A self design CO2 measurement system had been made by team from LAPAN to provide a more comprehensive research on atmospheric science. The reason of the sinusoidal curve of CO2 concentration in the surface observation is that the CO2 pattern. Photosynthetic rate and respiration are considered as the reason of the sinusoidal curve of CO2 concentration in the surface observation.

As a GHG (Green House Gas), CO2 absorbs emission energy radiation from earth in wavelength 2 - 20 micrometers. CO2 absorbs infrared energy for vibration and stretching, and lower atmosphere becomes warmer. Some scientist had a notion that CO2 is also possess a black body characteristic, thus the ratio of CO2 concentration will follow the absorption heat cycle of atmosphere. The higher CO2 concentration become shorter infrared path distance, before total atmospheric absorption happen, however occurred in the lower atmosphere. In the same time, more infrared will be released out to the space (Hennis Hug, 2008). The aim of this research is to study the vertical concentration of CO2 in Indonesia. The goal is to identify the concentration pattern in tropopause area, to discover the CO2 concentration movement and influences of surrounding stream, to find a characteristic of carbon dioxide in the surface, and to compare carbon dioxide concentration in certain location in Indonesia due to human activity

Data and Research Method

This research is basically to observe vertical and surface carbon dioxide concentration. The vertical observation utilized by launching a measuring balloon, the CO2 concentration can be measured, and the change of CO2 concentration and the probability of CO2 concentration can be identified. The CO2 pattern of CO2 NDIR sensor that transmit its result to the receiver, after reaching tropopause layer the payload disconnected automatically with the balloon and drop freely into the earth surface. The vertical observation is to monitor drumel variations of surface atmospheric carbon dioxide. To accomplish that, we build 5 CO2 ground station in 3 different island in Indonesia. Two of these station located in the equatorial region. Using the NDIR, CO2 sensor, result data then collected, analyzed and displayed by software by display. Adding to the data observation, we also monitor the CO2 surface concentration from the satellite data. The AIRS data from NASA (Atmospheric Infrared Sounder) in NASA Aqua Satellite. The data consist of mole fraction value of carbon dioxide in free troposphere. In daily or monthly observation, vertical observation data shows part of the continuous keeling curve of the CO2 pattern where the maximum concentration occurred in 7.00 - 8.00 in the morning, while the minimum concentration occurred at about 12.00 - 16.00 in the afternoon.

Instrument systems to measure CO2 vertical and balloon launched (Source : Chunaeni Latief,2008)

In surface observation data can be plotted. The pattern of the CO2 profile measurement was similar to different location. At certain elevation (example at 2,279 km in Bandung Oct'08) shows the CO2 concentration went down (decrease) to 298.1 ppm, and then went up (increase), with temperatures still went down (decrease) about 17.43 °C, this because seasons transition from dry to rainy season respectively. This phenomenon called mixing height, it occurred from the concentration changes due to balloon move up because of the convection from seasons variation before.

Vertical Observation

Balloon carrying payload with sensor was conducted with height arrangement from 18 to 18.5 km with velocity between 2.5 m/s until 6.9 m/s, and time sampling 30 seconds per data. It was expected that there would be a layer sample between 75 - 180 m. So there would be a representative scene at atmosphere layer and the ability in sending data and also saving power better. After the result of measurement compilation by the software, CO2 data concentration can be converted into ideal gas, then the data can be plotted.

Surface Observation

The wind observation also related to the CO2 ground station located in 5 different location (Bandung, Bualasakoe, Batam, Palembang and Pontianak). The last two location was located in the equatorial region. Every CO2 ground station consists of NDIR CO2 sensor with measurement range 0 - 2000 ppm, attached to 12.5 meter tower and joint with self design data logger. The sensor has response time of 30 seconds with accuracy 0.25ppm ± 2% of reading. The sensor was placed inside sensor house to protect from heat and water. The result data can be monitored in the CO2 display in daily observation. Added to the observation were the wind observation (wind speed and wind direction) from two different sources, from NCMR models analysis and AWS (Automatic Weather Station) placed in each station.

CONCLUSION

A self design CO2 measurement system had been made by team from LAPAN for measuring both vertical and surface CO2 concentration to provide a more comprehensive research on atmospheric science research. Added to this research are the AIRS data satellite from NASA.

CO2 vertical concentration pattern in different location (Bandung and Waloasakoe) shows that by increased altitude the CO2 concentration becomes lower. The vertical profile nearly had the same pattern, (increasing altitude will cause a decrease of CO2 concentration) in every location but there was also a changing pattern in certain altitude (CO2 concentration becomes lower although the altitude increases) which presumed because of mixing height.

In surface observation there is a same pattern in every location which result a sinusoidal pattern of CO2 concentration. The yearly observation data shows part of the continuous keeling curve of the CO2 pattern where the maximum concentration occurred in August - October while the maximum in March - April (although it still in research progress). Maximum concentration value occurred at about 3.90 - 8.00 in the morning, while the minimum concentration value occurred at about 12.00 - 16.00 in the afternoon. The wind observation also related to the surface CO2 pattern where the maximum wind speed (5 m/s) in 5 and wind direction (10°) during the maximum in the afternoon. The wind speed also increased from 10° to 16.30° will reduce the CO2 concentration.

Reference