PROC. INTERNAT. CONF. SCI. ENGIN. ISSN 2597-5250 | EISSN 2598-232X
Volume 1, October 2017 | Pages: 131-135

The Technique Analysis of CO_2 in Troposphere using AIRS

Nunung Isnaini Dwi Ningsih
Integrated Laboratory, Pysics Department, Faculty of Science and Technology, UIN Syarif Hidayatullah Jakarta
Jl. Ir. H. Juanda No 95 Ciputat, Banten, Tangerang Selatan 15412, Indonesia. Tel. +62-021-740 1592, Fax. +62-021-749 5967
Email: nunung_isnaini@uinjkt.ac.id

Abstract. *Ningsih N I D. 2017. The Technique Analysis of CO_2 in Troposphere using AIRS. Proc Internat Conf Sci Engin 1: 131-135.* Currently global warming has become an international issue. One of the biggest contributors to global warming is carbon dioxide (CO_2). CO_2 gas is one of the most prominent gases of greenhouse gases or greenhouse gases in the atmosphere and has an important role in the Earth's climate. Increased CO_2 contributes more than 50% to the effects of global warming. Various methods and measuring instruments of CO_2 concentration developed from optical sensors to measuring CO_2 directly from space using satellites. Atmosphere Infrared Sounder (AIRS) is one of NASA's six (6) instances launched on May 4, 2002 installed on the AQUA satellite. This instrument uses sounding technology that determines the vertical profile of CO_2 from space. This instrument supports climate-related research and also in improving weather forecasts. AIRS data can be obtained online from the Giovanni Website at http://giovanni.gsfc.nasa.gov. Giovani is an application provided by NASA to make it easier to acquire, visualize, and analyze remote sensing data with ASCII data facilities that can be downloaded directly. The purpose of this research is to conduct CO_2 analysis in Indonesia online using Giovanni Website year 2013-2016. Rendering data online shows the CO_2 fluctuated every month, but yearly data shows the CO2 increased signifantly and the higest value in 2016, its reach 4.039 ppm. The results of CO_2 analysis is expected to assist in the process of prevention or reduction of CO_2 emissions in the air as one of the activities of environmental conservation.

Keywords: Atmosphere Infrared Sounder (AIRS), CO_2, Giovanni Website

INTRODUCTION

Global warming is one of the effects of greenhouse gas. This condition has become an international issue, marked by the holding of various international conferences that discuss the issue. Gases that trap heat in the atmosphere are called greenhouse gases or greenhouse gases. These greenhouse gases include methane (CH_4), nitrogen dioxide (N_2O), carbon dioxide (CO_2), and florin gases. In 2012 the emissions generated by these gases are CH_4 (9%), N_2O (6%), CO_2 (82%) and Fluorine (3%), respectively. This trapped gas causes the planet become hotter (http://www.epa.gov/, 2014). One of the biggest factors on increasing CO_2 emissions is human activity. This CO_2 increase occurred since the beginning of the industrial revolution, because at that time it began to be wider to use fossil fuels and agricultural land conversion into industry. Recent research reveald that CO_2 increase continously and faster increasingly. The cycle of CO_2 in the atmosphere is very important because it has a role of as an earth blanket that captures long-wave radiation. Increasing the amount of CO_2 in the atmosphere will increase the greenhouse effect/warming of the earth's temperature. It is known that CO_2 contributes 63% in the effects of global warming due to its long life time in the atmosphere and the number increases every year (ESRL, 2010 in (Ambarsari, 2011).

Various activities related to CO_2 emissions reduction in the air are held by both nationally and internationally. One of some goals is direct any development program toward low-carbon development (http://www.puspijak.org/, 2011). Some laws in Indonesia related to climate change are Law no. 6 of 1994 on Ratification of the United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change). In addition, Law no.17 of 2004 about on the ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto Protocol to the United Nations Framework Convention on Climate Change). Then, UU no. 17 Year 2004 is a form of joint commitment to maintain the stability of greenhouse gas concentrations in the atmosphere (Riandi, AR, 2008 in (Ningsih, 2014)). In addition to the above two main points, at the G-20 Conference and the UN Climate Change Conference at Copenhagen COP15 in 2009, Indonesia pledged to reduce carbon emissions without foreign assistance by 26% by 2020, or by 41% with foreign aid. The commitment of the Indonesian government is economic growth until 2020 by 70% while at the same time reducing carbon emissions by 41% (http://www.puspijak.org/, 2011).

Atmospheric Infrared Sounder (AIRS) is one of the six instruments on board the Aqua satellite, which is a part of the National Aeronautics and Space Administration (NASA) Earth Observing System. AIRS CO_2 retrievals use an analytical method for the determination of carbon dioxide and other minor gases in the troposphere from AIRS spectra. The AIRS data have been shown to be accurate to within 1.20 ppm of simultaneous measurements by aircraft (Chahine et al., 2005). The high-resolution Atmospheric Infrared Sounder (AIRS) was launched into Earth-orbit in May 2002, with the goal to support climate research and improve weather forecasting. AIRS uses cutting-edge

infrared technology and provides information related to air temperature, water vapor, trace gases and cloud property (e.g., Pagano et al., 2003; Chahine, Barnet, Olsen, Chen, & Maddy, 2006) (Chen, 2014).

The studied using AIRS for analysis troposphere CO_2 in Iraq during the period 2010 – 2011 have been carried out. In this research, the AIRS data and the Satellite measurements are able to measure the increase of the troposphere CO_2 concentrations over different regions (Rajab, 2012). The other research have been done is analysis a Saharan Dust Storm an online analysis use of of NASA Earth Science data (Acker, 2007). At the same time, NASA and Esa atmospheric data using Giovanni, the online visualization and analysis tool (Leptoukh, G., et.al 2007) carried out using NASA MODIS (Terra and Aqua) and ESA MERIS (ENVISAT) aerosol data. As an example, it demonstrates Giovanni usage for online multi-sensor remote sensing data comparison and analysis. This research explained that Giovanni, the NASA Goddard online visualization and analysis tool (http://giovanni.gsfc.nasa.gov) allows users explore various atmospheric phenomena without learning remote sensing data formats and downloading voluminous data. The research about CO_2 in Indonesia has been done 2005 which reveals that changes in atmospheric CO_2 gas concentration are part of the carbon cycle that is important to study (Samiaji, 2011). A study of sounding technology developments to measure CO_2 concentration in atmospheres using NASA's Atmospheric Infrared Sounder (AIRS) to measure CO_2 in Indonesia from 2002-2010 had been done, and it results show that CO_2 concentration in Indonesia continues to increase from 2002 to 2010 with interval concentrations between 370 and 390ppm (Ambarsari, 2011). Other than CO_2 analysis, AIRS has also been used to analyze O_3 over 5 (five) regions, namely Subang, Penang, Kuantan, Johor and Kota Bharu. The results show that seasonal variations in O_3 are fluctuations were observed between the NEM and SWM seasons. O3 gas has an inverse relationship with rain and has a positive relationship with temperature (Jasim M. and Rajab, H. S. 2013).

Based on the above description, the CO_2 analysis is interesting to do, especially the spread of CO_2 in the air over in Indonesia. Increased CO_2 in the air as one of the triggers of global warming. Analysis of CO_2 spread in the air will be more interesting when it can be done directly. Therefore, in this study will be done online so as to facilitate the measurement of CO_2 in the air globally. The results of CO_2 analysis is expected to assist in the process of prevention or reduction of CO_2 emissions in the air as one of the activities of environmental conservation.

The research problem is how to find the distribution pattern of CO_2 spread in Indonesia region, based on the data from remote sensing process done by AURA (OMI) satellite in the period of 2013-2016.

MATERIALS AND METHODS

Study Area

The study area was in Indonesia, a country in Southeast Asia, and lies between 6º LU - 11º LS and 95º BT - 141º BT. The research focus on the monitoring CO_2 emission in 2013 - 2016. Next, we will see an area depicting CO_2 distribution over 350ppm. Thus, the limitations of the study included analysis of spatial and temporal patterns of atmospheric CO_2 pollutants (in this study on troposphere layer) and the data used are derived AIRS which is analyzed using Giovani web based software. The data obtained from the image of Aura satellite, and then the duration taken as the data is from January 2013 to December 2016.

Material and Methods

This research has been carried out four years data from 2013 - 2016 focus on CO_2 distribution over Indonesia. The result from the analysis is CO_2 profile obtained from AIRS/Aqua L3 Monthly CO_2 in the free troposphere (AIRS-only) 2.5 degrees x 2 degrees V005. Using Giovanni Website (http: //disc. sci. gsfx. gov/ giovanni), the spatial correlation for CO_2 has been analyzed.

RESULTS AND DISCUSSION

The rendering on Giovanni Website results CO_2 distribution map, average monthly CO_2 graph and histogram showing mean, median, maximum, minimum, and standard deviation. The CO_2 distribution map provides an overview of CO_2 distribution maps with different colors for each area. Areas with high CO_2 distribution are marked in red, and the thicker one is red, indicating the higher CO_2 content in the region. Figure 1 shows the map of CO_2 distribution from 2013-2016. The bar beside the map ilustrated the range of CO_2 distribution which is each years have the different values.

Figure 1 shows the CO_2 distribution map over Indonesia, from CO_2 from 2013-2016 in Indonesia. The mean and standard deviation of yearly CO_2 was (398.46±3.06) ppm for entire period. In detail noticeable CO_2 increased year to year, based on the data of mean and standar deviation. The data shows that distribution CO_2 increase significantly ±2ppm every years. The CO_2 distribution map (2014) shows that areas of Indonesia almost covered by red colour. As has been explained that the red color indicates a high CO_2. It means, 2014 areas of Indonesia contribute on emission CO_2 with range of CO_2 (3,953 up to 3,981) ppm. This could be due to an expansion areas of forest fires in Jambi, Riau, East Java, West Kalimantan, Central Kalimantan, Maluku, NTB, and North Sulawesi. The increasing of forest fire causes spread of CO_2 extend to other parts of Indonesia.

The Giovanni website also provides data in the form of histogram graph so it is easier for us to see the mean,

median, standard deviation, maximum, and minimum value.

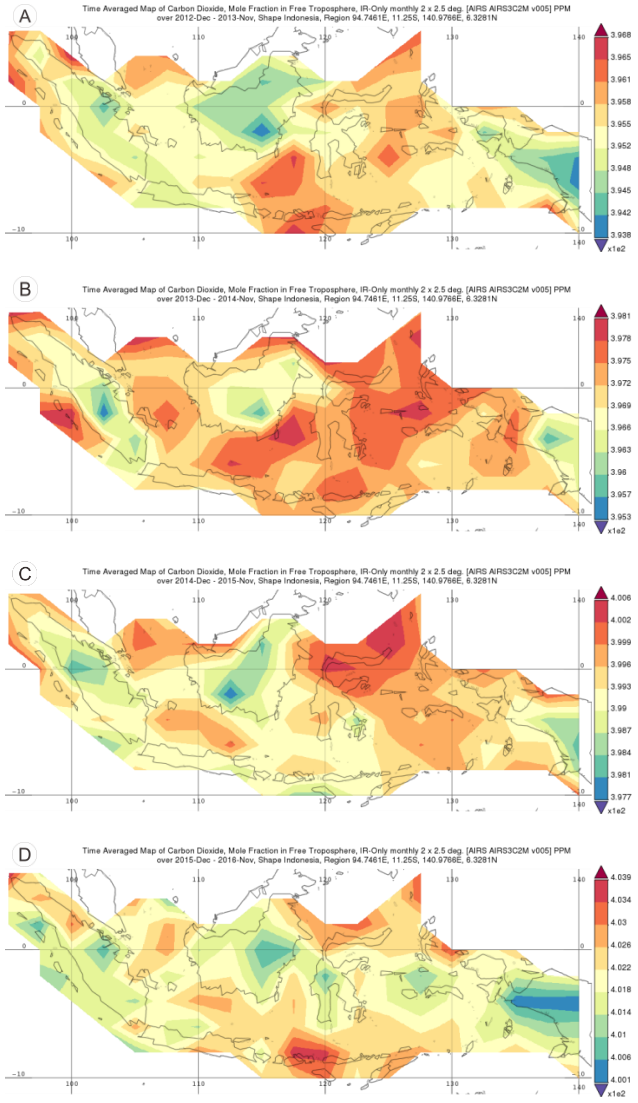

Figure 1. CO_2 distribution map over Indonesia **A**. 2013, **B**. 2014, **C**. 2015, **D**. 2016.

Table 1. Data of mean, median, std, max, and min CO_2 distribution in Indonesia 2013-2016.

Year	Mean	Median	Std	Max	Min
2013	395.47	395.52	1.64	404.99	385.55
2014	397.15	397.33	1.56	405.68	388.81
2015	399.38	399.36	1.68	409.50	388.72
2016	402.03	401.83	2.39	418.38	392.64

Besides of distribution maps and histogram, Giovanni Website also provides an average graph of CO_2 distribution. This graph facilitate to seeing an increase of CO_2 monthly.

Figure 2 shows the increasing of CO_2 distribution monthly, and v starting increase every April, 395.5ppm (2013), 397.5ppm (2014), 400ppm (2015), and 401.5ppm (2016). Then, Fig 3 describe the increasing of v yearly 2013-2016.

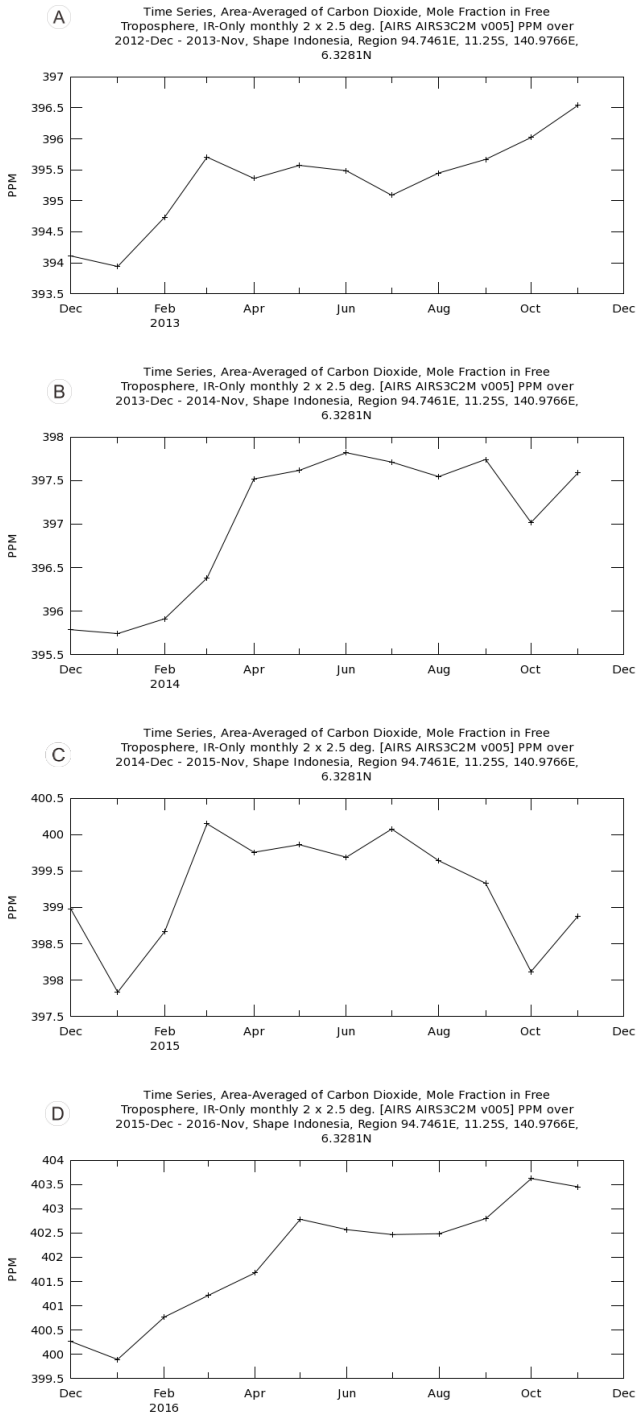

Figure 2. Graph, average CO_2 **A**. 2013, **B**. 2014, **C**. 2015, **D**. 2016.

Figure 3 has obtained from the Giovanni Website directly. This shows distribution CO_2 yearly from 2013-2016. The CO_2 distribution demonstrably increased significantly, and never down since 2013. If it is associated with the forest fires which also year by 2013, then this reason is highly correlated. The forest fires being one contributor CO_2 emissions Indonesia largest.

Nancy Harris, et.al, has written on http://www.wri-indonesia.org/, "Forest Fires in Indonesia Generate More Daily Emissions from the Overall Emission of the US Economy". The writing explained that according to

estimates published by Guido van der Werf at the Global Fire Emission Database, the number of hotspots detected in Indonesia 2015 is close to 100,000. In September, these fire spots each day produce emissions that exceed the daily average emissions of all US economic activity (Harris N, 2015).

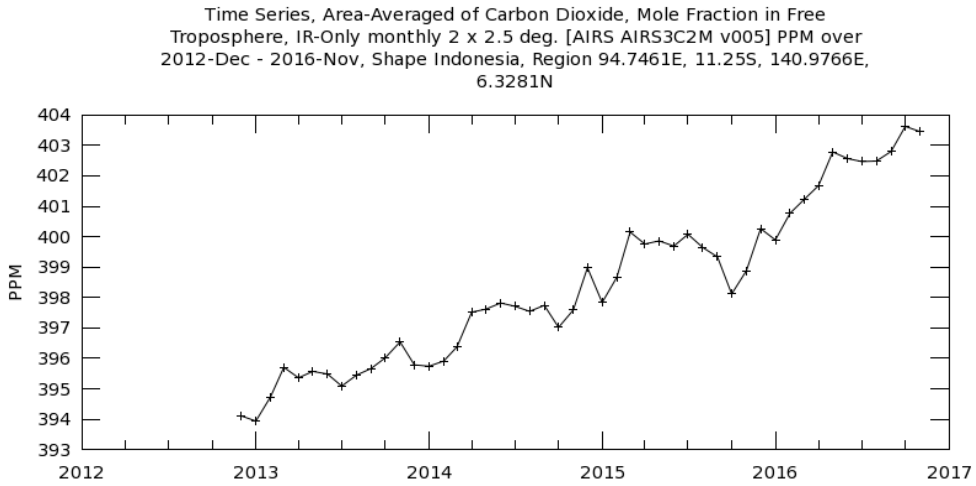

Figure 3. Graph of average distribution of CO_2 over the territory of Indonesia 2013-2016.

Discussion

Apprropriate with the purpose of research that is conduct CO_2 analysis in Indonesia online by using Giovanni site 2013-2016. The analysis views that CO_2 fluctuates every month, but the data annual shows that CO_2 tends to increase continously and reaches 4,039 ppm (2016). The mean and standard deviation (398.46±3.06) ppm for the entire period. The CO_2 progressively increase every year due to the observed during the 2013-2016 periods. If associated with previous research (Ambarsari, 2011), the CO_2 conditions above Indonesia increase continously from 2002-2010. The interval concentrations between 370 and 390ppm (2002-2010), and 385 and 418ppm (2013-2016). These incident can be linked to the forest fire incident in Indonesia, which is increase and extends from 2013.

The CO_2 distribution map and graph of CO_2 increase can be used as one a quick reference for environmentalists and policy makers in deciding the forest fire prevention activities significantly enough to reduce CO_2 emissions in the air. The goverment should be concentrate more to reduce the forest fire and fullfill the promise to reducing carbon emissions without reducing economics growth. The recommendations proposed in this research is using Triple Hellix concept to solve the problem.

CONCLUSIONS

The result of the study showed the CO_2 fluctuated every month, but yearly data shows the CO2 increased signifantly and the higest value in 2016, its reach 4.039 ppm. The results of CO_2 analysis is expected to assist in the process of prevention or reduction of CO_2 emissions in the air as one of the activities of environmental conservation.

ACKNOWLEDGEMENTS

The author sincerely acknowledge the NASA Goddard Earth Sciences Data Information and Sevices Center (DISC) for the provision of the AIRS data and images used in this paper, were acquired using GES-DISC interactive online visualization and analysis infrastructure (Giovanni).

REFERENCES

Acker, G. 2007. Online Analysis Enhances Use of NASA Earth Science Data. Eos, Vol. 88, No. 2, 9 January 2007.

Ambarsari, N. d. 2011. Kajian Perkembangan Teknologi Sounding untuk Mengukur Konsentrasi CO_2 di Atmosfer. Berita Dirgantara Vol 12 No. 1 Maret 2011 , 28-37.

Chen, X. 2014. A Case Study of Monitoring Emission from CO_2 Enhanced Oil Recovery by Remote Sensing Data. Energy and Environment Research; Vol. 4, No. 3 ISSN 1927-0569 E-ISSN 1927-0577 Canadian Center of Science and Education, 33-42.

Jasim M., Rajab, H. S. 2013. Monthly Distribution of Diurnal Total Column Ozone Based on the 2011 Satellite Data in Peninsular Malaysia. The Egyptian Journal of remote Sensing and Space Sciences , 103-109.

Leptoukh, G. 2007. Exploring NASA and ESA Atmospheric Data Using Giovanni, The Online Visualization and Analysis Tool. Proc. Envisat Symposium 2007, Montreux, Switzerland.

Ningsih, NID. 2012. Usulan Model Penerapan Green IT di Perguruan Tinggi Islam. Pros. Seminar Nasional Aplikasi Teknolgi Informasi, ISSN 1907-5022, Universitas Islam Indonesia

Rajab, M. A. 2012. Analysis of Troposphere Carbon Dioxide in IRAQ from Atmosphere Infrared Sounder (AIRS) data: 2010-

2011. Journal of Babylon University/Pure and Applied Sciences/ No.(1)/ Vol.(22): 2012, College of Science/Babylon University Scientific Conference, 524-531.

Samiaji, T. 2011. Gas CO2 di Wilayah Indonesia. Berita Dirgantara Vol. 12 No. 2 Juni 2011, 68-75.

http://nationalgeographic.co.id/. 2013. Dipetik Agustus 05, 2017, dari http://nationalgeographic.co.id/berita/: http://nationalgeographic.co.id/berita/2013/04/kadar-co2-bumi-sentuh-batas-mencemaskan

Harris, N., Minnemeyer, S., Stolle, F., Payne, OA., 16 Oktober 2015. Kebakaran Hutan di Indonesia Menghasilkan Emisi Harian yang Lebih Besar daripada Emisi Perekonomian AS Secara Keseluruhan**.** Dipetik Juni 12, 2017, dari http://www.wri-indonesia.org/id/

http://www.puspijak.org/. 02 Desember 2011. Retrieved Februari 20, 2014, http://www.puspijak.org/in/berita-terbaru/75-seminar-hasil-litbang-mendukung-pembangunan-rendah-karbon

http://www.epa.gov/. 06 Maret 2014. Retrieved Maret 19, 2014, http://www.epa.gov/climatechange/ghgemissions/gases.html

THIS PAGE INTENTIONALLY LEFT BLANK