

THE RAPID GROWTH OF PUBLICATIONS BY ATMOSPHERIC AND OCEANIC SCIENTISTS OF CHINESE ORIGIN

BY ZHANQING LI, LONG CHIU, STEVE WENG, DA-LIN ZHANG, JUN DU, JOSEPH HUANG, MENGLIN JIN,
HENRY JUANG, FUNG-CHI KO, SARAH LU, SONG YANG, DONGLIANG YUAN

Immigrants have made a significant contribution to American culture, economic well-being, and science and technology. A survey in the journal *Science* (28 May 2004 issue) showed that foreign-born or -educated scientists made exceptional contributions to U.S. science in almost all scientific disciplines. However, their contributions may not be appropriately recognized in terms of the proportion of all contributions they make to the scientific literature (Stephan and Levin 2001).

Within the last two decades, there has been a significant increase in the presence of Chinese-American (CA) scientists in the fields of oceanic, atmospheric, and Earth-related sciences. In fact, they represent about 9% of the total doctoral recipients (Johnson 2001). Flipping through the pages of journals in geophysics and Earth sciences, the significant proportion of articles authored or coauthored by scientists of Chinese origin is evident. Despite the anecdotal evidence, no objective statistics exist to quantify the growing trend. In an attempt to begin compiling statistics, the Chinese-American Oceanic and Atmospheric Association

(COAA) surveyed selected journals published by the AMS and the American Geophysical Union (AGU).

COAA itself is a product of the increasing presence of CAs in the Earth-science fields. The COAA was formed to meet the needs of the Chinese-American atmospheric, oceanic, and Earth-science community. Registered as a nonprofit organization, its purposes are to network atmospheric, oceanic, and related Earth-science professionals to establish a forum based on common interests, to promote professional opportunity and quality and to utilize science results to benefit society. With 66 founding members in 1993, COAA's membership has grown to over 400, mostly CAs living in regions with major meteorological institutions, such as Washington, D.C.; Boulder, Colorado; and Los Angeles, California.

We surveyed the author listings in the online versions of the following journals: *Journal of the Atmospheric Sciences (JAS)*; *Monthly Weather Review (MWR)*; *Journal of Climate (JCL)*; *Journal of Applied Meteorology (JAM)*; *Journal of Physical Oceanography (JPO)*; *Bulletin of the American Meteorological Society (BAMS)*; the *Journal of Geophysical Research—Atmospheres (JGR-A)*; the *Journal of Geophysical Research—Oceans (JGR-O)*; and *Geophysical Research Letters (GRL)*.

All volumes of the AMS journals are online (except for *BAMS*, archived back to 1970 only), while the online AGU journals date from 1994, as of this study, so our statistics for the AMS journals cover a longer time period than that for the AGU journals. It is worth noting that these journals represent just a handful of sampled periodicals to which Chinese authors contribute. Other leading journals, such as *Climate Dynamics*, *Climate Change*, *Boundary Layer Meteorology*, etc., are also major outlets for CA scientists in the atmospheric and oceanic science fields.

First, we selected articles that had at least one author of Chinese ethnic origin, and collected author names, article titles, institutions, and key words. We consid-

AFFILIATIONS: LI, ZHANG, AND JIN—University of Maryland, College Park, Maryland; CHIU—George Mason University, Fairfax, Virginia; WENG—University of Virginia, Charlottesville, Virginia; DU—National Oceanic and Atmospheric Administration, Washington, D.C.; HUANG—National Oceanic and Atmospheric Administration, Silver Spring, Maryland; JUANG, LU, AND YANG—National Oceanic and Atmospheric Administration, Camp Springs, Maryland; KO—University of Maryland, Solomons, Maryland; YUAN—Chinese Academy of Sciences, Beijing, China

CORRESPONDING AUTHOR: Zhanqing Li, Department of Atmospheric & Oceanic Science and ESSIC, 2207 CSS Bldg., University of Maryland, College Park, MD 20742
E-mail: zli@atmos.umd.edu

DOI:10.1175/BAMS-88-6-846

©2007 American Meteorological Society

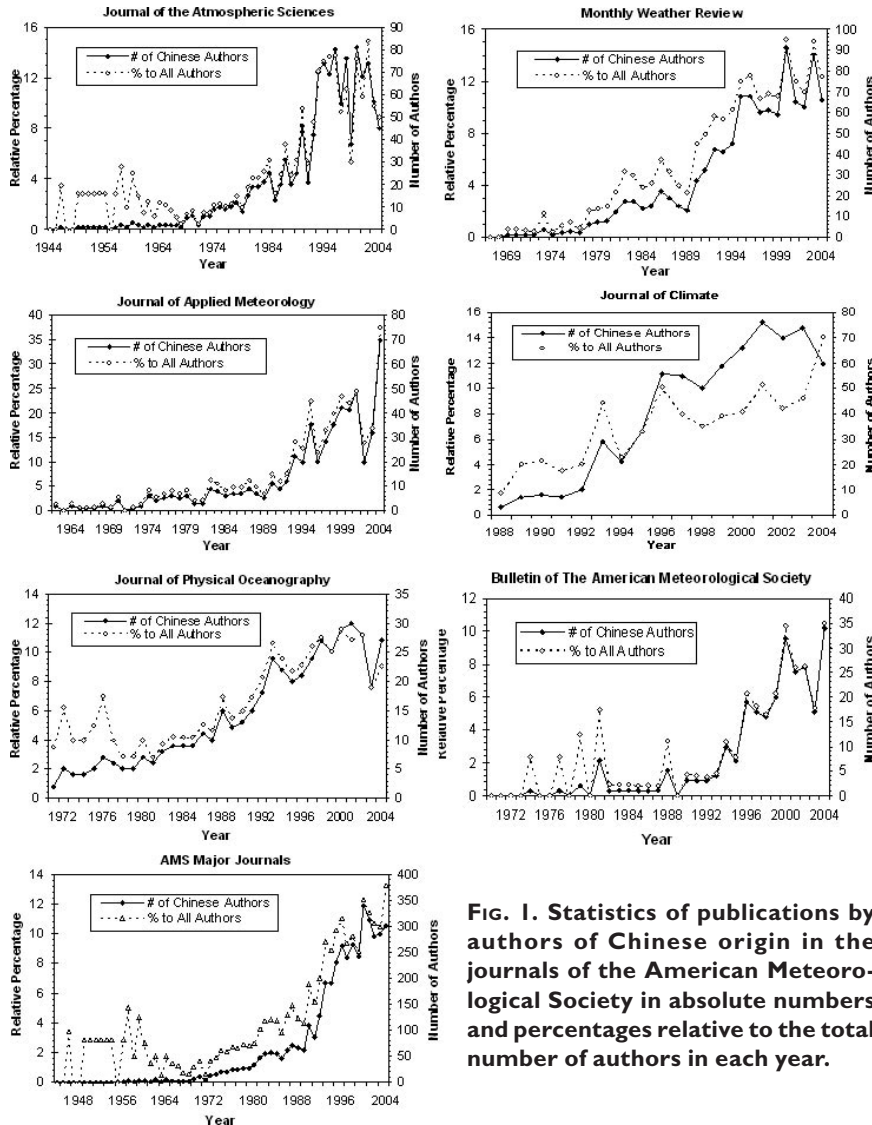


FIG. 1. Statistics of publications by authors of Chinese origin in the journals of the American Meteorological Society in absolute numbers and percentages relative to the total number of authors in each year.

ered an author to be of Chinese descent if he/she either had Chinese lineage or was from mainland China, Hong Kong, or Taiwan. To our knowledge, very few of them are second- or third-generation Chinese, based on the spelling and composition of their full names. We exercised care to distinguish Chinese from other ethnic groups, such as Korean, Vietnamese, etc. We may have missed or misplaced a handful of authors whose last names deviate from the conventional spelling used by the vast majority of Chinese who originated from these three regions. For each journal, we counted the number of Chinese authors and the total number of authors for every year. We did not consider the order of authorship. The trends were analyzed in terms of the number of authors and percentages relative to the total number of all authors in individual journals.

The statistics obtained from the AMS journals (Fig. 1) show that the number of publications by authors of Chinese descent was almost negligible prior to the 1970s (i.e., less than 10 each year for all the AMS journals). Steady increases occurred into the 1980s. By the mid-1980s, the total number of CAs in all the surveyed AMS journals reached about 50, or around 4%. Based on the spelling of their names, we determined that during this period the majority of authors originally came from Taiwan or Hong Kong.

After the mid-1980s, these numbers rapidly increased in all the journals, both in terms of the number of authors and the relative percentages. This is obviously attributable to the rapid increase in the influx of graduates and visiting scientists to the United States from mainland China, due to China's open-door policy that began in 1979. The sharpest increase took place in the 1990s, when many of the Chinese students graduated and/or started publishing. By the late 1990s, the publication numbers seem to have leveled off, with the total reaching approximately 300–350 authors, or 12%–14% in all surveyed AMS journals.

Comparisons among the different journals suggest that the scientists of Chinese origin have similar interests in many subdisciplines of the meteorological and oceanic science fields. The average number of Chinese authors in *JAS*, *MWR*, *JCL*, and *JAM* is around 70 annually for each journal over the last few years, although the number dropped significantly for *JAS* (down to 45 in 2004). This decrease was compensated for by increases in other journals, such as *JAM*, possibly hinting at a slight shift in the publication venue. It is interesting that the percentage curves match very closely with the curves of the numbers of authors.

Figure 2 shows similar statistics for the AGU journals. Due to the shorter time period covered by the available online versions of the AGU publications, the annual variation is not addressed here. Overall, the number of CA authors publishing papers in AGU's atmospheric and oceanic journals is about the same over the same period (~ 350), and the relative percentage is significantly higher (20%–25%) than that for the AMS journals. Again, the two curves have similar increasing trends.

This database, which is still under development, will be made available through COAA's Web site (www.coaaweb.org). We will augment it with simple search capabilities to facilitate strategic planning, networking, and resource management for the oceanic and atmospheric research communities. This survey sheds some light on the overall contribution of foreign-born scientists, and we hope it inspires more foreign students to pursue a science career in our fields.

ACKNOWLEDGMENTS. This work was sponsored by the Chinese-American Oceanic and Atmospheric Association. We thank previous and current board members who conceived the idea and encouraged us along the way.

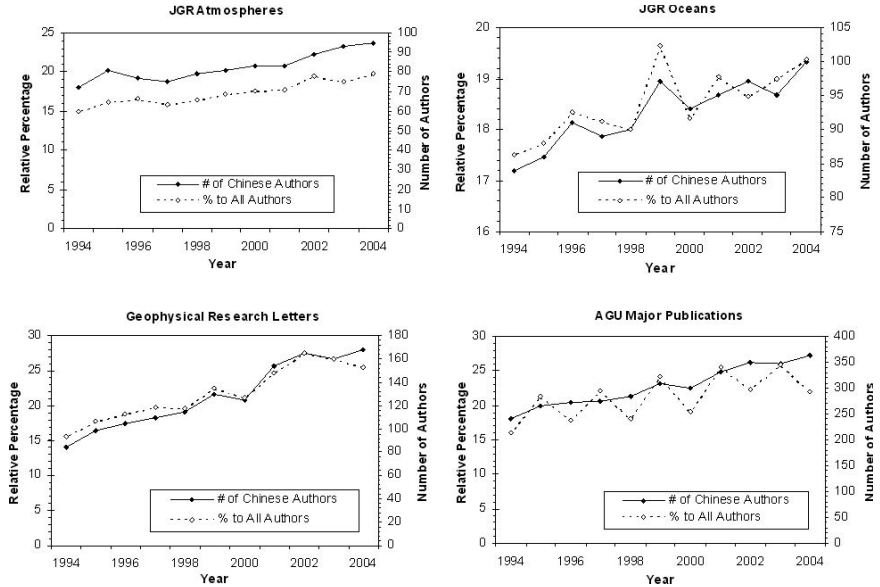


FIG. 2. Statistics of publications by authors of Chinese origin in the journals of the American Geophysical Union in absolute numbers and percentages relative to the total number of authors in each year.

FOR FURTHER READING

- Johnson, J. M., 2001: Human resource contributions to U.S. science and engineering from China. Issue brief, NSF Division of Science Resources Studies, NSF 01-311. (Available online at www.nsf.gov/statistics/issuebrf/nsf01311/sib01311.pdf.)
- Mervis, J., 2004: Many origins, one destination. *Science*, **304**, 1277–1288.
- Stephan, P. E., and S. G. Levin, 2001: Exceptional contributions to U.S. science by the foreign-born and foreign-educated. *Popul. Res. Policy Rev.*, **20**, 59–79.