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

AAS23-P01 会場:3 階ポスター会場 時間:4 月 28 日 18:15-19:30

固定電波源を利用した大気遅延推定手法に関する研究
A study on an atmospheric propagation delay estimation method using a fixed radio source

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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)).

キーワード: ウィンドプロファイラ, 水蒸気の水平分布の推定, 非静力学モデル, ソフトウェアラジオ, 側方放射, 大気伝搬遅延
Keywords: Wind Profiling Radar, estimation of horizontal humidity distribution, non-hydrostatic forecast model, software radio, side-lobe, propagation delay

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AAS23-P02 会場:3 階ポスター会場 時間:4 月 28 日 18:15-19:30

波長 266 nm のレーザーを用いた水蒸気ラマンライダーの開発
Development of a 266 nm Raman lidar for profiling atmospheric water vapor

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

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水蒸気は、雲・降水過程を通じて、気象水災害の要因となる局所的で時間変動が激しい大気現象に寄与する物質として知られている。本研究グループでは、水蒸気の時空間変動を捉えるための複数のラマンライダーを開発してきた。ラマンライダーでは、物質ごとに特有の周波数シフトを示す微弱なラマン散乱光を検出する必要があるため、背景光雑音の大きさが水蒸気の推定精度に強く影響する。現在までに構築したライダーは、光源として波長 532 nm と 355 nm のレーザーを使用しており、主に太陽光の影響が少ない夜間の観測に適用してきた。

本研究では、Nd:YAG レーザーの 4 倍高調波となる波長 266 nm のレーザーを用いた水蒸気ラマンライダーを開発する。波長 300 nm 以下では、ほとんどの太陽放射が成層圏のオゾン層によって吸収されるため、この波長領域では、太陽光に起因する背景雑音の影響をほぼ無視することができる。これにより昼夜連続の観測が可能となる。受光系は、口径 25 cm の望遠鏡と分光検出器で構成され、エアロゾルと空気分子からの弾性散乱（波長 266.1 nm）、窒素振動ラマン散乱（波長 283.6 nm）、水蒸気振動ラマン散乱（波長 294.6 nm）の信号を取得する。発表では、システムの概要と、水蒸気計測の初期解析結果について紹介する。

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AAS23-P03 会場:3 階ポスター会場 時間:4 月 28 日 18:15-19:30

ドコモ環境センサーネットワークによる稠密観測の取組みについて
About the approach and the progress of the DoCoMo environmental sensor network

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NTT ドコモでは 2008 年より自社無線基地局設備を活用して気象情報・環境情報の観測を行っており、現在全国 4,000 か所の環境センサーネットワークを展開している。
また、2012 年 10 月からは京都大学生存圏研究所と連携し、滋賀県の湖西地方に吹く強い局地風「比良おろし」の実態解明のため、より稠密な観測環境を整備してきた。
本発表においては、これまでの NTT ドコモによる稠密観測の取組みについて紹介を行う。

キーワード: 環境センサーネットワーク
Keywords: Environmental Sensor Network

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稠密観測 POTEKA によるダウンバーストと竜巻の観測結果
Surface Pressure Distributions of Downburst and Tornado captured by High Dense Ground Observation Network "POTEKA"

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

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明星電気株式会社は、稠密観測のための小型気象計 POTEKA Sta.(ポテカ：Point Tenki Kansoku、以下 POTEKA) を開発した。POTEKA は気温・湿度・気圧・感雨・日照を 1 分間隔で測定できる。その POTEKA を用いて、地元企業及び教育委員会の協力の下、「伊勢崎市 POTEKA プロジェクト」を発足させ、伊勢崎市内小中学校及び同市周辺のコンビニ (SAVE ON) に約 1.5～4km 間隔で計 55 ヶ所に設置した。本稿では、顕著な観測事例として 8 月 11 日に高崎市・前橋市で発生した突風現象と 9 月 16 日にみどり市で発生した竜巻の気圧の観測結果について紹介する。

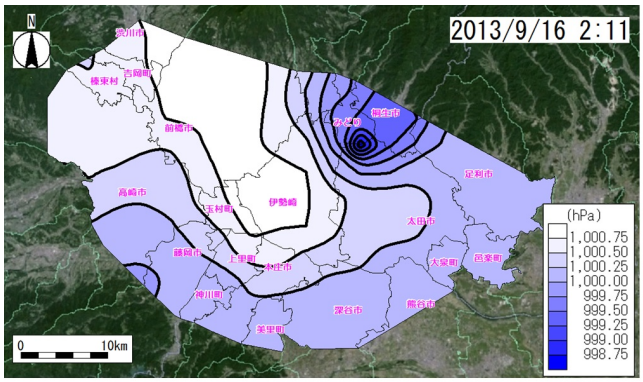
8 月 11 日の観測結果は、POTEKA の 1 分値では、1～2hPa 程度の一時的な上昇がみられた。これはダウンバースト発生時の下降流による一時的な気圧上昇であると示唆される。さらに詳しく見ると、気圧の上昇は 2 回発生している地点もあり、1 回目はガストフロントによるもの、2 回目はダウンバーストによる上昇と考えられる（詳細は「「地上稠密観測 POTEKA によるダウンバーストとガストフロントの識別)」を参照のこと)。

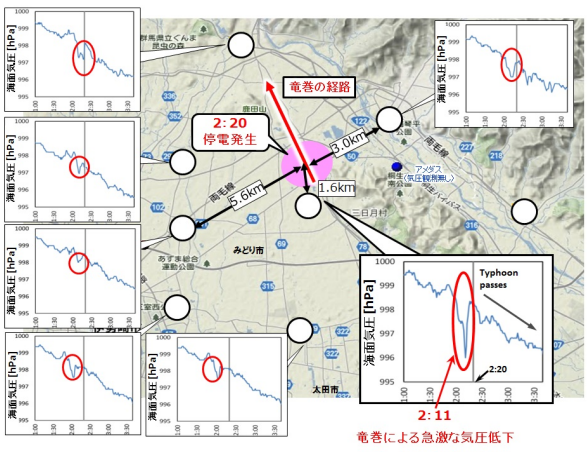
9 月 16 日は、台風通過に伴う気圧の低下の中で竜巻が発生し、みどり市内で 2 時 20 分に停電が発生した。その 1.2km 離れた POTEKA の気圧は 2 時 11 分に最大 3 分間で 3hPa の気圧の急低下を観測した。

今回のプロジェクトにより、ダウンバースト・竜巻発生時の地上における気圧の急激な変化を観測できた。ダウンバースト・竜巻発生時の地上における気圧変化を、これほど細かい時間的・空間分解能で観測した事例はほとんど見られない。また、観測結果から、気圧低下から被害発生までに、約数分～十数分の時間差があることから、稠密観測網による突風に対する事前の注意喚起が出来る可能性がある。この観測網はデータ蓄積の為、今後も観測を継続し、局所的な気象現象を捉え、日々の生活に密着したデータ活用方法を模索していきたい。

謝辞：本プロジェクト始動にあたり、伊勢崎市教育委員会殿、サンデン (株) 殿、(株) セーブオン殿には POTEKA 設置のご協力を頂きました。ここに御礼申し上げます。

キーワード: 稠密観測, ダウンバースト, 竜巻
Keywords: High Dence observation network, Downburst, Tornado





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AAS23-P05 会場:3 階ポスター会場 時間:4 月 28 日 18:15-19:30

領域モデル NHRCM における都市陸面のスキームの役割に関する感度実験
A sensibity study on the role of the urban land surface scheme for a regional climate model, NHRCM

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

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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.

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

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おろし風頻発域における突風率の時空間特性
Temporal and spatial characteristics of gust ratio in the

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

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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.

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AAS23-P07 会場:3 階ポスター会場 時間:4 月 28 日 18:15-19:30

超高分解能気温センサーを用いた気球観測による乱流の直接測定の試み
An traial of direct monitoring of turbulence intensity by using the balloon-borne high-resolution temperature sensor

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

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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.

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高解像度数値モデルによる比良おろしの再現実験
High resolution numerical study of migrating strong downslope wind ”Hira-Oroshi” in Japan

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

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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.

キーワード: 高解像度数値モデル, おろし風, 局地風
Keywords: High resolution numerical simulation, Downslope wind, Local wind