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**（For JSPS Fellow）**

**Form B-5**

Date（日付）
（Date/Month/Year:日/月/年）

# Activity Report -Science Dialogue Program-

**（サイエンス・ダイアログ事業　実施報告書）**

- Fellow's name（講師氏名）Sanjay Kumar Mehta　（ID No. P12025 ）

- Participating school（学校名）: Akasikita High School, Hyogo Perfecture

- Date （実施日時）: 19 June 2014　（Date/Month/Year:日/月/年）

- Lecture title（講演題目）:（in English） Monitoring Upper troposphere and Lower stratospheric temperature using Global positioning system techniques

（in Japanese）

- Lecture summary（講演概要）: Please summary your lecture 200-500 words.

The lecture was about to teach how to monitor upper troposphere and lower stratospheric temperature (UTLS) using global positioning system (GPS) techniques. I began the lecture with introducing my country "INDIA" and myself. I belong from northern part of India and I speak Hindi as my mother language which is also my national language. I graduated in Mathematics and subsequently obtained master degree in meteorology and PhD in Atmospheric Science. During the course of my research, I taught how to use GPS radio occulation (RO) data to study and mointor the atmosphere.

Before starting the lacture on GPS RO techniques, I made a brief introduction of the Atmosphere. Atmosphere is a thin gaseous envelop comprised mostly N2, O2, H2O, CO2 gases along with clouds surrounding our planent Earth. Earth recieves energy from the sun as a short wave radiation (0.1-0.5 micometer) which warm its surface and drives our life. The earth average temperature is about 287 K which also start emiiting radiation but at longer wavelengths (Infrared spectrum). The gaseous molecules present in the atmosphere allow the most of the shortwave radiation to reach the earth's surface. That is earth's atmosphere is relatively transparent to the incoming solar radiation. In contrary, the atmosphere does not allow to leave the longwave radiation emiited by earth's surface to the space, and most of them is absorbed by gaseous molecules present in the atmosphere. Thus the atmosphere is relatively opaque to outgoing long wave radiation, which enbales it to keep warmer than it would have been without atmosphere. This is known as green house effect.

Some of the shortwave radiations (about 22%) do scatter with air molecules, aerosol

and coulds and give spectacular phenomana such as blue sky in upper atmosphere, white sky in the lower atmosphere, red sunrise and sunset. Atmosphere is composed of about 78% of nitogen , 21 % of the oxygen molecues and 0.9% of Argon and rest 0.1% of trace gases. Trace gases include carbon dioxide (CO2), ozone, methane etc. Due to burning of the fosil fuel, we have introduced more CO2 to the atmosphere. That is, the amount the atmospheric conctrations has increase over the past decades and hence led to global warming. Besides this using chemicals in refrigration, also has included enormous amount of chlorofluorocarbons (CFCs) to the atmosphere. The atmospheric composition decreases exponentially with height, thus, atmosphere is denser (due to greater gravitational force) and higher pressure near the surface. The temperature also changes with height but not as density and pressure. The atmospheric temperature changes with height allow us to divide the atmosphere in four parts namely, troposphere, stratosphere, mesosphere and thermosphere.

GPS RO techniques work on the principal of Snell's law, where atmosphere acts as a lens. There are constellations of 29 GPS satellite which are being used for the Global Navigation system. These GPS satellite continuously sends electromagnetic signals to earth's surface. In course of entering to earth's atmosphere it gets bended. To record bending information, Low earth orbit satellite is placed which receives the GPS signals whenever interacted. This bending information allow to calculate the atmospheric refractivity and hence temperature. Therefore from GPS technique, temperature information for about 10-40 km is provided. Currently about 2000 temperature profiles per day are being observed uniformly worldwide. GPS technique provides an unique opportunity to study and monitor the upper troposphere and lower stratosphere. The upper troposphere and lower atmospheric temperature exhibits variability over wide range of timescales. On longer time scale, upper tropospheric warming and lower stratospheric cooling has been observed due to increase in concentrations of greenhouse gases.

- Language used（使用言語）: English

- Lecture format（講演形式）:

◆Lecture time（講演時間） 70 min（分）, Q&A time（質疑応答時間） 10 min（分）

◆Lecture style（ex.: used projector, conducted experiments）
（講演方法（例:プロジェクター使用による講演、実験・実習の有無など））
Used projector

◆Interpretation（ex.: assistance by accompanied person, provided Japanese explanation by yourself）（通訳（例:同行者によるサポート、講師本人による日本語説明））
myself

◆Name and title of accompanied person（同行者 職・氏名）
None

◆Other note worthy information（その他特筆すべき事項）:
None

- Impressions and opinions from accompanied person（同行者の方から、本事業に対する意見・感想等

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がありましたら、お願いいたします。）: