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Igor Krupnik, Michael A. Lang,
and Scott E. Miller
Editors

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Cooperation at the Poles? Placing the First International Polar Year in the Context of Nineteenth-Century Scientific Exploration and Collaboration

Marc Rothenberg

ABSTRACT. The first International Polar Year (IPY) of 1882–1883 came at the end of a half-century of efforts at collaborative and/or cooperative research among the scientific communities of Europe and the United States. These efforts included the Magnetic Crusade, a cooperative endeavor to solve fundamental questions in terrestrial magnetism; a variety of plans for international cooperation in the gathering of meteorological data; the observations of the transits of Venus; and the establishment of the Smithsonian's international network to alert astronomers of new phenomena. It was also a half century when scientific exploration of the polar regions was still problematic in terms of the safety and survival of the investigator. This paper will look at scientific cooperation and earlier Polar research as the background for the first IPY, with special emphasis on the leadership role taken by the Smithsonian Institution.

INTRODUCTION

The first International Polar Year (IPY), which included 14 expeditions sponsored by 11 countries (12 expeditions to the North Polar Region, 2 to the South Polar Region), was a landmark event in the history of polar science. During the half-century leading up to the coordinated research efforts of 1882–1883, scientific research in the Polar Regions had been very problematic. Survival, let alone the successful completion of observations, was uncertain. The use of trained specialists was a rarity. Instead, research was usually conducted as a sideline to the primary objectives or mission of the expedition, which were geographical discovery, by a scientifically inclined explorer, military officer, or physician who made observations or collected specimens on a limited basis. Attempting to reach higher latitudes was an end in itself, a form of international competition, independent of any scientific return (Barr, 1983:464).

The catalyst for the transformation from competition and exploration to cooperation and scientific research was Karl Weyprecht, the Austrian explorer who first suggested the IPY. It was Weyprecht's "drive, ambition, and connections" which were essential in bring the idea of an international, cooperative attack on the problems of polar science to fruition, although he died in 1881, before the IPY was officially launched (Barr, 1983:464).

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It is important, however, not to claim too much for the first IPY. It did not launch science on an entirely new path of international cooperation. That was already a well-trod path by the last quarter of the nineteenth-century, and many of the programs of the Smithsonian Institution, for example, incorporated some aspect of international cooperation. If it proved "that international scientific ventures were possible on a large scale," as C. J. Taylor (1981:376) contended, it was just one of many proofs. If it demonstrated that scientists could cooperate in spite of national differences at a time that when international relations were fraught with danger (Budd, 2001:50–51), so too did scientists in a variety of other disciplines cooperate during this era in order to further research on a number of different scientific questions.

The IPY was organized at the end of a half century marked by efforts at collaborative research or other forms of cooperation in the physical sciences among and between the scientific communities of Europe and the United States. These efforts included the Magnetic Crusade, a collaborative endeavor to solve fundamental questions in terrestrial magnetism; a variety of plans for international cooperation in the gathering of meteorological data; the establishment of the Smithsonian's international network to alert astronomers of new phenomena; and the many expeditions sent out throughout the world to observe the transits of Venus. The level of cooperation ranged from simply improving communication among scientists to establishing common standards for recording observations.

This urge to cooperate across national boundaries in the nineteenth century was not limited to the world of science. It was an integral part of the Victorian-era Euro-American society. Perhaps this urge was most clearly expressed through the organization of international congresses. For example, no less than 32 international congresses met in conjunction with the 1878 Exposition at Paris. The various agendas included cooperation, coordination, standardization, exchange of information, best methods for the gathering of statistics, and efforts at common solutions for common problems. The congresses ranged in subject area from legal issues, such as international copyright, patent rights, and legal medicine to social issues, such as prevention of cruelty to animals, the treatment of alcoholism, guidelines for military ambulance service, and aid to the blind and deaf. Science was not left out. Among the scientific fields to hold congresses in Paris that year were geometry, anthropology, ethnography, botany, geology, and meteorology. Included on the agendas of the scientific congresses were such issues as simultaneity of observations and uniform nomenclatures. There was also a congress to discuss the possibility of the adoption of a uniform system of weight, measures, and coinage (United States, 1880:1:455–464).

In this paper, I will briefly summarize the various nineteenth-century efforts at international collaboration and cooperation in science, with particular attention to the role played by the Smithsonian Institution and its leader, Joseph Henry. From this discussion, it should be evident that a proposal for international cooperation to solve a scientific question, such as the proposal for the first IPY, would not appear to be a startling new idea to European or American physical and earth scientists in the 1870s or 1880s. In fact, just the opposite was true; by the last quarter of the nineteenth century, efforts at cooperation were the norm, not the exception. The story is not one of inevitable success. Sometimes the efforts at cooperation failed. The general movement of the international physical science community, however, was toward better communication and coordination. Rather than look at the IPY as a new beginning, it is more accurate, I believe, to look at it as a culmination. What occurred with the first IPY was not a revolution in international science, but the transformation of polar science; it began to more closely resemble the norm in international science.

MAGNETIC CRUSADE

The first great international effort at coordinating physical science research in the nineteenth century was the Magnetic Crusade, which focused on the international gathering of terrestrial magnetic observations (Cawood, 1977; 1979). The roots of the Magnetic Crusade lay in the appreciation by early nineteenth-century scientists that the variations of the earth's magnetic field were extremely complex. Driven by both the desire to understand geomagnetic activity and the hope of creating a practical system of navigation through geomagnetic observations, observers created an informal system of contacts "to provide a degree of order in the sometimes spasmodic and rather uncoordinated work—and of course, to exchange information" (Cawood, 1979:496).

Although Alexander von Humboldt put together a loose association of magnetic observatories linked through Paris, which had been the center of terrestrial magnetic observations early in the century, a more important, and more formal, system was organized in the German-speaking world. Carl Friedrich Gauss and Wilhelm Weber founded a system in 1834 under the name of the Göttingen Magnetische Verein. Inspired by the work on the Continent, the

British Association for the Advancement of Science agreed, in 1838, to establish its own system. Led by Samuel Hunt Christie, John Herschel, Humphrey Lloyd, and Edward Sabine, the British Association system consisted of 10 observatories, with coverage expanded to include the British colonies and India (with the cooperation of the East India Company). The British system coordinated with 23 other observatories scattered in the Russian Empire, Asia, North America, North Africa, and Europe, all of whom were funded by their respective governments, except for those in the United States funded by academic institutions (Girard College and Harvard University). Also part of this effort was a British naval expedition to make observations in Antarctica, led by James Clark Ross (1839–1843).

There were some limitations to the international cooperation. Although the British system synchronized observations using Göttingen Mean Time, as suggested by the Göttingen Magnetische Verein, so that data could be compared, there was no formal collaboration. The Paris Observatory acted independently of its other European counterparts. Nonetheless, by the time the Crusade formally ended in 1848, there was a firmly established network of magnetic observatories in Europe, throughout the British Empire, and in the United States that continued to make observations and exchange data. Other observatories later joined in the cooperative venture, including that of the Smithsonian Institution (Rhees, 1859:27–29). Most importantly, as Cawood argued, the Magnetic Crusade demonstrated "that large-scale operations could be organized and carried through" (1979:516). Even Taylor, who argued for the significance of the IPY in the demonstration of the possibilities of large-scale international cooperation, admitted that the Magnetic Crusade "provided many precedents for subsequent global scientific endeavours" (1981:370).

METEOROLOGICAL COOPERATION

Weather does not respect political boundaries, and many meteorologists realized the need for cooperation. German meteorologists took the lead, with such organizations as the Süddeutsche Meteorologische Verein (1841), the Könglich Preussische Meteorologische Institut (1847), and the Norddeutsche Seewarte (1872). These organizations had relatively limited geographical coverage, however, and were international only because of the political fragmentation of the German scientific community (Fleming, 1990:165–166).

A more significant international approach to meteorological observations took place in the United States. Perhaps not coincidently, it was first directed by a physicist who was an active geomagnetic observer, who had cooperated with the Magnetic Crusade, and was aware of the rewards and challenges of international cooperation. Not only had Joseph Henry received practical advice on observing from Edward Sabine while in England in 1837 (Reingold et al., 1979:312–313), but he also "had conversation with Mr[.] Christie on the subject of establishing magnetic observator[i]es to cooperate with those established by Humboldt" (Reingold et al., 1979:303). Joseph Henry became the first secretary of the Smithsonian Institution in 1846 and established a program that placed an emphasis on the coordination of large-scale research projects, arguing that there were no other institutions in the United States equipped to do so. The first such project Henry embraced was the development what Elias Loomis, one of Henry's consultants in meteorology, characterized as "a grand meteorological crusade" for collecting meteorological observations (Smithsonian Institution, 1848:207).

The system devised by Henry had two distinct but interrelated components, both requiring cooperation. The first was a system of observers who—using standard apparatus, techniques, and forms to the greatest extent possible—maintained monthly logs of weather conditions that were sent to the Smithsonian for reduction. These logs were used to understand climate and weather tendencies over the long term. From the onset, it was recognized that "to give this system its greatest efficiency, the co-operation of the British government and of the Hudson's Bay Company [in Canada] is absolutely indispensable" (Smithsonian, 1848:207). Both the British government and the private Hudson's Bay Company quickly agreed to cooperate (Fleming, 1990:123). The program soon expanded throughout North and Central America. Observers were recruited in Bermuda, Mexico, all the Central American countries, and throughout the West Indies, frequently drawing, in the latter two regions, upon Americans residing overseas (Smithsonian Institution, 1872:68–69). The second component was the use of the telegraph to forward data on weather in real time to the Smithsonian, allowing, in the late 1850s, for the publication of the first scientifically based weather forecasts in newspapers and the first publicly posted weather maps. These forecasts were based on the conclusions drawn from the monthly data logs. Unlike the data gathering, the forecasting only lasted a few years and ended before the dream of making it international was accomplished. Among the obstacles it ran into was the realization by the commercial telegraph companies that weather data was a valuable commercial commodity; the companies wanted to charge for the use of the lines (Fleming, 1990: 145; Rothenberg et al., 2007:102).

Henry's international system worked in part because there were no government meteorologists involved who felt the need to protect their own national systems. Instead, Henry was relying on an international network of independent observers. Two efforts bracketing Henry's establishment of the Smithsonian network demonstrated that meteorology was not yet ready for extended international cooperation.

In 1845, an international meeting of scientists interested in terrestrial magnetism and meteorology was held in conjunction with the meeting of the British Association for the Advancement of Science. Efforts to establish some sort of coordination of meteorological observations, akin to the Magnetic Crusade, ran into a very serious obstacle. The government meteorologists of the various European nations had too much invested in their own systems to lay them aside for some common system. As Edward Sabine remembered two decades later (1866:30), the government meteorologists "manifested so marked a disposition . . . to adhere to their respective arrangements in regard to instruments, times of observation, and modes of publication," as to make it clear the time for a uniform system "had not then arrived."

Another effort came a few years later. Matthew Fontaine Maury, a naval officer, oceanographer, and director of the Naval Observatory (Williams, 1963) was a keen student of meteorology. For example, he had independently recognized the possibilities presented for weather forecasting by the telegraph almost as early as Henry had (Fleming, 1990: 109). In 1851, a request from the British government to the United States government on behalf of the Royal Engineers, who were conducting meteorological observations throughout the empire, ended up being forwarded to Maury for a response. The Royal Engineers had suggested the need to establish a uniform system of recording meteorological data. Maury attempted to expand this request into a broad international cooperative venture covering both nautical and terrestrial meteorology. What this venture demonstrated was that the European meteorological community was still not yet ready for such a bold stroke. Although Maury did manage to organize an 1853 meeting in Brussels to which 10 nations sent representatives, the roadblocks to international exchange of information, let alone real cooperation, were still huge. The sole major accomplishment of the meeting was the agreement that nations that did not use centigrade as the standard scale for temperature would add that scale to the standard thermometer (Fleming, 1990: 107–109; Anderson, 2005:245).

After 1870, a new player in American and international meteorology appeared. Albert J. Myer, the commander of the United States Army Signal Corps, seized on the transmission of storm information as a worthy responsibility for a military organization facing budget cuts. Eventually the Smithsonian transferred its system to the Signal Corps (Hawes, 1966).

Myer's organization came to the forefront of American meteorology just when the international community was becoming more open to the possibilities of broad cooperation. At the 1872 meeting of the Gesellschaft deutscher Naturforscher und Ärzte in Leipzig, meteorologists called for an international gathering to further standardization and cooperation for terrestrial observations. The result was the 1873 congress in Vienna, which ultimately attracted representatives from 20 nations. At the Vienna Congress, Myer's proposal for international simultaneous observations was agreed to, leading to the *Bulletin of International Simultaneous Observations,* first published by the Signal Office in 1875 (Hawes, 1966). There were, however, still obstacles to be overcome, such as the continuing conflict between the metric and English systems of measurement (Anderson, 2005:246). Even so, the discussions had begun (Luedecke, 2004) and, with the second international meteorological congress of 1879, held in Rome, "a pattern of voluntary cooperation between meteorologists on international problems" had been established which bypassed the national meteorological organizations (Weiss, 1975:809).

COOPERATION IN ASTRONOMY

Henry and the Smithsonian were involved in other international cooperative efforts, for example in astronomical communication. As the quantity and quality of telescopes increased in the nineteenth century, so did the number of comets and asteroids discovered. C. H. F. Peters, professor of astronomy at Hamilton College in upstate New York, a prolific discoverer of asteroids, was aware of the importance of the dissemination of observations to other astronomers to aid in the calculation of orbits (or even the relocation of the object). Because he was also German-born and educated, he was in closer touch with his colleagues on the European continent than most of his colleagues in American observatories (Rothenberg, 1999) He wrote to Henry in January 1872, suggesting a system of communicating discoveries among the world's astronomers using the Atlantic cable and the land telegraph systems of the U.S. and Europe. Peters's system would be modeled after the Smithsonian international exchange system for publications, in which the Smithsonian served as the intermediary between American scientists and scientific institutions seeking to distribute their publications throughout the world, and their foreign counterparts seeking to distribute publications in the United States. In the case of astronomy, the Smithsonian would serve as the American node, receiving announcements of discoveries and distributing them to two proposed European nodes—the observatories at Leipzig and Vienna—and vice versa. Given Henry's well-known inclination to support international cooperation, Peters expressed his optimism that the Smithsonian would be willing to pick up the cost of trans-Atlantic telegraph transmission (Rothenberg et al., 2007:447)

Henry, responding as Peters had anticipated, immediately began seeking support for Peters's plan. It took eighteen months for Peters's proposal to be fully implemented, in part because Henry wanted to avoid having science pay for the use of the telegraph. Within a year, Henry had secured the support of Cyrus Field, the father of the Atlantic cable, and William Orton, president of Western Union, for free employment of the Atlantic Cable and the telegraph system in the United States for the transmission of astronomical data. By February 1873 the Smithsonian had begun transmitting information to the Royal Greenwich Observatory for further dissemination to Europe, and through the Associated Press, to astronomers throughout the United States. On the other side of the Atlantic, the European state telegraph companies eventually also agreed to carry the data free of charge. By May 1873 that Henry was able to announce the launching of the system, with European nodes at the major national observatories: Greenwich, Paris, Berlin, Vienna, and, a little later, Pulkova. Working out some of the confusion over which of the observatories had what reporting responsibilities took some time to work out, as did developing a standard lexicon, but by 1883, when Spencer Baird, Henry's successor at the Smithsonian, turned the responsibility for the U.S. node over to Harvard College Observatory, the information exchange was world-wide. Approximately fifty European observatories were linked to Harvard's counterpart in Europe, the observatory at Kiel, and connections had also been made with observatories in South America, Australia, and South Africa (Rothenberg et al., 2007, 448; Jones and Boyd, 1971:197).

TRANSITS OF VENUS

Transits of Venus, the observation from Earth of the passage of that planet across the face of the sun, are rare astronomical events. Two occur eight years apart, with a gap of over a century between pairs. Because of their application in establishing the astronomical unit, the distance between the earth and the sun, which is the essential yardstick for solar system astronomy, the astronomical community was very eager to take advantage of the opportunities provided by the transits of 1874 and 1882. Ultimately, 13 nations sent out observing expeditions to observe one or both transits. A number of nations established government commissions to oversee the efforts, including the United States. Astronomers exchanged copies of their observing protocols and coordinated with each other in selecting observing sites (Dick, 2004; Duerbeck, 2004; Dick, 2003:243, 265).

Planning had begun as early as 1857, with the publication of Astronomer Royal George B. Airy's suggestions of possible observing sites (Airy, 1857). Among the desirable locations, from an astronomical perspective, was Antarctica. For the first time, there was serious discussion of establishing a scientific observing site in Antarctica.

But the transits occurred in December. Were astronomical observations in Antarctica that time of year practical? Scientists were divided. Airy, using information provided him from Edward Sabine, concluded that "December is rather early in the season for a visit to this land, but probably not too early, as especially firm ice will be quite as good for these observations as dry land" (1857:216). He called for a reconnaissance ahead of time to test whether it was practical to establish an observing station in the Polar Regions. J. E. Davis, a British naval officer and Arctic explorer, was even more optimistic, although very realistic as to the difficulties. He developed a plan in 1869 for observations of the 1882 transit from Antarctica, but noted in his presentation to the Royal Geographical Society (1869), that such observations would have required the observing parties to winter over. There was insufficient time to find a safe harbor and establish the observing station prior to the transit. In the case of the 1882 observers, Davis argued that they should be landed in late 1881 with sufficient supplies to last two years, even though the plan was to have them picked up in about a year. It was necessary to leave a margin of error. He did warn of the problematic weather conditions, describing the weather as "either very bad or very delightful" (1869:93). To Davis, it was a gamble worth taking, but it seemed less attractive to astronomers who were going to be making once in a lifetime observations. In contrast to Davis and Airy, Simon Newcomb, the leading American astronomer and a member of the American Transit of Venus Commission, was much more pessimistic. He rejected the idea of astronomical observations from "the Antarctica continent and the neighboring islands . . . because a party can neither be landed nor subsisted there; and if they could, the weather would probably prevent any observations from being taken" (1874:30).

Although observations were not made from the continent of Antarctica, the 1874 transit was observed by parties from Britain, Germany, France, and the United States from stations on islands within the Antarctic Convergence, including Kerguelen (Newcomb apparently thought Kerguelen sufficiently north not to be considered "a neighboring island") and Saint-Paul. The 1874 observations were only moderately successful because of weather problems (Bertrand, 1971:258; Duerbeck, 2004;). But the seeds were planted for a more extensive investigation of the Antarctic. Davis had argued from the beginning that the Antarctic stations should also "obtain a series of observations in meteorology and other branches" (1869: 93), while the American expedition conducted biological and geological collecting which "resulted in a significant contribution to the scientific knowledge of the Antarctic" (Bertrand, 1971:255). Although the combination of the uncertainty of the weather and the difficulties, dangers, and expense of sending parties to Antarctica seemed to have discouraged most further efforts in that direction for the 1882 transit, Germany sent an expedition to South Georgia for the dual purpose of conducting transit of Venus observations and other observations as part of the IPY (Duerbeck, 2004:14).

Later observers have recognized the significance of the transit of Venus expeditions in establishing a precedent for later cooperative research in Antarctica. Julian Dowdeswell of the Scott Polar Research Institute has called these observations of 9 December 1872, "the earliest example of international coordination in polar science and a clear precursor to the first IPY" (Dowdeswell, 2007). The geographer Kenneth Bertrand also argues that the transit observations belong to the history of Antarctic research, although he skips over the IPY, because it was primarily an Arctic venture, and contends that the international program for observing the transit was a "predecessor of the International Geophysical Year" (1971:255).

POLAR STUDIES: SURVIVING THE ELEMENTS AND MORE

So if the first IPY was not a path breaking forerunner of later international cooperative research programs, what was its significance? It was 'Polar.' That may seem obvious, but at the time when it was organized, uncertainty hung over Polar research, at least in the United States. The question might be asked: would any effort to gather data in the Polar Regions be a waste of human and scientific resources?

The United States, and especially the Smithsonian, had supported scientific research in the Arctic during the three decades prior to the IPY (Lindsay, 1993; Sherwood, 1965; Fitzhugh, this volume). Some of this could be solidly placed under the heading of international cooperation, though not at the level exemplified by the first IPY. For example, the Smithsonian had developed strong ties with the British Hudson's Bay Company, and in a spirit of international cooperation, company employees had collected natural history specimens and made meteorological observations. In addition, Francis L. McClintock, a British Polar explorer, had turned his Arctic meteorological observations over to the Smithsonian for reduction (Rothenberg et al., 2004:142, 143).

The Smithsonian had also arranged for the reduction and publication of the geophysical observations made by two U.S. polar endeavors, the second Elisha Kent Kane expedition (1853–1855) and the I. I. Hayes expedition (1860–1861). The apparatus used in the latter expedition were on loan from the Smithsonian (Rothenberg et al., 2004:142–144). In addition, the Smithsonian encouraged natural history research at relatively lower latitudes in Alaska as part of its broader program of supporting the scientific exploration of the American West (Fitzhugh, this volume; Goetzmann, 1966). Among the collectors were Robert Kennicott, working in conjunction with the Western Union Telegraph Company's survey of a telegraph route across Alaska, and W. H. Dall, who was Kennicott's successor and then served with the U.S. Coast Survey (Rothenberg et al., 2007:128, 397). Both were very closely associated with the Smithsonian and its northern research and collecting program (Fitzhugh, this volume).

Polar research was dangerous, as Henry admitted in 1860, requiring "much personal inconvenience and perhaps risk of life" (Rothenberg et al., 2004:141). That opinion was no doubt further reinforced by the death of Kennicott in 1866 and the disaster of the U.S. Polaris Expedition, led by Charles Francis Hall, in 1871. This latter expedition has been renown in the history of exploration because of the debate over whether the expedition's scientist/physician murdered the commander (Loomis, 1991). But beyond the human cost, the expedition's failure temporarily dashed the hopes of the American scientific community for governmental support for intensive research in the Polar region.

Although it has been claimed that Hall, an experienced Arctic explorer, was "lacking credibility as a man of science" (Robinson, 2006:76), he had received the endorsement of Joseph Henry during the debate over who would lead the expedition (Rothenberg et al., 2007:288). There was no question that science was to be a part of the expedition. The legislation which established the expedition, and provided an appropriation of $50,000 for it, ordered that "the scientific operations of the expedition be prescribed in accordance with the advice of the National Academy of Sciences" (United States, 1871:251). That advice, including the selection of the scientist, Dr. Emil Bessels, a zoologist, came primarily from Henry, as president of the National Academy of Sciences, and his Assistant Secretary at the Smithsonian, Spencer F. Baird, who chaired the Academy committee for the expedition. In his report on the preparation for the scientific aspect of the expedition, Henry acknowledged that Hall's primary mission was "not of a scientific character" and that to have attached "a full corps of scientific observers" to it would have been inappropriate (Rothenberg et al., 2007:352). Officially, he recognized the reality of the politics of exploration and was willing to settle for having Bessels and a few junior observers on the expedition, armed with instructions from some of the leading scientists in the United States on collecting data and specimens in astronomy, geophysics, meteorology, natural history, and geology. Unofficially, Henry had the expectation that if the Polaris Expedition was successful, Congress could be persuaded to follow up the triumph with an appropriation "for another expedition of which the observation and investigation of physical phenomena would be the primary object" (Rothenberg et al., 2007:355). But with the failure of the Polaris Expedition in 1871, the hope of additional Congressional funding was dashed. It would be another decade before another U.S. government-sponsored expedition would be sent to the polar region, and it would occur under the auspices of the first IPY in 1881.

Participation by the United States in the first IPY in 1881–1884 was coordinated by U.S. Army Signal Corps, which was experienced in conducting meteorological observations. However, the Smithsonian was in charge of many aspects of the U.S. IPY scholarly program and laid claim to all its resulting 'natural history' collections (Krupnik, this volume). The eastern U.S. mission, on Ellesmere Island, under the command of Lt. Adolphus Greely, was a reasonable success from the perspective of its scientific observations and data returned. But the expedition was plagued by mutiny, bad luck, and poor judgment, and more than two-thirds of the participants perished. In contrast, the Alaskan (Point Barrow) mission, commanded by Lt. P. Henry Ray, had an uneventful time, returning valuable scientific data and abundant natural history and ethnology collections with little fuss (Burch, this volume; Crowell, this volume; Krupnik, this volume). Furthermore, the little fuss that accompanied Ray's expedition may be the most important aspect of it and the reason why it was a turning point in the history of American scientific ventures in the polar regions. For the first time, an expedition "made survival in the Arctic wastes at 70º below zero look routine to Americans" (Goetzmann, 1986:428). That survival was at least a reasonable expectation was a necessary premise to further scientific exploration of the polar regions.

CONCLUSION

There is an important caveat to this apparent success story of increasing science cooperation. An agreement for international cooperation was not always followed by implementation. As one representative to the unsuccessful 1853 Brussels conference noted, when the delegates returned home, "every one followed his own plan and did what he pleased" (Fleming, 1990:109). Even after the founding of the International Meteorological Organization in 1879, conflict was avoided by the issuing of "resolutions and recommendations that national weather services could, and often did, ignore" (Edwards, 2004:827).

In addition, William Budd (2001) was correct in identifying the same half century between roughly 1835 and 1885, which I argue was marked by increased efforts at scientific cooperation, as also a half century of intense international rivalry. And that rivalry is the flip side of the history of scientific cooperation. Prestige and glory were strong motivations for participating in collaborative ventures. National scientific communities could, and frequently did, point to the activities of international rivals to encourage their governments to provide financial support for research. Participation in certain international endeavors, such as the Magnetic Crusade or the transit of Venus observations, the argument went, was absolutely necessary if a nation was to maintain status within the international community. Scientists would use the activities of other governments to shame their own to action. As Cawood noted, the willingness of the Norwegian Parliament to fund a geomagnetic expedition in 1828, while at the same time denying the funds for the erection of a royal residence, "became an almost obligatory precedent to be quoted in all British pleas for the government backing of terrestrial magnetism" (1979:506). Cawood warned, moreover, that there was "a very narrow dividing line between international cooperation and international rivalry"

(1979:518). When international relations soured, or nationalistic emotions increased, the presence of government funding and the recognition of the domestic political value of scientific success could possibly result in national factors overwhelming the cooperative, international aspects of research. International cooperation in meteorology suffered from the unwillingness of government-funded scientists to turn their backs on the immense investment they had made in their own systems and accept a foreign system. It remains to see, when historians look back, whether rivalry or cooperation will be the dominant theme for the latest International Polar Year in 2007–2009.

LITERATURE CITED

Airy, George B. 1857. On the Means which Will Be Available for Correcting the Measure of the Sun's Distance, in the Next Twenty-Five Years. *Monthly Notices of the Royal Astronomical Society*, 17: 208–221

Anderson, Katharine. 2005. *Predicting the Weather: Victorians and the Science of Meteorology.* Chicago: Chicago University Press.

Barr, William. 1983. Geographical Aspects of the First International Polar Year, 1882–1883. *Annals of the Association of American Geographers*, 73:463–484.

Bertrand, Kenneth J. 1971. *Americans in Antarctica, 1775–1948.* New York: American Geographical Society.

Budd, W. F. 2001. "The Scientific Imperative for Antarctic Research." In *The Antarctic: Past, Present and Future,* ed. J. Jabour-Green and M. Haward, pp. 41–59. Antarctic CRC Research Report 28.

Burch, Ernest S., Jr. 2009. "Smithsonian Contributions to Alaskan Ethnography: The IPY Expedition to Barrow, 1881–1883." In *Smithsonian at the Poles: Contributions to International Polar Year Science*, ed. I. Krupnik, M. A. Lang, and S. E. Miller, pp. 89–98. Washington, D.C.: Smithsonian Institution Scholarly Press.

Cawood, John. 1977. Terrestrial Magnetism and the Development of International Collaboration in the Early Nineteenth Century. *Annals of Science*, 34:551–587.

———. 1979. The Magnetic Crusade: Science and Politics in Early Victorian Britain. *Isis*, 70:493–518.

Crowell, Aron L. 2009. "The Art of Iñupiaq Whaling: Elders' Interpretations of International Polar Year Ethnological Collections." In *Smithsonian at the Poles: Contributions to International Polar Year Science*, ed. I. Krupnik, M. A. Lang, and S. E. Miller, pp. 99–114. Washington, D.C.: Smithsonian Institution Scholarly Press.

Davis, J. E. 1869. On Antarctic Discovery and Its Connection with the Transit of Venus. *Journal of the Royal Geographical Society*, 39: 91–95.

Dick, Steven J. 2003. *Sky and Ocean Joined: The U.S. Naval Observatory, 1830–2000.* Cambridge, U.K.: Cambridge University Press.

———. 2004. The American Transit of Venus Expeditions of 1874 and 1882. In *Proceedings of IAU Colloquium No. 196,* pp. 100–110. Cambridge, U.K.: Cambridge University Press.

Dowdeswell, Julian. U.K.—Scott Polar Research Institute, International Polar Year Outreach Project. http://www.spkp.se/ipy/ipyou03.htm (accessed 7 September 2007).

Duerbeck, Hilmar W. 2004. The German Transit of Venus Expeditions of 1874 and 1882: Organizations, Methods, Stations, Results. *Journal of Astronomical History and Heritage*, 7:8–17.

Edwards, Paul N. 2004. "A Vast Machine": Standards as Social Technology. *Science*, 304:827.

Fitzhugh, William W. 2009. "'Of No Ordinary Importance': Reversing Polarities in Smithsonian Arctic Studies." In *Smithsonian at the Poles: Contributions to International Polar Year Science*, ed. I. Krupnik, M. A. Lang, and S. E. Miller, pp. 61–78. Washington, D.C.: Smithsonian Institution Scholarly Press.

Fleming, James Rodger. 1990. *Meteorology in America, 1800–1870.* Baltimore: Johns Hopkins University Press.

Goetzmann, William H. 1966. *Exploration and Empire: The Explorer and the Scientist in the Winning of the American West.* New York: Alfred A. Knopf.

———. 1986. *New Lands, New Men: America and the Second Great Age of Discovery.* New York: Viking.

Hawes, Joseph M. 1966. The Signal Corps and Its Weather Service, 1870–1890. *Military Affairs*, 30:68–76.

Jones, Bessie Zaban, and Lyle Gifford Boyd. 1971. *The Harvard College Observatory: The First Four Directorships.* Cambridge, Mass.: Harvard University Press.

Krupnik, Igor. 2009. "'The Way We See It Coming': Building the Legacy of Indigenous Observations in IPY 2007–2008." In *Smithsonian at the Poles: Contributions to International Polar Year Science*, ed. I. Krupnik, M. A. Lang, and S. E. Miller, pp. 129–142. Washington, D.C.: Smithsonian Institution Scholarly Press.

Lindsay, Debra J. 1993. *Science in the Subarctic: Trappers, Traders, and the Smithsonian Institution.* Washington, D.C.: Smithsonian Institution Press.

Loomis, Chauncy C. 1991. *Weird and Tragic Shores: The Story of Charles Francis Hall, Explorer.* Lincoln: University of Nebraska Press.

Luedecke, Cornelia. 2004. The First International Polar Year (1882–83): A Big Science Experiment with Small Science Equipment. *History of Meteorology*, 1:55–64.

[Newcomb, Simon]. 1874. The Coming Transit of Venus. *Harper's New Monthly Magazine*, 50:25–35.

Reingold, Nathan, Arthur P. Molella, Marc Rothenberg, Kathleen Waldenfels, and Joel N. Bodansky, eds. 1979. *The Papers of Joseph Henry.* Volume 3. Washington, D.C.: Smithsonian Institution Press.

Rhees, William J. 1859. *An Account of the Smithsonian Institution, Its Founder, Building, Operations, Etc., Prepared from the Reports of Prof. Henry to the Regents, and Other Authentic Sources.* Washington, D.C.: Thomas McGill.

Robinson, Michael F. 2006. *The Coldest Crucible: Arctic Exploration and American Culture.* Chicago: University of Chicago Press.

Rothenberg, Marc. 1999. Peters, Christian Henry. *American National Biography,* 17:391–392.

Rothenberg, Marc, Kathleen W. Dorman, Frank R. Millikan, Deborah Y. Jeffries, and Sarah Shoenfeld, eds. 2004. *The Papers of Joseph Henry.* Volume 10. Sagamore Beach, Mass.: Science History Publications.

———, eds. 2007. *The Papers of Joseph Henry.* Volume 11. Sagamore Beach, Mass.: Science History Publications.

Sabine, Edward. 1866. Note on a Correspondence between Her Majesty's Government and the President and Council of the Royal Society Regarding Meteorological Observations to Be Made by Land and Sea. *Proceedings of the Royal Society of London*, 15:29–38.

Sherwood, Morgan. 1965. *Exploration of Alaska, 1865–1900.* New Haven, Conn.: Yale University Press.

Smithsonian Institution. 1848. *Annual Report of the Board of Regents of the Smithsonian Institution for 1847.* Washington, D.C.: Tippen and Steeper.

———. 1872. *Annual Report of the Board of Regents of the Smithsonian Institution for 1868.* Washington, D.C.: Government Printing Office.

Taylor, C. J. 1981. First International Polar Year, 1982–83. *Arctic,* 34: 370–376.

United States. 1871. *The Statutes at Large and Proclamations of the United States of America, from December 1869 to March 1871.* Boston: Little, Brown, and Company.

United States, Commission to the Paris Universal Exposition. 1880. *Reports of the United States Commissioners to the Paris Universal Exposition, 1878.* Volume 1. Washington, D.C.: Government Printing Office.

Weiss, Edith Brown. 1975. International Responses to Weather Modification. *International Organization,* 29:805–826.

Williams, Francis L. 1963. *Matthew Fontaine Maury, Scientist of the Sea.* New Brunswick, N.J.: Rutgers University Press.