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REPORT FROM E-MAIL DISCUSSION ON "GLOBAL WARMING: WHAT IS THE SCIENTIFIC TRUTH?"

Hideo YOSHIDA*

*Department of Aeronautics and Astronautics, Kyoto University, Sakyo-ku, Kyoto 606-8501, Japan

ABSTRACT Global warming is currently a key topic in international politics; therefore, the impact of measures taken to counteract it is enormous. However, it should be noted that considerable controversy surrounds the scientific truth on global warming. Therefore, clarifying the scientific truth is both urgent and crucial. To this end, the author, as vice chairman of the editorial committee of the Japan Society of Energy and Resources, coordinated an e-mail discussion among five prominent Japanese scientists. The full text in Japanese, including data forming the basis of the discussion, is available for download from the homepage of the Japan Society of Energy and Resources (http://www.jser.gr.jp/). To the author's knowledge, the discussion, supporting papers, and associated data represent the first trial of its kind. On the occasion of ICOPE-09, the coordinator summarizes the outline of the e-mail discussion and illustrates state-of-the-art research on global warming.

Keywords: Global warming, Scientific truth, IPCC, CO_2, E-mail discussion

1. INTRODUCTION

This paper is a brief introduction to an e-mail discussion originally published in the January and March 2009 issues of *the Journal of the Japan Society of Energy and Resources* (*JJSER*) in Japanese [1] [2]. Since the author served as coordinator of the discussion, this chapter begins with the English translations of "the cover page of the article shown in Fig. 1" and "Preface," both of which were prepared by the coordinator.

"Global Warming: What is the Scientific Truth?"

The earth's climate is a very complex system resulting from interactions of the solar system, atmosphere, ocean, and continents. The phenomena of the climate consist of numerous physical and chemical processes with various space and time scales, and their effects on the climate are not always linear but frequently nonlinear. Therefore, scientific clarification of the climate is extremely difficult despite a large number of scientists having devoted considerable time to this task. Consequently, the truth and facts behind the causes of global warming remain controversial. In this issue, five prominent scientists with differing standpoints have conducted a valuable e-mail discussion.

Prof. Syun-Ichi. Akasofu, Alaska University, USA (Top in Fig. 1)
Dr. Seita Emori, National Institute for Environmental Studies, Japan (Lower left in Fig. 1)
Prof. Kiminori Itoh, Yokohama National University, Japan (Upper left in Fig. 1)
Dr. Kanya Kusano, Japan Agency for Marine-Earth Science and Technology, Japan (now Prof. of Nagoya University) (Lower right in Fig. 1)
Prof. Shigenori Maruyama, Tokyo Institute of Technology, Japan (Upper right in Fig. 1)

Fig. 1 The cover page of the article published in *the Journal of the Japan Society of Energy and Resources*, January 2009

Preface

On the next day of June 23, 1988, The New York Times reported the following:

> *Global Warming Has Begun, Expert Tells Senate*
> *Dr. James E. Hansen of the National Aeronautics and Space Administration told a Congressional committee that it was 99 percent certain that the warming trend was not a natural variation but was caused by a buildup of carbon dioxide and other artificial gases in the atmosphere.*

Nearly 20 years after Dr. Hansen's statement, the 2007 Nobel peace prize was awarded jointly to Mr. Al Gore and the Intergovernmental Panel on Climate Change (IPCC). Global warming therefore came considered an important topic, and concerted global efforts have been made to reduce CO_2 emission, which is regarded as the principal cause of global warming. However, while most governments, organizations, mass media report, and people in general believe that global warming results from increased concentrations of CO_2 in the atmosphere, considerable controversy exists among scientists in the US, Europe, and Japan. Scientists opposed to the conclusions of the IPCC are often referred to as skeptics or naysayers.

As the mitigation of global warming was the main topic at the G8 Hokkaido Toyako Summit 2008, its social and economic impacts are enormous, rightly or wrongly. It is, however, dangerous to take hasty and strong action to reduce CO_2 emissions purely on the basis of precautionary measures, without having firm scientific consensus on the true causes. The following opinion is common: Irrespective of the ultimate cause of global warming, all movements to reduce CO_2 emissions are welcome in terms of mankind becoming aware of the earth's limitations and therefore seeking to save energy and resources. However, we should not forget essential scientific discussions.

As an alternative to the conventional New Year talk in the JJSER, I proposed an e-mail discussion on these important topics. Although similar trials have been conducted in some TV programs, their limitations were obvious; talks at cross purposes and the extinction of the discussion shortly after the programs aired. In this issue, five scientists conducted preliminary discussions on the framework of the main discussion, exchanging indepth and well-researched e-mails with data to support their conclusions. Since their e-mails are recorded in the JJSER, and their supporting data was uploaded to the homepage of JSER (http://www.jser.gr.jp/), readers can consider their opinions and determine which opinions are more reasonable. In the future, this issue will serve as a precious archive on global warming in the early 21st century.

It should be noted that the scope of the discussion is limited to purely scientific topics on the phenomena relating to the temperature characteristics of the earth's surface, although there is wide political and economic scope to the global warming argument.

At this juncture, I would like to add a few words repeatedly considered during the discussion. The words "science" and "conscience" are almost identical; both stem from "scio" in Latin, meaning "to know." Hence, making efforts to find the truth through sincere discussion is considered to be "science" and/or "conscience." I express my gratitude to the five splendid scientists who conducted the discussion "in a spirit of scientific detachment." (Bertrand Russell; Why man should keep away from the moon, The Times, July 15, 1969)

Listening to "Smile" (Charlie Chaplin; Modern Times, 1936), a famous song in the 20th century, and thinking of the day when the present discussion will be a precious archive of the 21st century.

December 16, 2008

Coordinator
Vice chairman of the editorial committee of JSER
Hideo Yoshida, Professor of Kyoto University

2. PREPARATION OF E-MAIL DISCUSSION

The present discussion was conducted by e-mail among the five scientists and the coordinator. During the initial three months (July–September, 2008), we prepared a framework for the discussion. First, to mutually understand viewpoints, a preliminary questionnaire based on so-called "SPM by WG1 in the fourth Assessment Report of IPCC" and shown in Table 1, was issued. Since this is just a simple triple-choice questionnaire, it should be noted that Table 1 merely shows unspecific images of the five scientists. It is clear that only Dr. Emori supports the IPCC conclusions—to which he had made an active contribution. It is worth noting that various opinions exist, even among the skeptics and naysayers.

In the light of the results shown in Table 1, we anticipated the ensuing discussions and decided to concentrate on the two topics:

Part 1 Causes of Temperature Rise in the Late 20th Century,
Part 2 Future Predictions.
We later added a third topic
Part 3 Others,
when we extended the discussion to the March 2009 issue. The list of formal e-mails is shown in Table 2. However, by the end of the discussion, we had actually exchanged more than one thousand e-mails.

In principle, once the e-mail discussion started in October 2008, there was a simultaneous exchange of e-mails. To clearly demonstrate the time sequence of the successive e-mails, the date of each e-mail was recorded; the one exception being the real-time e-mail discussion in 4.4. This is a slightly edited form of the discussion and is based on the numerous e-mails exchanged between Prof. Maruyama and Dr. Emori on February 19 and 20, 2009.

Table 1 Results of Preliminary Questionnaire to Understand Five Scientists' Standpoints
(○: agree, Δ: partly agree, ×: do not agree)

The Fourth Assessment Report of the IPCC A report of Working Group I of the IPCC, Summary for Policymakers http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf	Aka-sofu	Emori	Itoh	Kusa-no	Maru-yama
Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture.	○	○	○	Δ	×
Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.	○	○	Δ	○	○
Palaeoclimatic information supports the interpretation that the warmth of the last half century is unusual in at least the previous 1,300 years.	×	○	Δ	×	×
Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns.	×	○	×	×	×
Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.	×	○	Δ	×	×

3. BRIEF REVIEW OF E-MAIL DISCUSSION

Since the five scientists have different backgrounds and viewpoints, the coordinator initially expected the discussion to be conducted among all five scientists, in various combinations. However, most of the discussion involved Dr. Emori of the IPCC and the other four scientists. Consequently, Dr. Emori frequently prepared replies to the other four scientists; if necessary, he asked colleagues in Japan and/or abroad to collaborate, their names are listed in the acknowledgements in his papers. The entire discussion consists of 32 mails (sections).

It is extremely difficult for the coordinator to summarize the e-mail discussions covering numerous topics and offering profound insights into the subject.

Perhaps, the only common agreement among the five scientists is that the temperature rise in the late 20th century is indisputable. Prof. Akasofu, however, stressed that it is mainly due to the superposition of two natural oscillations, and that global warming has recently stopped. Although Prof. Itoh partly agreed with the anthropogenic effect, he simultaneously pointed out the importance of natural variation and the uncertainty of temperature measurement. Prof. Maruyama's viewpoint is mainly based on a long-range time scale, and he has focused on the sun's activity. Dr. Emori response was that although some uncertainty inevitably exists, the conclusion drawn by IPCC is reasonable in terms of the available data.

Concerning the global circulation model (GCM), the prediction from which forms the basis of the IPCC's conclusion, all five scientists, including Dr. Emori, referred to its incomplete nature. In particular, Dr. Kusano and Dr. Emori exchanged many key opinions on the GCM. Although Dr. Kusano considered that the global warming predicted by the GCM models is merely a hypothesis at present, both he and Dr. Emori displayed a mutual understanding.

Among the five scientists, Prof. Itoh was most active in expressing his opinions on a wide range of global warming topics, and continuously led the entire discussion through to its final stage. Part 3 of the paper, published in the March issue, covered various topics that had not been properly categorized into either Part 1 or Part 2; including 7.1, in which Prof. Itoh's question was directed to Prof. Maruyama, unlike the other discussions entailing Dr. Emori and one of the other four scientists.

The differences in opinion between Dr. Emori and the other four scientists were not mitigated after the discussion. However, without doubt, the present discussion is of the highest level and is the most focused of all previous discussions.

4. IMPACT OF PUBLICATION ON THE INTERNET

Just before the publication of the January issue, the five scientists and the coordinator agreed to simultaneously publish the discussion on the homepage of JSER (http://www.jser.gr.jp/). Since the PDF files of the article are freely accessible, many people in Japan and throughout the world can access the site.

If you search for the present discussion on the internet, you will find countless sites referring to it; the coordinator introduces some of these sites below.

4.1 In Japan

Japan has three main newspapers—*Yomiuri*, *Asahi*, and *Mainichi*. All of these newspapers, as well as *the Sankei Shimbun* and *the Environmental News*, reported on the discussion:

Table 2 Contents of E-mail Discussion

Part 1 Causes of Temperature Rise In the Late 20th Century	1. Introductory Discussion	
	1.1 Akasofu: Global warming has stopped	1.2 Itoh: Temperature increase = natural variations + anthropogenic factors + observational errors
	1.3 Emori: Full of misunderstandings, lack of consistency and quantitativity	
	1.4 Akasofu: Two natural oscillations have caused the present global warming	
	1.5 Emori: IPCC does not ignore natural variabilities, nor does it guess wrong	
	2. Uncertainty in Temperature Measurement	3. Climate Sensitivity
	2.1 Itoh: IPCC concludes too quickly that "rough-and-ready" is dangerous	3.1 Itoh: Observation-based estimations appear to show small climate sensitivity
	2.2 Emori: The theories that suggest uncertainty also require scrutiny	3.2 Emori: Evidence is weak for a small climate sensitivity
	4. Real-time E-mail Discussion Stemming from an Evaluation of Solar Activity	
	4.1 Emori: Doubt raised on sunspot plot	
	4.2 Maruyama: Reply to Dr. Emori, role of paleoclimatology, and direction of future study	
	4.3 Emori: Future projections never depend on paleo-data	
	4.4 Maruyama and Emori: We had a real-time e-mail discussion	
Part 2 Future Predictions	5. State-of-the-art Global Circulation Model, Potential of GCM	
	5.1 Kusano: Reliability of numerical simulations for future predictions	
	5.2 Emori: Underestimated reliability of models and overestimated unknown factors	
	5.3 Kusano: Anthropogenic global warming is still a hypothesis, and we have to explore the various possibilities	
	5.4 Emori: Theories like cosmic rays never seem to bring "verification"	
	5.5 Kusano: For our mutual understanding	
	5.6 Emori: Distinction is needed between qualitative and quantitative validity	
	5.7 Kusano: How important is it to discuss the quantitative accuracy and uncertainty?	
	5.8 Emori: Mutual understanding may be reached	
	5.9 Itoh: On predictive models	
	5.10 Emori: IPCC never excludes simple methods	
	5.11 Itoh: On predictions and models	
	5.12 Emori: On projections and models	
	6. Factors Governing Local Climate in the Future	
	6.1 Itoh: CO_2 contributes little to regional/local climate changes; still uncertain on other large contributions	
	6.2 Emori: Factors other than GHGs are surely important for near term and regional/local scales	
Part 3 Others	7. Others	
	7.1 Itoh: What serves as essential criticism for IPCC?	
	7.2 Itoh: "Science" in the IPCC reports should be inspected; the case of hurricanes as an example	
	7.3 Itoh: Relationship between temperature and CO_2 concentration	
	7.4 Emori: "Facts" versus "views"	
	7.5 Itoh: It may be not detrimental if a mutual understanding cannot be reached	

- January 12, 2009: *The Mainichi Newspapers*
  http://mainichi.jp/life/ecology/archive/news/2009/01/20090112ddm002040147000c.html
- January 21, 2009: *The Environmental News*
  http://www.kankyo-news.co.jp/ps/qn/guest/news/showbody.cgi?CCODE=68&NCODE=155
- March 2, 2009: *The Yomiuri Shimbun*
  http://www.yomiuri.co.jp/eco/ondan/on090302_01.htm
- June 26, 2009: *The Asahi Shimbun*
  https://aspara.asahi.com/blog/science/entry/dypLEK022P
- August 2, 2009: The Sankei Shimbun
  http://sankei.jp.msn.com/science/science/090802/scn0908021801001-n1.htm

One of the sites, on which we had not expected the discussion to be covered and were therefore very pleased to learn of, highlights an example of the problems with the Japanese language being used for a university entrance examination:

- April, 2009: On global environmental problem
  http://www.yomiuri.co.jp/education/kouza/kokugo/0904/k0904_1.htm

4.2 In the World

The Register reported on the discussion, providing an English translation of some of the papers by Prof. Akasofu and Dr. Kusano on the following site:

- February 25, 2009: Japan's boffins: Global warming isn't man-made, Climate science is 'ancient astrology', claims report
  http://www.theregister.co.uk/2009/02/25/jstor_climate_report_translation/

This article served as a trigger for international interest in the discussion. For instance, soon after the publication of *the Register*'s article, articles appeared on many sites:

- February 25, 2009: Japanese Commission Challenges UN: Global Warming Not Man-made

http://www.newsbusters.org/blogs/noel-sheppard/2009/02/25/japanese-commission-challenges-un-global-warming-not-man-made .

Regrettably, however, not all sites provided correct comments when referring to the discussion. Therefore, on *the Australian News*

- March 14, 2009: Japanese scientists cool on theories
  http://www.theaustralian.news.com.au/story/0,25197,25182520-2703,00.html

the coordinator quotes the following sentences by Peter Alford, Tokyo correspondent:

> *However, the paper's co-ordinator said the JSER's position on anthropogenic global warming was neutral. "This paper represents the views of the individuals and not of the society," said Hideo Yoshida, of Kyoto University. "The purpose is to stimulate debate among scholars and readers, and let them form their own judgment."*

CONCLUDING REMARKS

A majority of the attendees at ICOPE-09, including the author, are mechanical engineers specializing in thermal and/or fluid engineering related to power and energy. Therefore, we all have fundamental knowledge of the physics of global warming. However, generally speaking, since climate change is a complex subject, we have a tendency to rely on key information sources in the world. Although, to some extent, we cannot help being passive about global warming, we do have a responsibility as engineers and/or scientists to actively consider it. Also, we are all aware that mechanical engineers usually have well-balanced views on various complex systems.

In light of the above-mentioned situation, the author hopes the present e-mail discussion provides valuable information about this state-of-the-art study on global warming. The present discussion may not provide a firm conclusion, but it does make tentative steps toward discovering the truth about global warming.

REFERENCES

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