Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-01 Room:424 Time:April 28 10:00-10:15

Estimation of Several Kilometer Scale PWV Distribution using GNSS Slant Path Delay for Monitoring of Cumulus Convection

SHOJI, Yoshinori[1*]

[1]Meteorological Research Institute

A procedure for estimating precipitable water vapor (PWV) distribution around each ground-based station of the global navigation satellite system (GNSS) on a scale of several kilometers is presented. This procedure utilizes the difference between zenith total delay above a GNSS station and zenith mapped slant path delay (SPD). By assuming an exponential distribution for the horizontal water vapor gradient, this difference can be used to estimate the PWV gradient in each SPD direction. Shoji (2013) proposed the WVI index, which is defined as the standard deviation of the PWV_{SPD}. The retrieved PWV gradient in this study can be regarded as another utilization of PWV_{SPD}. In the WVI index, ray path direction data is not utilized. The PWV gradient proposed in this paper utilizes both the deviation of PWVSPD and information on its direction.

The procedure was tested for an estimation of the PWV variation associated with the parent storm of an F3 Fujita scale tornado that occurred in Ibaraki prefecture on May 6, 2012. Differential reflectivity observed by a dual-polarimetric radar showed the existence of a developed parent cloud approximately 1 h before the tornado occurred. A high-resolution numerical weather model simulation showed the existence of a strong PWV gradient around the parent cloud, made evident by the co-existence of a strong updraft and downdraft within an approximately 5-km radius. The PWV gradient calculated using the GNSS observation network with an average spacing of approximately 17 km could not detect such a small-scale, strong PWV gradient. The PWV gradient estimated using the proposed procedure revealed a strong PWV gradient and its enhancement. In this case, higher order inhomogeneity component of each SPD played a critical role.

However, the gradient was weaker than the NWP simulation. This might be partly because of the insufficient observation density. Horizontal scale of the higher order inhomogeneity component of each SPD is about several kilometers and we adopt distance cutoff of 5 km. In order to analyze several kilometer scale PWV distribution, we need denser GNSS network with at least 10 km horizontal spacing. Another possible reason for the weaker gradient may be insufficient and inhomogeneous coverage of GPS satellites. As of 2012, carrier waves transmitted from six to twelve GPS satellites could be observed simultaneously at each GNSS site in Japan. This might be insufficient for estimating the water vapor gradient in all directions. Also, we need to carefully check the quality of each SPD. In this study, following Shoji (2013), the effects of the satellite clock error and multipath (reflected wave) are tried to eliminate. However it is difficult to distinguish atmospheric signal with those noises, especially under local severe weather.

The number of GNSSs has been increasing. As of December 2013, 24 satellites of the Russian GLONASS are in operation. The European Union's GNSS (Galileo) is in the experimental phase and China is also developing an independent GNSS system named COMPASS. Furthermore, a number of space-based augmentation systems (e.g., Japan's QZSS) and regional navigation satellite systems (e.g. the Indian Regional Navigation Satellite System, or IRNSS) will contribute further satellites and signals to the multi-constellation GNSS. In the next step of this study, we will assess the impact of the increased number of SPDs on multi-GNSS.

Keywords: Mesoscale meteorology, Watervapor, Global Navigation Satellite System

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-02 Room:424 Time:April 28 10:15-10:30

Numerical Simulation on Retrieval of Meso-gamma Scale PWV Distribution with the Quasi-Zenith Satellite System (QZSS)

OIGAWA, Masanori[1*] ; REALINI, Eugenio[1] ; SEKO, Hiromu[2] ; TSUDA, Toshitaka[1]

[1]Research Institute for Sustainable Humanosphere (RISH), Kyoto University, [2]Meteorological Research Institute (MRI), Japan Meteorological Agency (JMA)

A simulation study was conducted to investigate the retrieval of meso-gamma scale Precipitable Water Vapor (PWV) distribution with QZSS, using the output of a non-hydrostatic numerical weather prediction model. The evaluation was performed on PWV values obtained by simulating three different methods: using all GPS satellites above an elevation angle higher than 10 degree (PWVG) (conventional GPS meteorology method), using only the QZSS satellite at highest elevation (PWVQ) and using only the GPS satellite at highest elevation (PWVHG).

The RMSEs of PWVG, PWVQ and PWVHG were compared, assuming the vertically integrated water vapor amount of the model as true PWV. As a result, the RMSEs of PWVG, PWVQ and PWVHG were 2.78, 0.13 and 0.59 mm, respectively, 5 minutes before the rainfall. The PWVHG time series had a large discontinuity (~2 mm) when the GPS satellite at the highest elevation changed, whereas that of the PWVQ time series was small, because the elevation angle at which the replacement of the highest elevation QZSS satellite occurs is much higher. The standard deviation of PWVQ was smaller than those of PWVG and PWVHG, which vary largely depending on the GPS satellites geometry.

When the spatial distributions of PWVG and PWVQ were compared to the meso-gamma scale distribution of the reference PWV, PWVG smoothed out the PWV fluctuations whereas PWVQ captured them well, due to the higher spatial resolution achievable by using only high-elevation slant paths. These results suggest that meso-gamma scale water vapor fluctuations associated with a thunderstorm can be retrieved by using a dense GNSS receiver network and analyzing PWV derived from a single high elevation GNSS satellite. In this paper we focus on QZSS, as this constellation is especially promising in this context since it is going to provide nearly continuous PWV observations also as its highest satellite changes, contrary to using highest satellites from multiple GNSS constellations.

Keywords: precipitable water vapor, Quasi-Zenith Satellite System, thunderstorm, non-hydrostatic model

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-03 Room:424 Time:April 28 10:30-10:45

Data assimilation experiments of refractivity distribution observed by an operational Doppler Radar of JMA

SEKO, Hiromu[1*] ; SATO, Eiichi[2] ; SAKANASHI, Takanori[3]

[1]Meteorological Research Institute, JAMSTEC, [2]Meteorological Research Institute, [3]Japan Meteorological Agency

Because low-level convergence of water vapor generates the convections, accuracy of local heavy rainfall forecasts is expected to be improved when horizontal distribution of low-level water vapor is observed. 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 can estimate refractivity, which is a function of temperature and water vapor, from the delay of radio waves. If radio waves of many Doppler Radars that have been deployed in Japan are used in producing initial conditions of numerical forecasts, the forecast accuracy of thunderstorms is expected to be improved through improvement of water vapor fields by using this technique.

In this presentation, temporal variations of refractivity observed by Tokyo Radar and the impacts of refractivity on the rainfall forecasts will be presented.

Acknowledgements:

This study was supported by ”Grants-in-Aid for Scientific Research: Establishment of estimation methods of water vapor from Radar phase data reflected from fixed structures” and ”Projection of Planet Earth Variations for Mitigating Natural Disasters (Field 3)” in ”Strategic Programs for Innovative Research (SPIRE)”.

Keywords: Doppler Radar, Refractivity, Water vapor, Data assimilation

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-04 Room:424 Time:April 28 11:00-11:15

Overview and future strategy of docomo Environmental Sensor Network(ESN)

TSUBOYA, Hisakazu[1*] ; HIGASHI, Kuniaki[2] ; FURUMOTO, Jun-ichi[2]

[1]Division of life support business promossion,NTT DOCOMO Corporation, [2]Research Institute for Sustainable Humanosphere, Kyoto University

NTT docomo had launched a nation-wide and hyper-dense network for the measurement of both weather and environmental element since 2008 and provide them as new information contents to the markets. Its realtime data could be applied to various industrial issues, namely hazard prediction, agriculture, and medical&healthcare. docomo make the new network infrastructure more sophisticated and is planning to expand its sensor stations, which has been set only to its radio base stations up to now, to any customers who need to measure their own environment.

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-05 Room:424 Time:April 28 11:15-11:30

High Dense Ground Observation Network ”POTEKA” in Gunma, Japan

MAEDA, Ryota[1*] ; YOSHIKURA, Tomomi[1] ; KURE, Hirotaka[1] ; YADA, Takuya[1] ; MORITA, Toshiaki[1] ; IWASAKI, Hiroyuki[2]

[1]Meisei Electric co., ltd., [2]Faculty of Education, Gunma University

Meisei developed compact weather sensor (POTEKA Sta.) and cloud data-transfer system (POTEKA Lab.) to achieve high dense observation network. ”POTEKA” stands for ”Point Tenki Kansoku”. POTEKA project has been demonstrated the validity for the use of disaster prevention, health and medical care, teaching material, agriculture and energy management, and comfortable living environment in cooperation with local companies and education board since August 2013.

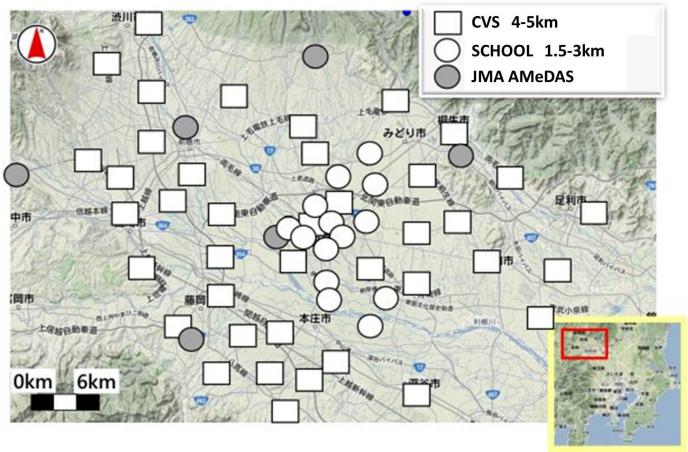
POTEKA Sta. measures wide range of meteorological and environmental variables such as temperature, relative humidity, pressure, sunlight, and rain detection with a one minute resolution. This low-cost weather sensor enables us to achieve finer-meshed or higher density weather observation system economically. Finer-meshed and more extensive data collected are easily accessible through ordinal Web sites (PC, Tablets, etc.) without any special software.

Spatio-temporal high dense observation network (total 55 stations, 1.5˜4km-mesh) was installed in Isesaki city, Gunma, Japan. Observation with elementary/junior high school and convenience store (SAVE ON) are performed at 14 stations and 41 stations, respectively, which spatially captured local surface weather phenomenon (fig. 1).

This paper presents some examples including 1. local distribution of surface temperature around Isesaki, 2. preventing heat stroke at school, and 3. school education for class and research.

Acknowledgments: The authors would like to thank SANDEN Corporation, SAVE ON, and Board of Education of Isesaki city for support POTEKA project.

Keywords: dense, big data, instrument, network, observation



Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-06 Room:424 Time:April 28 11:30-11:45

Observation of downburst in Takasaki and Maebashi city, Gunma on 11 August 2013

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

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

On the evening of 11 August 2013, a severe thunderstorm passed over the Takasaki and Maebashi city, Gunma prefecture, and produced gusty wind damages. The change of surface weather elements was recorded by dense observation network POTEKA when gust occurred. In this study, we follow the development and propagation of gust-front and downburst through the analysis of features of the pressure field observed by POTEKA. The result of this analysis reveals that the reason of gust caused damages in Maebashi city is downburst.

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-07 Room:424 Time:April 28 11:45-12:00

Helicopter-borne thermocamera measurements of surface temperatures in downtown Tokyo -Comparison of 2013 with 2007-

TSUNEMATSU, Nobumitsu[1*] ; YOKOYAMA, Hitoshi[1] ; HONJO, Tsuyoshi[3] ; ICHIHASHI, Arata[1] ; ANDO, Haruo[1] ; MATSUMOTO, Futoshi[1] ; SETO, Yoshihito[2]

[1]Tokyo Metropolitan Research Institute for Environmental Protection, [2]Chiba University, [3]Tokyo Metropolitan Research Institute for Environmental Protection/Tokyo Metropolitan University

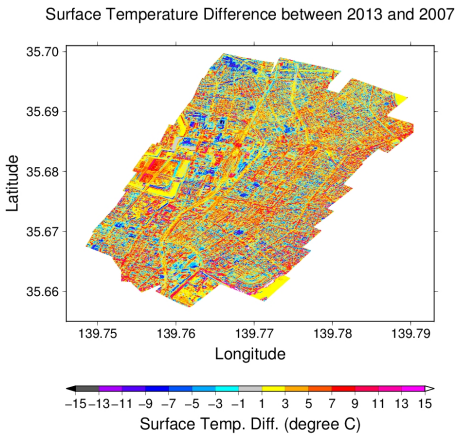
Annual mean air temperatures in downtown Tokyo have increased about 3 degrees Celsius in the past 100 years due to global warming and urban heat island. The frequency of heat stroke outbreaks in Tokyo tends to increase in recent years. The Tokyo metropolitan research institute for Environmental Protection has therefore investigated the current situation of the temperature rises in Tokyo through the monitoring of urban heat island. This can contribute to verification of measure effects on urban heat island.

As part of the investigations, we performed helicopter-borne infrared thermocamera measurements of surface temperatures in downtown Tokyo (mainly an Otemachi-Marunouchi-Yurakucho area) on two different extremely hot days, Aug. 19, 2013 (hereafter, HTM13) and Aug. 7, 2007 (HTM07). The measurements were carried out in the daytime (12-13 local time) and the nighttime (20-22 local time), using a Robinson R22 helicopter with a longwave (8-14um) infrared thermocamera (TS7302) developed at NEC Avio Infrared Technologies Co., Ltd. An altitude of the helicopter flight was 610 m. The daytime air temperatures on those days reached 32-33 degrees Celsius although southerly sea breezes prevailed in the area. Compared with the HTM07 case, a higher air temperature condition was predominant prior to HTM13.

Results of analyses of data from the thermocamera-derived images (a 2 m ground resolution) show that surface temperatures obtained from HTM13 are relatively large in the greater part of the area, compared with HTM07 (refer to a figure shown below), whereas, smaller surface temperatures can be recognized in redevelopment areas where new buildings have been constructed after 2007. (Note that the emissivity of each surface material can influence it.) Also, the thermocamera-derived images projected on Google Earth show higher surface temperatures on intersections.

In addition, we would like to show geographical distributions of the observed surface temperatures in the nighttime, differences between the daytime and nighttime surface temperatures, and a relationship between surface temperatures and sky view factors.

Keywords: Helicopter-borne measurements, thermocamera, surface temperature, downtown Tokyo, verification of measure effects on urban heat island, extremely hot days



Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-08 Room:424 Time:April 28 12:00-12:15

How Does A Typhoon Affect The Local Downslope Wind Hirodo-Kaze In Japan?

FUDEYASU, Hironori[1*] ; KIYOHARA, Yasutomo[2] ; OHASHI, Yukitaka[3] ; KUWAGATA, Tsuneo[4] ; MORIYAMA, Fumiaki[1]

[1]Yokohama National University, [2]The Certified and Accredited Meteorologists of Japan, Japan, [3]Okayama University of Science, Japan, [4]National Institute for Agro-Environmental Sciences, Japan

The Hirodo-kaze is one of the well-known strong local winds in Japan. Hirodo-kaze occurs at the southern base of Mt. Nagi (1240 m) in the northeastern Okayama Prefecture, when the lower-troposphere synoptic wind is strong northerly in association with a typhoon. Previous studies have described the mechanisms that force downslope winds and large-amplitude mountain waves. However, descriptions of the effect of temporal changes in the large-scale environment on the severe downslope wind are not enough. The purpose of present study is to examine the forcing mechanisms during a Hirodo-kaze and the effects of typhoons on the occurrence of a Hirodo-kaze.

The Hirodo-kaze that occurred in association with Typhoon Pabuk was investigated as a case study. At 06 UTC on 21 August 2001, when Pabuk was located over the sea about 80 km southwest of the Kii peninsula, strong surface winds related to the cyclonic circulation of Pabuk were observed in Shikoku and Kinki districts. Relatively weak northerlies prevailed in Chugoku district far from Pabuk, but a strong northerly was observed at the station located in the lee of Mt. Nagi, about 5 km south of the crest of Mt. Nagi, namely Hirodo-kaze.

The mesoscale model, MM5, successfully reproduces the major features of the observed Hirodo-kaze and Typhoon Pabuk. During the Hirodo-kaze, the severe downslope winds in the transitional flow develop in the lower troposphere below the mean-state critical layer. The Hirodo-kaze is closely linked to the strong wind region accompanying the severe downslope winds. After the cessation of the Hirodo-kaze, distinct mountain waves dominate in the lower troposphere where the Scorer parameter decreases with height. The region of strong wind retreat windward as the Hirodo-kaze ceases. Temporal changes in the characteristics of mountain waves in the lee of Mt. Nagi are primarily attributed to the changes in the large-scale environmental winds due to the movement of Typhoon Pabuk.

The effects of intense typhoons on the occurrence of the Hirodo-kaze were also investigated statistically using data using European Center for Medium Range Weather Forecast 40?year re?analysis data (ERA-40). According to the several reports of Okayama meteorological station, twelve Hirodo-kaze events occurred between 1989 and 2001. During these events, strong lower-tropospheric northerlies were overlain by middle-tropospheric southerlies. These favorable conditions occur only as an intense typhoon moves over the sea southwest of Kii peninsula. Thus, the intense typhoon that moves over the sea southwest of the Kii peninsula creates favorable environmental conditions that support the occurrence of the Hirodo-kaze.

Keywords: typhoon, local downslope wind, MM5

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-09 Room:424 Time:April 28 12:15-12:40

Observation and application of the Phased Array Radar

USHIO, Tomoo[1*] ; WU, Ting[1] ; KIKUCHI, Hiroshi[1] ; SHIMAMURA, Shigeharu[1] ; MEGA, Tomoaki[1] ; MIZUTANI, Fumihiko[2] ; WADA, Masakazu[2] ; IGUCHI, Toshio[3] ; SATOH, Shinsuke[3] ; TAKAHASHI, Nobuhiro[3]

[1]Osaka University, [2]Toshiba, [3]NICT

The phased array radar system which was installed in 2012 in Osaka University 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 continuous operation has been done and succeeded in getting several hazardous rain fall events with lightning locations. The data for these events captured by the Phased Array Radar shows the unique capability of the high resolution weather radar. In this presentation, over view of the Phased Array Radar is firstly given, and after that observation results and future direction of the Phased Array Radar Network with polarimetric capability is shown.

Keywords: Radar, Phased Array, Precipitation

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-10 Room:424 Time:April 28 14:15-14:30

Statistical analyses on the characteristics of heavy rainfall events

TSUGUTI, Hiroshige[1*] ; KATO, Teruyuki[1]

[1]Meteorological Research Institute

In this study, to clarify general characteristics of heavy rainfall events in Japan, we have conducted various statistical analyses on them.

For the warm seasons (April - November) from 1995 to 2009, we objectively extracted heavy rainfall events occurring in Japan by using Radar-Raingauge analyzed rainfall dataset produced by the Japan Meteorological Agency. As a result, 386 events were extracted. Over 75 % of all events occurred during three months of July, August, and September, and many events were distributed around the coastal areas of the Pacific Ocean in Kyushu, Shikoku, Kinki, and Tokai regions. Synoptic weather conditions causing the heavy rainfall events were clarified, and consequently the pattern associated with typhoons or tropical cyclones was the most predominant, which accounted for 32.4 % of all events. Then, stationary fronts, remote precipitation of typhoons or tropical cyclones, and low depressions accounted for 21.2 %, 17.9 %, and 14.2 %, respectively. The classification for the shape of the precipitation systems causing the heavy rainfall events showed that the most predominant system was ”band-shaped”, which accounted for 43.5 % of all events.

The environmental fields of heavy rainfall events ($>$130 mm/3hr) were statistically analyzed using the Japanese 55-year reanalysis data (JRA-55). Characteristics of them were elucidated by comparing the environmental fields of moderate rainfall events (10-30 mm/3hr). In July (the late Baiu season) in Kyushu region, the low-level equivalent potential temperature and water vapor flux in the vicinity of Kyushu Island were significantly larger in heavy rainfall events than in moderate ones, and the atmospheric stability became more unstable in heavy rainfall events. Furthermore, to distinguish heavy rainfall events from moderate ones, the combination of two elements of low-level water vapor flux and atmospheric stability was more effective than the unique usage of each element.

Keywords: heavy rainfall, statistical analysis

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-11 Room:424 Time:April 28 14:30-14:55

MRI Rapid-Scan and Super-Resolution Observations in severe storms: Recent Progress and Future Plans

KENICHI, Kusunoki[1*] ; INOUE, Hanako[1] ; YOSHIDA, Satoru[1] ; KATO, Rhohei[2] ; FUJIWARA, Chusei[3]

[1]Meteorological Research Institute, [2]Alpha-denshi Co., Ltd., [3]East Japan Railway Company

In this presentation, we will introduce the recent progress, present examples, and future plans of rapid-scan and super-resolution observations in severe storms of the Meteorological Research Institute (MRI).

1. A linear array of pressure and wind sensors for high resolution in situ measurements in winter tornadoes

In order to improve our understanding of near-surface tornadic features, we developed a linear array of wind and pressure sensors (LAWPS) for high resolution in situ measurements in winter tornado cores. The pressure and wind sensors were deployed along a 1.2km-long linear array that is located parallel to and about 100m from the shoreline. Wind data are obtained using 12 two- dimensional fast-response ultrasonic anemometers placed at a height of 5 m at intervals of 100 m. Pressure data are obtained using 25 barometers placed at a height of 50cm at intervals of 50m. The pressure ports are designed and loaded to the barometers to reduce the dynamic pressure associated with wind and turbulence. In this presentation, the system overview and the measurement technique will be described, as well as some examples of actual winter tornado observations of the system and X-band Doppler radar simultaneously.

2. An X-band phased array Doppler radar for the research of severe storms

Many severe storms evolve on time scales shorter than that resolved by conventional mechanically scanning radar systems. MRI has a new project of development of severe storm observations and detections from a phased array radar. The azimuth scan is similar to the conventional scan with a mechanically rotating antenna and at a variable rate between 1- 6 rpm. 128 slotted waveguide array elements fixed above the antenna panel produce transmit beam and an electronic elevation scanning will be performed. With the electronic elevation and mechanical azimuth scanning, the radar can observe the entire sky in less than a minute. Such high temporal resolution sampling will be expected to provide a realistic structure of rapidly evolving storm. In this presentation, some basic characteristics of the radar and a brief description of future tasks for detection and prediction of severe storms will be presented.

Keywords: tornado, rapid-scan and super-resolution observations, phased array radar

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-12 Room:424 Time:April 28 14:55-15:20

Fine radar echo structure revealed by a high scanning and high-range-resolution X-band marine radar

FUJIYOSHI, Yasushi[1*]

[1]Inst. Low Temp. Sci., Hokkaido Univ.

We used an X-band (9410 MHz) marine radar (KODEN Co., Ltd.), which is not powerful and not very sensitive (its peak transmitted power is 25 kW and minimum detection power is -90 dbm); however, the radar has a high range resolution (15 m). Although its antenna usually rotates horizontally to detect ships, we changed the rotation direction of the slot antenna (2 m in length) from horizontal to vertical (Range Elevation Indicator-scan), and recorded every 2 s. We deployed this radar at various places. We will report very interesting phenomena that are firstly detected by this high-scanning and high-resolution radar.

Keywords: marine radar, fine structure of radar echo, precipitating cloud, angel echo, gravity current head

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-13 Room:424 Time:April 28 15:20-15:35

Applications of weather radar network in private companies

TESHIBA, Michihiro[1*]

[1]Weathernews Inc.

Recently, various weather radars have been developed not only with novel functions of observation, but with low cost. As a result, each private companies can deploy their own weather radars and make a radar network. In the US, for example, local TV stations have their weather radars and the current situation is analyzed through their radars' data. However, in Japan weather radars have not been deployed yet. In this paper I would like to introduce the Weathernews (WNI)'s weather radar network in Japan and we would discuss future work in order to expand this type of network in Japan.

Keywords: weather radar, radar network, private company

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-14 Room:424 Time:April 28 15:35-15:50

Temporal Variation of Close-Proximity Soundings within a Significant Tornadic Supercell Environment

ARAKI, Kentaro[1*] ; ISHIMOTO, Hiroshi[1] ; MURAKAMI, Masataka[1] ; TAJIRI, Takuya[1]

[1]Meteorological Research Institute

We examined proximity soundings at intervals of a few minutes and at distances of less than 20 km from a significant tornadic (SIGTOR) supercell that occurred on 6 May 2012 in Japan. We used a 1-dimensional variational (1DVAR) technique that combined the observations of a ground-based microwave radiometer with outputs from a numerical model. Based on the results of the 1DVAR, several supercell and tornado forecast parameters were calculated and compared with values typical of SIGTOR supercell environments in the United States. One and a half hours before the occurrence of the tornado, the value of convective available potential energy increased significantly to about 1000 J kg^{-1}, a value that is smaller than the typical value in the United States. Low-level vertical wind shear and some composite parameters attained maximum values at the time when the distance to the supercell was the smallest. The vertical wind shear parameters and some composite parameters indicated that the environment fell into the SIGTOR supercell category. This result shows that the thermodynamic environments became unstable before the approach of the supercell, and the low-level vertical wind shear changed locally near the supercell.

Keywords: tornado, supercell, microwave radiometer, 1DVAR

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-15 Room:424 Time:April 28 15:50-16:05

Data Assimilation experiment of Tsukuba tornado on May 6, 2012 using MRI Doppler Radar data

YOKOTA, Sho[1*] ; KUNII, Masaru[1] ; SEKO, Hiromu[2]

[1]Meteorological Research Institute, [2]Meteorological Research Institute/JAMSTEC

A strong tornado with F3 scale caused serious damage in Tsukuba city on May 6, 2012. This tornado was generated at the southern tip of a precipitation area, which was moving northeastward over the Kanto Plain. Besides the Tsukuba tornado, two tornadoes were observed a few ten kilometers north of the Tsukuba tornado. The lower vortex associated with the Tsukuba tornado, as well as its precipitation area, was well captured by the Doppler Radar of the Meteorological Research Institute (MRI), because the Tsukuba tornado passed 15 km north of the MRI. However, data assimilation experiments using the high-resolution data, such as Radar data, have not been performed yet. In this study, Doppler wind data observed by the MRI-Radar were assimilated with an ensemble Kalman filter so as to evaluate the impact of the assimilation of Doppler wind.

In this experiment, a Nested Local Ensemble Transform Kalman Filter (Nested- LETKF) system, with 12 ensemble members, was used. In Outer-LETKF (horizontal grid interval: 15 km), hourly operational observation data used in the Japan Meteorological Agency (JMA) operational model were assimilated with 6 hour intervals. In Inner-LETKF (horizontal grid interval: 1.875 km), data obtained every 10 minutes was assimilated with 1 hour intervals. To assess the impact of the Doppler wind observations, we basically performed two experiments. The ”CTL” experiment used conventional observations, that is, the original settings of the Nested-LETKF. The other ”VR” experiment assimilated the Doppler wind data observed by MRI-Radar additionally in Inner-LETKF, while all other settings were the same as CTL. After the data assimilation experiments, downscaling ensemble experiments (horizontal grid interval: 350m) were carried out by using the analyses and 12 perturbations of each CTL and VR at 10:00 JST on May 6, 2012 as initial conditions.

In the downscaling ensemble experiments, two vortices were formed although three vortices were actually observed. The southern vortex in VR was stronger and passed about 2 km closer to the observed tornado than that in CTL. To clarify those differences, we focused on Storm Relative Helicity (SReH) and low level humidity (Low-Qv) at 10:00 JST. The SReH and Low-Qv were compared to the maximum velocity of the Tsukuba tornado vortex (Vmax) and to the latitude where the vortex existed when it passed 140E (L140), using the analyses and 12 perturbations of VR. As a result, Vmax had a positive correlation to SReH in and south of the precipitation area. It also had a positive correlation to the Low-Qv in the south of the precipitation area, and in the south of the genesis point of the vortices. In fact, Low-Qv in the south of the genesis point of vortices in VR was increased by the assimilation of Doppler wind. On the other hand, L140 had a negative correlation with Low-Qv in the south of the precipitation area. It shows that the precipitation area was elongated in the meridian directions and that the vortex was generated further to the south if humidity was higher in the south of the precipitation area.

The wind speed and location of the vortex had correlations with SReH in and south of the precipitation area. They also had correlations with Low-Qv in the south of the precipitation area and in the south of the genesis point of vortices. Therefore, proper correction of these values by data assimilation is important to better reproduce the vortex.

Acknowledgements:

The authors thank the members of the second Laboratory, Meteorological Satellite and Observation System Research Department, MRI for providing the Doppler radar data. This study was supported by ”Projection of Planet Earth Variations for Mitigating Natural Disasters (Field 3)” in ”Strategic Programs for Innovative Research (SPIRE)” and ”Tokyo Metropolitan Area Convection Study for Extreme Weather Resilient Cities (TOMACS)”.

Keywords: data assimilation, tornado, Doppler Radar

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-16 Room:424 Time:April 28 16:15-16:40

Development of Phased Array Weather Radar and Doppler Lidar Network Fusion Data System

SATOH, Shinsuke[1*] ; YASUI, Motoaki[1] ; MAENO, Hideo[1] ; HANADO, Hiroshi[1] ; TAKAHASHI, Nobuhiro[1] ; IWAI, Hironori[1] ; KAWAMURA, Seiji[1] ; KOJIMA, Shoichiro[1] ; AMAGAI, Jun[1] ; TANAKA, Kenji[1] ; OCHIAI, Satoshi[1] ; KUBOTA, Minoru[1] ; IGUCHI, Toshio[1]

[1]National Institute of Information and Communications Technology

At National Institute of Information and Communications Technology (NICT), we promote advanced research and development of remote sensing technology, to reduce the damage of severe weather disasters caused by localized heavy rainfalls or tornadoes. An industry-academia-government team consisting of Toshiba, Osaka University, and NICT developed one-dimensional phased array weather radar (PAWR) that it is possible to seamless 3D observation in 10 ? 30 seconds. In May 2012, we installed PAWR at Osaka University Suita Campus, and started test observation. From the observation, a first echo appeared in an isolated cumulonimbus cloud was falling to the ground for about 10 minutes. In order to predict the generation point of the cumulonimbus cloud, we need other data which includes wind fields before cloud generation, distributions of water vapor and aerosol, and so on. For that reason, we develop a sensor fusion system with PAWR, Doppler lidar, and others. We install the systems to both NICT Advanced ICT Research Institute (Iwaoka, Nishi-ku, Kobe, Hyogo) and NICT Okinawa Electromagnetic Technology Center (Onna, Kunigami, Okinawa), and install the network data system to NICT headquarters (Koganei, Tokyo).

The sensor fusion system consists of the PAWR antenna in a radome installed on the roof of a 20 m tower, Doppler lidar (Leosphere 400s) on the deck at the height of 15 m of the tower, microwave radiometer to measure water vapor, and sky-radiometer to measure aerosol. Also, temperature, humidity, wind speed components (u, v, w), pressure, rainfall amount, radiation budget, and cloud images (4 directions and whole sky) are measured. All sensors are connected by network for remote operation and automatic data acquisition. The observation data are transferred in real-time through the fast network lines (JGN-X) from Kobe and Okinawa to Koganei for data processing to make a composite map, and so on. The processing data are displayed on a big 4K display TV, and are published using a web server.

We will start test observation after the system completion in March, 2014. At NICT, we also promote research and development of network data system using advanced ICT for big-data processing, transfer, visualization. We give this system a nickname of PANDA: **P**hased **A**rray weather radar and Doppler lidar **N**etwork fusion **DA**ta system, and will publish the data from http://panda.nict.go.jp/.

Keywords: phased array weather radar, Doppler lidar, network data system, remote sensing, localized heavy rainfall

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-17 Room:424 Time:April 28 16:40-16:55

Campaign Observation at Keihanshin Area for Detecting Convection Genesis

YAMAGUCHI, Kosei[1*] ; NAKAKITA, Eiichi[1]

[1]Disaster Prevention Research Institute

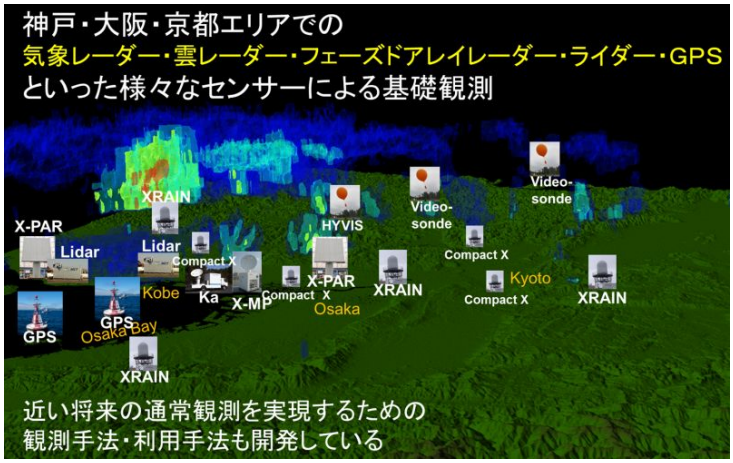
In 2008, around 50 people who enjoyed sunny days along the riverside were flushed away by a sudden flash flood in a small river channel (Toga River) in Kobe urban area of Japan. This extreme event was a combinational result of steep basin slope, paved urban area, and severely localized heavy rainfall, which is more frequent happening in the recent summer of 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 develop a detection technique for the early stage of rain-cell as the first cell aloft (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. In our recent study using the 3-D volume scanning information from the X-MP radars, we have successfully developed an algorithm (1) to detect newly generated baby-cells, (2) to identify dangerous level of the baby-cells, and (3) to trace the movement of the baby-cells.

In the developed algorithm, firstly, the detection of newly generated baby-cells is based on the information of 3-D volume scanning data with very fine resolution of the X-MP radars. Secondly, the identification of the dangerous level, whether the detected baby-cells will grow up to heavy rainfall on the ground, is evaluated with the information of vorticity of the baby-cells based on the Doppler velocity information from the radars. Finally, the tracking of the baby-cells is based on the conventional cell tracking scheme. The preliminary test of the algorithm shows that especially, the identification of the developing baby-cells with the vorticity information is very powerful, and most of baby-cells in the early stage of heavy rainfall events were successfully identified. In detail, all the 19 developing baby-cells under our surveillance were successfully detected, and there was only one false alarm (forecasted as a heavy rainfall event, but it was not).

In our presentation, upgraded performance index of our proposed algorithm will be introduced based on various rainfall events happened in Kyoto and Osaka area, Japan. In addition to improving this practical early detection algorithm for localized heavy rainfall events in urban area, we are conducting newly designed observation combination in Kansai area with numerous sensors and equipments as shown in figure to identify the mechanism of the localized heavy rainfall events in urban area, such as Osaka, Kobe and Kyoto. It is definitely our mission to realize a next-generation operational observation network with different types of sensors for earlier detection and/or prediction of generating storm from the stage of air plume and/or cloud. Presentation partly includes current situation and future plan of a plot type field experiment with X-band- polarimetric radar, Ku-band cloud radar, Lider, and X-band phased array radar.

Keywords: Radar, Lidar, Videosonde, Urban Meteorology



Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-18 Room:424 Time:April 28 16:55-17:10

Analysis of fine-scale airflows over complex topography by super-high-resolution numerical model

TAKEMI, Tetsuya[1*]

[1]Disaster Prevention Research Institute, Kyoto University

With the increase in computational resources, mesoscale meteorological simulations with the grid spacing on the order of 100 m have been conducted not only in idealized studies but also in studies that deal with real cases. In real cases, the benefits from such high-resolution simulations are considered to be better representations of surface topography such as complex terrains and complex distribution of man-made structures. In this presentation, we will demonstrate how fine-scale airflows over complex topography such as terrains and urban districts are represented in numerical simulations of local-scale wind fields under real meteorological settings. Some of the case studies of high wind events are described. For the numerical simulations of specific weather events, we use the Weather Research and Forecasting (WRF) model by downscaling from kilometer-scales to 100-meter-scales with the use of nesting capability. Further downscaling from 100-meter-scales down to 10-meters or higher requires the explicit representation of not only complex terrains but also buildings and structures. For this purpose, we developed an approach to couple a mesoscale meteorological model (i.e., the WRF model) and a computational fluid dynamics (CFD) model (Nakayama et al. 2012). A large-eddy simulation model for airflows over urban geometries (Nakayama et al. 2011) is employed as a CFD model. A unique feature of the present coupling approach, an improved version of the perturbation recycling method of Mayor et al. (2002), is to generate turbulence due to urban-like roughness obstacles with the meteorological effects produced by the mesoscale model being retained. The basic idea of this coupling approach and a case study for a high wind event in the downtown district of Tokyo are demonstrated. Furthermore, some other applications of the present approach for airflow simulations over complex topography including airflows over complex terrain of Fukushima during March 2011 will be briefly introduced.

Keywords: High-resolution numerical model, airflows over complex topography, mesoscale meteorological model, large-eddy simulation

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P01 Room:Poster Time:April 28 18:15-19:30

A study on an atmospheric propagation delay estimation method using a fixed radio source

INAKA, Shigeru[1*] ; FURUMOTO, Jun-ichi[1] ; SEKO, Hiromu[2] ; TSUDA, Toshitaka[1] ; HASHIGUCHI, Hiroyuki[1] ; ISHIHARA, Masahito[3]

[1]Research Institute of Sustainable Humanosphere, Kyoto University, [2]Meteorological Research Institute, [3]Education unit for Adaptation to Extreme Weather Conditons and Resilient Society, Kyoto University

This study aims to develop a new method to observe water vapor horizontal distribution using a side-lobe emission of the 1.3 GHz-band wind profiling radar (WPR). The phase delay of the received side-lobe emission is mainly due to the refractive index fluctuation along the propagation path. In the atmospheric boundary layer, the temporal and spatial non-uniformity of water vapor determines the refractive index fluctuation. Main scope of the study is to extract humidity information from the atmospheric phase delay of side-lobe emission from a WPR. Horizontal humidity distribution can be derived by the data assimilation into numerical prediction model.

The receiver system and data analysis algorithm were developed. A software radio, USRP N200 with an RX daughter board was employed to detect side-lobe emission received by an antenna. A Rubidium frequency standard and a 1 pps signal source of GPS receiver were used for accurate estimation of phase delay variation. The frequency stability of a crystal oscillator, which is generally employed for a reference frequency source of WPR, is insufficient for the accurate estimation. We proposed a new method to compensate the frequency uncertainty of WPR by using data of the additional receiver nearby the WPR site.

IQ data detected by USRP B210 which is controled by GNURadio, an open source software. By using GNURadio the system will be low cost.The program written in IDL language extracts the temporal variation of the phase delay from the received IQ signal. In order to achieve good performance even in low SNR conditions, we developed an algorithm using STFT (Short-term Fourier transformation) aiming to remove noise in undesired frequency range.

The developed system is promising to derive humidity information from side-lobe emission from various WPRs such as the operational WPR network in Japan (WINDAS (WInd profiler Network and Data Acquisition System)).

Keywords: Wind Profiling Radar, estimation of horizontal humidity distribution, non-hydrostatic forecast model, software radio, side-lobe, propagation delay

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P02 Room:Poster Time:April 28 18:15-19:30

Development of a 266 nm Raman lidar for profiling atmospheric water vapor

UESUGI, Takuma[1*] ; YABUKI, Masanori[1] ; LIU, Yutong[1] ; TSUDA, Toshitaka[1]

[1]Research Institute for Sustainable Humanosphere

It is projected that localized extreme weather events could increase due to the effects of global warming, resulting in severe weather disasters, such as a torrential rain, floods, and so on. Understanding water vapor's behavior in the atmosphere is essential to understand a fundamental mechanism of these weather events. Therefore, continuous monitoring system to measure the atmospheric water vapor with good spatio-temporal resolution is required. We have developed several water vapor Raman lidar systems employing the laser wavelengths of 355 and 532 nm. However, the signal-to-noise ratio of the Raman lidar strongly depends on the sky background because of the detection of the weak inelastic scattering of light by molecules. Therefore, these systems were mainly used during nighttime.

Hence, we have newly developed a water vapor Raman lidar using a quadrupled Nd:YAG laser at a wavelength of 266 nm. This wavelength is in the ultraviolet (UV) range below 300 nm known as the "solar-blind" region, because practically all radiation at these wavelengths is absorbed by the ozone layer in the stratosphere. It has the advantage of having no daytime solar background radiation in the system. The lidar is equipped with a 25 cm receiving telescope and is used for measuring the light separated into an elastic backscatter signal and vibrational Raman signals of nitrogen and water vapor at wavelengths of 266.1, 283.6, and 294.6 nm, respectively. This system can be used for continuous water vapor measurements in the lower troposphere. This study introduces the design of the UV lidar system and shows the preliminary results of water vapor profiles.

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P03 Room:Poster Time:April 28 18:15-19:30

About the approach and the progress of the DoCoMo environmental sensor network

KANO, Kayo[1*] ; MIYAJIMA, Akiko[1] ; KIKKAWA, Yoshiaki[1] ; TSUBOYA, Hisakazu[1] ; HIGASHI, Kuniaki[2] ; FURUMOTO, Jun-ichi[2]

[1]Division of life support business promossion,NTT DOCOMO Corporation, [2]Research Institute for Sustainable Humanosphere, Kyoto University

Since 2008, the automated meteorological observation network has been developed by NTT DOCOMO corporation and a total of 4,000 stations are operating now.

The hyper-dense wind measurement network was constructed through the industrial-academical corporation between NTT DOCOMO and Kyoto University, which enables us to elucidate the detailed characteristics of strong downslope windstorm, Hira Oroshi, blowing down in the West coast of the Lake Biwa.

This paper discussed the outline of our activities and fruitful results will be discussed in detail.

Keywords: Environmental Sensor Network

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P04 Room:Poster Time:April 28 18:15-19:30

Surface Pressure Distributions of Downburst and Tornado captured by High Dense Ground Observation Network ”POTEKA”

SATO, Kae[1*] ; KURE, Hirotaka[1] ; YADA, Takuya[1] ; MAEDA, Ryota[1] ; KOJIMA, Shinya[1] ; MORITA, Toshiaki[1] ; IWASAKI, Hiroyuki[2]

[1]Meisei Electric Co. Ltd., [2]Faculty of Education, Gunma University

Meisei developed low-cost compact weather sensor (POTEKA Sta., hereinafter referred to as the POTEKA), which can measure temperature, relative humidity, pressure, sunlight, and rain detection per one minute and achieve higher density weather observation system economically. We installed economical and high dense ground observation network (total 55 stations, 1.5˜4 km-mesh) in Gunma, Japan. This paper presents observation of wind gust phenomena around Takasaki city and Maebashi city on 11 August 2013 and tornado in Midori city on 16 September 2013.

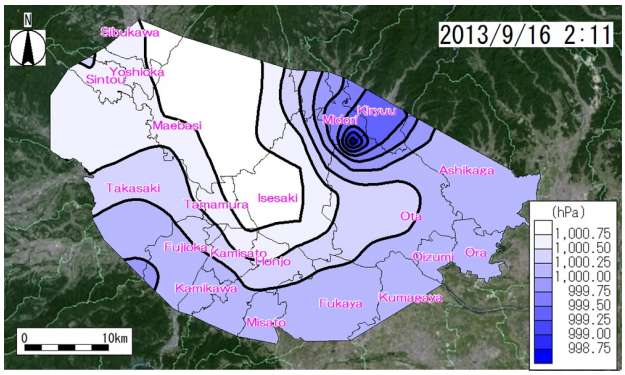
Pressure jumps of 1-2 hPa were recorded at POTEKA with one minute resolution, indicating that the temporal high pressure was caused by downburst downflow. Beside, two pressure jump can be found at some stations. The first and second jumps are coincided with gust fronts and down flow of downburst, respectively (Discrimination between downburst and gust-front by the surface dense observation network POTEKA).

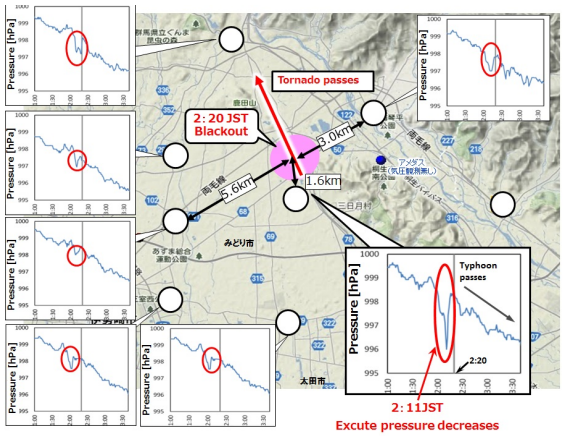
In the September 16, tornado occurred in Typhoon passes, and blackout occurred at 2:20(JST). At the point from 1.2km away, surface pressure was decreasing 3hPa in 3 minutes at 1.6km blackout area away (Fig.)

Local weather observation network consisting of POTEKA succeeded in capturing the change of surface pressure caused by gust wind phenomena with unprecedented spatio-temporal resolution, which enables us not only to distinguish between gust fronts and downbursts but also to detect such wind phenomena earlier. The observation network is going to continue in the future to data accumulation.

Acknowledgments: The authors would like to thank SANDEN Corporation, SAVE ON, and Board of Education of Isesaki city for support POTEKA project.

Keywords: High Dence observation network, Downburst, Tornado





Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P05 Room:Poster Time:April 28 18:15-19:30

A sensibity study on the role of the urban land surface scheme for a regional climate model, NHRCM

SHIDO, Fumitake[1*] ; AOYAGI, Toshinori[1] ; SEINO, Naoko[1] ; SASAKI, Hidetaka[1]

[1]Meteorological Research Institute, Japan Meteorological Agency

The conditions of land surfaces give large impacts on surface air temperature, via the dynamical and thermal energy exchanging. In order to forecast the physical quantities, such as momentum, heat, and vapor fluxes from the land surface, we have selected a sophisticated vegetation scheme of the SiB (Simple Biosphere) as the land surface scheme of the MRI's NHRCM (Non-Hydrostatic Regional Climate Model). Recently, as model-resolution became higher up to several kilo-meter, non-vegetation but urbanized grids had appeared, and these grids were treated as dried bare ground on the SiB to express the so-called urban deserts. But, in these grids, reproducibility of the climatology seemed to be insufficient. Therefore, we need to apply the new scheme to improve the representation of radiation and heat budgets in such urban area. For that purpose, we developed a new scheme for urban land surface to applied to a regional climate model. This new scheme is called SPUC (Square Prism Urban Canopy, Aoyagi and Seino 2011).

In this study, we applied SiB and SPUC scheme to the 4km-resolution NHRCM, executed present climate simulations, and compared outputs with observational data of JMA(Japan Meteorological Agency). The target area was Kanto-Koshin region including Tokyo metropolitan area. As initial and boundary condition, we used the JMA's RANAL (Regional analysis) dataset (20km resolution), which was downscaled once by NHRCM10km with SiB scheme for all grid. The 10km resolution dataset was also downscaled by NHRCM4km. We executed the 4km experiments, using SiB scheme for all land grids (NHRCM-SiB), and using both SiB for natural surface grids and SPUC for urban surface grids (NHRCM-SPUC).Time integration was continuously executed for about 5 years from August 1st, 2001 to September 1st, 2006.

The result of the experiment using SiB scheme had negative bias(about -1.3 ^{o}C) in the surface temperature in the Tokyo metropolitan area. By using SPUC scheme, this negative bias changed to positive(+1.55 ^{o}C). Although the bias remains, the correlation factor between the simulation and observation was improved from 0.73 (NHRCM-SiB) to 0.86 (NHRCM-SPUC). This improvement implies that NHRCM-SPUC had the better reproducibility on horizontal distribution of air temperature. On the other hand, the difference was hardly seen in total amount of precipitation in five years.

This research is supported by SOUSEI program of MEXT, Japan.

Keywords: regional climate, land surface, downscaling, urban canopy

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P06 Room:Poster Time:April 28 18:15-19:30

Temporal and spatial characteristics of gust ratio in the

SAKAMOTO, Hiroto[1*] ; HIGASHI, Kuniaki[1] ; MATSUI, Kazuyuki[2] ; KANO, Kayo[3] ; TSUBOYA, Hisakazu[3] ; FURUMOTO, Jun-ichi[1] ; HASHIGUCHI, Hiroyuki[1]

[1]Research Institute for Sustainable Humanosphere, [2]Environmental Education Working Group in Biwako Region, [3]NTT DOCOMO Corporation

Localized downslope wind often causes severe disasters, although the dynamics of these severe phenomena has not fully elucidated due to their small temporal and spatial scale. The damage by downslope wind is strongly determined by the instantaneous maximum wind speed. Since the numerical model can derive averaged wind speed along time and space determined by the model resolution. The classical analogous theory points out that the gust ratio, which is defined as the ratio of maximum wind velocity to the averaged wind velocity, becomes a constant value (1.5-2.0), depends only on the roughness length of surface condition.

In the actual atmosphere with the horizontal inhomogeneity, the gust ratio may varies with time even at the same location. The sophisticated modeling of gust ratio beyond the simple constant model is very important for the forecasting of gust damage. The detailed characteristics of gust ratio was investigated by the data of hyper-dense surface observation network in the Hira Oroshi region. The temporal and spatial characteristics of gust ratio and future prospective to install our algorithm into the numerical prediction models are discussed in the presentation.

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P07 Room:Poster Time:April 28 18:15-19:30

An traial of direct monitoring of turbulence intensity by using the balloon-borne high-resolution temperature sensor

FURUMOTO, Jun-ichi[1*] ; SHIMIZU, Kensaku[2] ; KAI, Kohei[2] ; HIGASHI, Kuniaki[1] ; HASHIGUCHI, Hiroyuki[1]

[1]Research Institute for Sustainable Humanosphere, [2]Meisei Electric Corporation

The fine tungsten wire (10 um diameter) temperature sensor, whose response time is 5/1000sec on surface and 40/1000sec at around 30km altitude, were employed to detect turbulence intensities. For the temperture data at the sampling frequency of 16Hz were used for the tuebulence detection. The comtamination of the wake of the ballon should be carefully removed from the original data before the analysis of turbulence.

We are developing the new method to extract temperature purtarvation by turbulence at the vertical wavelength shorter than the effects of pendular movement of radiosondes.

The preliminary results show very promissing to detect turbulence intensities to compare with echo intensity of atmosphere radar.

The detailed scheme and first results are discussed in the presentation.

Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

AAS23-P08 Room:Poster Time:April 28 18:15-19:30

High resolution numerical study of migrating strong downslope wind ”Hira-Oroshi” in Japan

HIGASHI, Kuniaki[1*] ; FURUMOTO, Jun-ichi[1] ; HASHIGUCHI, Hiroyuki[1]

[1]Research Institute for Sustainable Humanosphere Kyoto University

This paper studied the generation mechanism of a unique downslope wind in the west coast of Lake Biwa, Shiga, Japan. This strong downslope wind, feared as ”Hira-Oroshi” for millennial years shows the narrow gust of a few kilometers in the various location within 10 km width area. This feature cannot be explained by the conventional mechanism of previous studies: the location of downslope wind is strongly restricted by the location of valley in mountain range. Due to such distinct characteristic, the numerical prediction of this gust wind is too inaccurate to use operationally.

Considering strong demands to the prediction of this gust wind, this study aims to elucidate the mechanism via very fine numerical forecast model with the horizontal resolution of 50 m. The results successfully represented the narrow gust wind structure in the edge of the mountain range. The spots of gust wind due to complicated topographical structure is also seen in the simulation results, although the gust wind speed changes with the larger scale wind direction and speed. Because the stagnant region due to the breaking of the mountain wave is widely extended in the leeward of the mountain range in the free atmosphere (˜1 km), the location of the gust wind looks to be determined by the detailed topographic structure of the mountain range and the a kilometer-scale eddies over the Lake Biwa.

The simulation results suggested these synergy effects determined the gust generation and its location. The unveiled behavior of the gust wind is also beneficial to the improvement of the gust prediction.

Keywords: High resolution numerical simulation, Downslope wind, Local wind