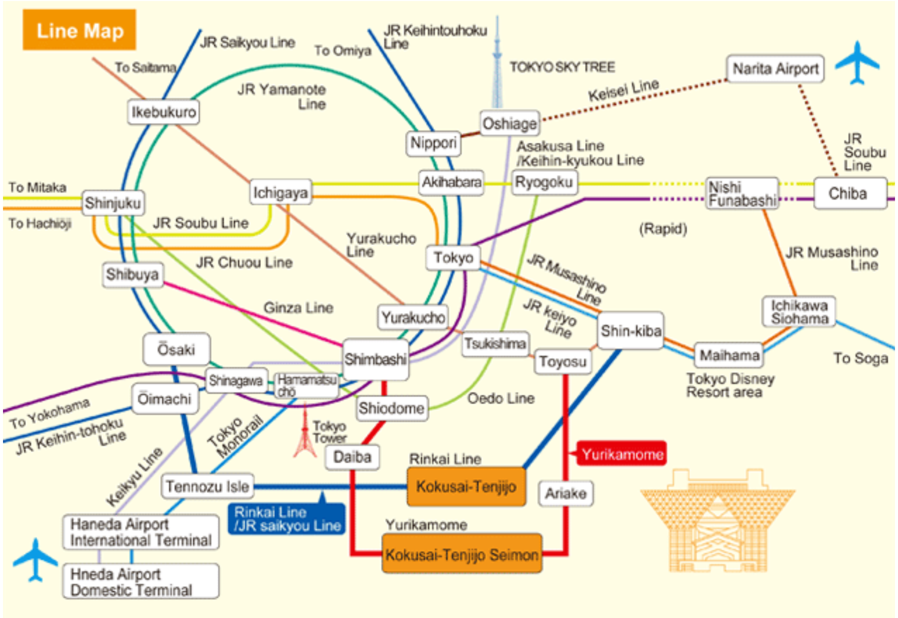
[1]Disaster Prevention Research Institute, Kyoto University
[2]Sumitomo Heavy Industries, Ltd.
[3]Tokyo Electric Power Co., Inc.

In 2008, around 50 people who enjoyed sunny days along the riverside were flushed away by a sudden flash flood in a small river channel in Kobe urban area, in Japan. This extreme event was a combinational result of steep basin slope, paved urban area, and severely localized heavy rainfall, which is more frequently happening in Japan. There are many short and steep rivers passing through urban areas in Japan, and the most of riverside along these rivers are used as a public open place. Because of the steep basin slope and the paved urban area, only short time of the localized heavy rainfall, such as 30 minutes of rainfall with 50mm/hr of intensity, can cause very dangerous situation in urban areas as in the Toga River case.

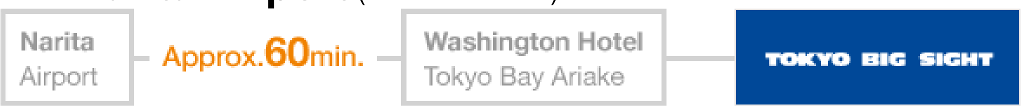
In order to prevent such flash flood damages, it is very necessary to detect the rain-cells, which may develop to sever storm, as soon as possible and to alert people to evacuate from riverfront before the severe events occur. In this study, we developed a detection technique for the early stage of rain-cell (hereafter, baby-cell) in the middle atmospheric layers before it generates heavy rainfall on the ground. The early detection technique is utilizing the 3-D volume scanning data from X-band Multi Parameter radars (X-MP radars), which are equipped near to the most urban area in Japan recently. By considering vorticity in baby-cells from the Doppler velocity information, which can be observed directly by the radar network, it is able to decide whether the baby-cell is going to develop to the heavy rainfall or not. The early detection and risk projection techniques are combined as an experimental operational prediction system in the Ministry of Land Infrastructure and Transportation.

Venue: Tokyo Big Sight, Room 608

Tokyo Big Sight

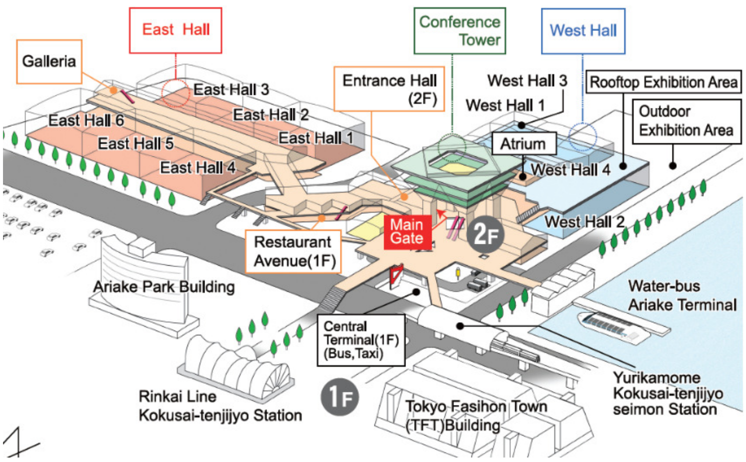


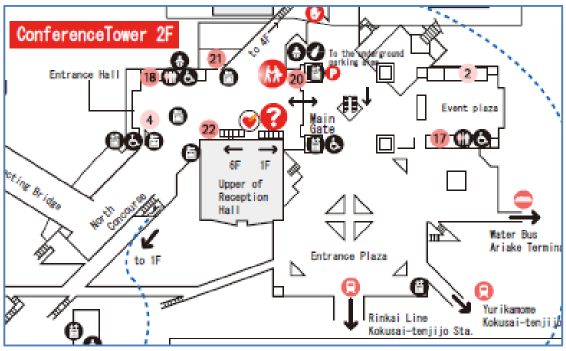
From **Narita Airport** (Limousine Bus)

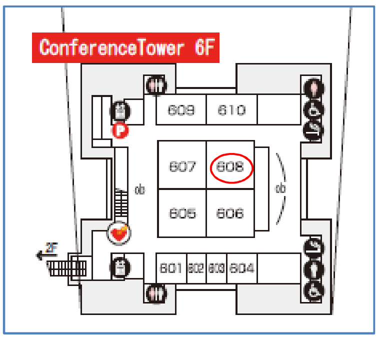


From **Haneda Airport** (Limousine Bus)

Room 608







(http://www.bigsight.jp/)

Banquet:

HOTEL GRAND PACIFIC LE DAIBA,
Lobby Café "LE BOUQUET" (Second floor)
26 November, 18:00-19:30
Dinner and free drink ￥6,420

Excursion of 2nd TOMACS/RDP workshop for foreign participants

Lightning and cloud observation facility at Tokyo Sky Tree and Life Safety Learning Center, 28th November 2014

1. Tokyo Sky Tree

Tokyo sky tree is the tallest free-standing broadcasting tower in the world(634m). Central Research Institute of Electric Power Industry (CRIEPI) installed Rogowski coils on the tower at a height of 497min order to observe the current wave-shapes of lightning striking. National Research Institute for Earth Science and Disaster Prevention (NIED) is planning to install cloud-droplet spectrometer at the 497m level for the purpose of verification of cloud radars. In the excursion, we will take you to the 497m point of Tokyo Sky Tree to see the observation facilities.(http://www.tokyo-skytree.jp/index.html)

2. Life Safety Learning Center

The center provides a disaster experience tour (earthquake, smoke, flood, and a movie). In the tour, visitors can go through two hours of disaster prevention experience with an instructor. http://www.tfd.metro.tokyo.jp/hp-hjbskan/index.html

Schedule:

Friday 28 November

9:30	Departure from Hotel Grand Pacific Le Daiba (via Tokyo Bay Ariake Washington Hotel)
10:00-12:45	Tokyo Sky Tree
13:00 -14:00	Lunch
14:30 -16:20	Life Safety Learning Center
17:00	Hotel Grand PacificLe Daiba

Notice

- Please have movable clothes and any favorable shoes on (high-heel shoes are prohibited).
- Please prepare a towel for the Life Safety Learning Center.

Contact Information:
Local Organizing Committee of TOMACS/RDP International workshop E-mail: misumi@bosai.go.jp