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PERSPECTIVE

Reading and thinking about International Polar Years: five recent books

Dave Carlson

CarlsonWorks, 4957 Sundance Square, Boulder, CO 80301, USA

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Correspondence
Dave Carlson, CarlsonWorks, 4957 Sundance Square, Boulder, CO 80301, USA. E-mail: ipy.djc@gmail.com

Abstract

Within the polar science community the Polar (and Geophysical) Years represent signal events. We often read, largely within geoscience literature, that those events represented positive and dramatic steps forward in international science. From five recent books—two historical compilations and three personal narratives—augmented by interviews with a few key participants, a more cautious picture emerges, of remarkable successes but also of occasional or even persistent missteps and deficiencies. An improved understanding of the IPY concept and experience can provide useful guidance for future polar and global science.

Many within the polar community accept as doctrine that our unique history of periodic coordinated events, the International Polar (also Geophysical) Years, has played an influential, perhaps even determining, role in the course of global science and technology and in public perceptions of same. In their *Framework* document, the planners of International Polar Year 2007–08 (henceforth IPY 4, with apologies to those who count otherwise) asserted that the first IPY (IPY 1, 1882–83) "set a precedent for international cooperation in the realm of science" (ICSU 2004: 9) and that the International Geophysical Year of 1957–58 (IGY, a.k.a. IPY 3) "fundamentally changed how earth and space science is conducted and reverberated far beyond the initial years of exploration and research" (ICSU 2004: 10). Recognizing a degree of narcissism and the greater danger of arrogance, we should take longer and broader views to evaluate critically the impacts of IPYs. We must assess whether we can and should believe our own public relations messages.

A global medical and public health community, coordinated through the World Health Organization (WHO), existed for nearly a decade before the IGY. The WHO came into force in 1948, two years earlier than the World Meteorological Organization; by 1959 it had already held its 12th World Health Assembly, focused in that year on global eradication of smallpox. From 1956 to 1958, the WHO global network coordinated information about and response to the widespread and life-threatening avian flu epidemic. During those same years the science and technology of nuclear weapons raced onward. By 1952, the UK had joined the USA and USSR in the international club of nuclear weapons owners/operators. In 1957, those three countries conducted more than 40 test explosions and in 1958 more than 100. In 1958 the USA President announced the successful under-ice transit of the North Pole by the nuclear-powered submarine USS *Nautilus*, while Bertrand Russell started a global Campaign for Nuclear Disarmament. Intrepid seismologists motoring cautiously across Antarctica during the IGY, often without radio contact, eventually learned about and received inoculations against the global flu pandemic. They also collected snow samples for later analysis in distant laboratories, where researchers scrutinized isotopic signals for evidence of bomb construction. Thus, by the time of the IGY, researchers as well as citizens could hardly avoid evidence of science and technology with polar and global impact.

In this context, and as a vigorous proponent of IPY 4 (I served as Director of the IPY International Programme Office, 2005–10), I therefore accepted with interest a request to review *Globalizing polar science—reconsidering the International Polar and Geophysical Years* (Launius et al. 2010; henceforth, *Globalizing*) for this journal. The book poses some provocative core questions. For example (my

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selection): "How might one situate the IPYs in the larger context of trans-national science? Were the questions asked in these international campaigns limited to what technologies, methodologies and processes could answer; or were the goals beyond extant technologies, methodologies and processes? How did the politics of science shape the efforts in the IPYs, and how was politics shaped by them? Is there such a thing as global science? What does it entail? How did it arise, and how has it been sustained?"

Strangely, these questions do not appear until the end of Chapter 4 (Launius 2010). Few of the other chapters address any of the core questions. Apparently, no editor attempted to match content to questions. In fairness, each of these authors invested time and effort to convert symposium presentations into printable format, but, with notable exceptions, we get mostly desk views from within US science agencies, a mixture of hagiography, disjoint case studies and vague interpretation. From the cover blurb I expected to read "overviews of the scientific progress achieved in each case" and about the "emergence of the global geosciences". Despite interesting individual viewpoints, the book as a whole fails on both points. The book reminded me of tailings piles in Colorado mining towns: large volumes of material processed for minute amounts of valuable content.

Nevertheless, the core questions and some key content in *Globalizing* deserve attention and discussion. For a more systematic overview of the IPYs, I turned to *The history of the International Polar Years (IPYs)* (Barr & Lüdecke 2010; henceforth *History*). (Here, I issue the requisite disclaimer: I wrote the foreword to this *From Pole to Pole* series and I contributed a short chapter on the most recent IPY to this first volume devoted to history; in return I received one copy of the book and no other compensation.) In *History,* I found an orderly and nicely illustrated approach to the origins, setting, participation, achievements and impacts of IPYs 1 and 2 and the IGY (IPY 3), assembled from a broadly international group of authors accessing a wide range of source materials. The contents of the *History* book address many core questions posed by the *Globalizing* book quite well.

I still felt, however, that I gained a predominantly academic view of these international science events from both books. These "distant" views, necessary perhaps in the cases of IPY 1 and IPY 2 (1932–33), contrasted too strongly with my personal experiences of IPY 4. I sought the authentic voices of actual participants, available in print and in person from a few veterans of the IGY and perhaps just starting to emerge from IPY 4. For first-person and in-the-field narratives of the IGY, I used *Innocents on the ice—a memoir of Antarctic exploration 1957* (Behrendt 1998; henceforth *Innocents*) and *Opening space research—dreams, technology and scientific discovery* (Ludwig 2011; henceforth *Opening space*). For IPY 4, I read *Tara Arctic—a New Zealander's epic voyage* (Redvers 2010; henceforth *Tara*). Often, during and since IPY 4, I spoke to and learned from John Behrendt and Grant Redvers, and more recently to George Ludwig. I also spoke to Stanley Ruttenberg, former head of the US National Committee, IGY Program Office, and Harriet Barker, who knew Sydney Chapman after the IGY. I read valuable transcripts of two interviews (December 2002, March 2003) with Phillip Mange (AIP 2003), who served two years as "deputy" and general go-fer (his word) in the IGY's international coordination office. A historiography chapter (Launius 2010) in *Globalizing* lists the *Innocents* book. Except for Chapter 14 (Belanger 2010) in *Globalizing*, I found no evidence that any chapters of either *Globalizing* or *History* explored these other sources.

Drawing from this mixture of materials—largely, I admit, from accessible friends and colleagues—and based on my experiences in IPY 4, I consider below several issues with continuing relevance for polar and global science.

International cooperation

In our era of global scientific challenges—climate change, biodiversity loss, rapid pandemics—one hopes that mechanisms of international cooperation have evolved to meet these challenges. That the International Council for Science (ICSU) maintains a Committee on Freedom and Responsibility in the conduct of Science reminds us that our present freedoms require constant vigilance and carry substantial responsibilities. Based on present expectations—freedom to collaborate, freedom to access and exchange information, and freedom to travel—IPY 4 built its programme around international projects and required those projects to incorporate and document international participation as a condition of endorsement. In Chapter 14 of *History* (Carlson 2010), I describe that process and its impact on the eventual course and composition of IPY 4. In practice, funding for international IPY 4 projects came exclusively from or through national agencies and sources; every project needed to compete within and satisfy priorities of one or more nations. Once successful on funding, ships and aircraft, often carrying multinational crews, transported materiel to project destinations, often across national boundaries. Before the *Tara* team faced the hazards of winter on the Arctic Ocean, they confronted layers of national and international rules, regulations and requirements on immigration, customs, aviation and maritime operations (*Tara* chapters 2–4). Redvers' observant and entertaining

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account in *Tara* reminds us that the success of grand international plans often comes down to respectful, persistent and creative interactions at hundreds of small but crucial international interfaces.

Unlike the international project approach of IPY 4, the previous IPYs relied strongly on national planning and activities, resulting in what today we might regard as multinational coordination. Tammiksaar et al. (2010, *History* Chapter 2) document the planning for IPY 1 as it occurred almost exclusively among leaders of national meteorological observatories, with the implementation of 14 new stations around the Arctic by separate efforts of single nations: coordination rather than cooperation (Elzinga 2010a, *History* Chapter 4). Chapters 6 (Lüdecke & Lajus 2010), 7 (Barr et al. 2010) and 8 (Elzinga 2010b) of *History* provide a useful guide to the planning, expeditions and impacts of IPY 2. Again, the programme followed the "separate but parallel" national coordination model: mutual agreement on observational goals and coordinated measurement strategies with actual planning and implementation remaining the responsibility of national programmes. IGY again followed this national coordination model through national plans and national committees, most notably in Antarctica, where Argentina and Chile gained multinational agreement that IGY science would not impact on-going sovereignty claims (Dodds et al. 2010, *History* Chapter 10). In practice, for Argentina, Chile and, to greater or lesser extent, other nations as well, this agreement restricted research to national activities operating almost entirely within national claim boundaries. Likewise, Japan faced opposition from Australia and New Zealand, backed by the USA and USSR, to its early plans for IGY Antarctic research, with the consequence that it eventually settled on an unclaimed "gap" region in east Antarctica, a site of scientific opportunity determined by political reality (Stevenson 2010, *Globalization* Chapter 7). Agreement, at least in principle, and general public compliance with this sector-based approach for Antarctic research during IGY itself represented a hesitant effort toward more inclusive international scientific engagement, but again in a coordination rather than cooperation mode. Behrendt relates numerous instances of official opposition to cooperation between US researchers and colleagues at an adjacent Argentine ice station (*Innocents*, pp. 144, 169, 236).

Competition, rather than cooperation, represented the primary characteristic of IGY international interactions. The USA and USSR competed on every front in Antarctica: speed of traverses across crevassed ice, earliest arrival of ships through difficult pack ice, farthest penetrations. Berhendt describes changes in routes and schedules imposed so that US ships could out-perform Soviet competitors (*Innocents*, p. 392). Dodds et al. (2010, *History* Chapter 10) provides a parallel and interesting account from a Soviet viewpoint. Most notably, of course, the USSR "won" the IGY satellite competition with the launch of Sputnik in October 1957, an achievement that triggered enormous disappointment within the US IGY community (see first-hand accounts in Sullivan 1961 and *Opening space*) and consternation among US scientific, political and military establishments. *Opening space* provides a detailed account of consequences and responses within the US satellite community.

Another IGY competition occurred between the Republic of China (ROC, Taipei) and the People's Republic of China (PRC, Beijing). Official IGY history attributes this dispute to intransigent animosity between the two Chinese parties exacerbated by a last-minute application to participate submitted by ROC. Wang & Zhang (2010, *Globalization* Chapter 8) offer a very different, well-documented and, unfortunately, entirely plausible explanation: that the USA pushed ROC to enter a late bid for IGY status, with the deliberate and calculated intention that such a bid would force PRC withdrawal. Meanwhile, a prominent US IGY leader publicly chastised PRC for its "backward" stance with regards to international participation (*Globalization*, p. 152).

What other calculations and machinations, hidden in defence departments and foreign ministries around the world, complicated the international cooperation of IGY? Regrettably, one further example comes to light. The protagonist, in this case the US military, covertly launched and exploded at least six nuclear weapons at extreme altitudes in the outermost atmosphere during 1958. While members of its IGY committees complained publicly of Soviet reluctance to share information about Sputnik, the USA, without warning, notice or explanation, conducted a reckless global intrusion. Of course IGY observers around the world, with their eyes and instruments focused on the outer atmosphere, picked up signals of these explosions—how could they not? Sullivan gives the event, code-named Argus, a full chapter, and quotes Van Allen, a pioneering explorer of the outer atmosphere, as considering Argus "one of the greatest experiments in *pure science* ever conducted" (Sullivan 1961:163, my emphasis). Sullivan assures readers that fallout of radioactive particles from these explosions, quickly detectable near the launch island in the South Atlantic and distantly at Buenos Aires, would occur gradually and widely at insignificant levels, according to the US Atomic Energy Commission. Failure by that commission to inform the North American public about fallout patterns and exposure levels from prior atmospheric tests casts substantial doubt on all safety assertions. In this context,

collection and analysis of snow samples from Antarctica gain a broader implication. Regardless of its immediate impact or benefit, how did this large global but entirely arbitrary event fit the model of international scientific cooperation during the IGY? Neither *Globalization* nor *History* touches on this event. Why not?

Programme management

The progenitors of the IGY, as they navigated national, bilateral and ICSU politics and sought to establish an international management office, proclaimed an intention to avoid cumbersome international bureaucracy, "the perpetuation of unnecessary organization" in their words (*Globalization*, p. 194). A similar intent emerges from the IPY 4 *Framework* document: "minimal bureaucracy" (ICSU 2004: 28). Based on extensive consultations and solicitation of national participation and plans, IGY planners had some indication of the event's scale and international participation. The planners of IPY 4, working on the basis of a few hundred initial expressions of interest (ICSU 2004: 7), greatly underestimated the eventual size of and enthusiasm for IPY 4 (Carlson 2010, *History* Chapter 14). Speaking for the three full-time members of the IPY 4 International Programme Office (IPO; on good days and for special events we occasionally enjoyed the luxury of two or three additional part-time employees), we rather smile at concerns about "unnecessary organization". From Mange's recollections (AIP 2003) of his time in the equivalent IGY international office, located in Brussels, we recognize very well the "everyone-helps-with-everything" necessity. We also resonate with recollections by Ruttenberg and Mange that national and international IGY offices felt strongly that they had a unique opportunity to impact the course of science and public engagement with science.

The IGY planners insisted that scientists occupy all key roles of leadership in committees and in the IGY coordination office. Their committees, executive committee and office staff consisted almost entirely of upper atmosphere geophysicists, all known to each other and in some cases fresh from advisor-to-student roles. The IPY 4 Joint Committee also consisted of scientists, but of deliberately broad scientific background and wide geographic representation. The three IPY 4 IPO staff had scientific training in oceanography, atmospheric chemistry and urban geography. Despite international titles and global focus, and even as the IGY and IPY 4 each entrained participation from more than 60 countries, neither programme ventured very far from either home office or sponsor location for executive planning meetings. IGY held five such meetings entirely within Europe, while IPY 4 held eight meetings in Europe and one in Canada. With the welcome establishment of new International Programme Offices in Beijing (Integrated Research on Disaster Risk) and Tokyo (World Data System), one hopes for a wider geographic distribution of future international planning events.

Many IGY planners had recent experience in national war technology efforts. That experience inevitably shaped their intentions for and their approach to IGY. Ludwig mentions "an infusion of funds and an integrating mechanism" (*Opening space*, p. 67) as motivations for US participation in IGY. Integration refers to a desire and need to get science, their science, organized or reorganized from post-war individual efforts back to and forward to something more coherent and with larger impact. This effort to organize an "attack" (drawing from recent experience) on the "unknown" (the future, with the war-stimulated age of rocketry as but one example) emerged strongly in the public language of IGY. Sullivan titled his book *Assault on the unknown*. Sydney Chapman, a "dynamo" of IGY (e.g., Good 2010, *Globalization* Chapter 10), described the IGY as an army of scientists led by a team of scientific generals and authored a popular article entitled "Mass attack on Earth's mysteries" (*Globalization*, p. 177). What personal and collective experiences of the recent war influenced this aggressive language, and the vision and organization of the IGY? Unfortunately, none of the books reviewed here explores these topics. How did Chapman, a pre-war pacifist, come to these views? How do these views contrast with IPY 4, wherein many participants found motivation in a need to act, in individual and organized ways, on the global challenge of climate change and its urgent implications for polar ecosystems? How do oft-promoted IPY 4 catch-phrases "Polar science—global impact" and "Science in the right place at the right time" differ from the "mass attack" messages of the IGY, and what do those contrasting messages reveal about polar science, global science, and science in relation to society then and now? Examining this language and the motivations it reflects will provide fertile ground for exploration and understanding, ground not yet travelled.

In the first three IPYs, the planners and promoters, having promised a one-time event of limited duration, wished for and proposed continuation. Having promoted discrete out-and-back data gathering expeditions, IPY 1 leaders realized quickly that they needed on-going resources for compilation and analysis (Elzinga 2010a, *History* Chapter 4). IPY 2, after a difficult start and limited implementation, managed a small continuation of sub-Antarctic meteorological observations into 1934 (Elzinga 2010b, *History* Chapter 8). Many individuals

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and nations argued for continuation of IGY activities (Mange, Ruttenberg), resulting in limited participation in a succeeding (and little known) International Year of the Quiet Sun (IYQS). These small continuation efforts notwithstanding, none of the IPYs, however successful scientifically or internationally, gained substantial national political and funding support beyond the terms of their original proposals. Has this situation changed after IPY 4? Does the continued urgency of change in polar regions open extension opportunities? In light of this persistent history, on-going efforts to promote an International Polar Initiative to succeed IPY 4 appear familiar and, despite the unquestioned urgency, futile.

Data

With respect to one *Globalization* core question already quoted, we can say with certainty that all four IPYs set their data goals "beyond extant technologies, methodologies and processes." IPY 1 intended widespread scientific exchange of data but data collation and distribution activities fell into an unfunded hiatus after the expeditions. Countries compiled national reports on very slow schedules and with "insufficient" distribution (*History*, p. 120). The fact that researchers more than a century later extracted useful information from IPY 1 records (e.g., Wood & Overland 2006) suggests that neglect rather than poor quality represented the primary limitation. Ambitious data plans for IPY 2 also foundered due to the absence of follow-up funding and the onset of WW II; collation of geomagnetic data into a central archive and publication of an IPY 2 bibliography did not occur until 1951 (Elzinga 2010b, *History* Chapter 8). Much IPY 2 data remained unused at the start of the IGY (Barr & Bulkeley 2010, *History* Chapter 12). Although the IGY initiated a global network of data centres to address the antecedent problems, most of those voluntary discipline-focused data centres started late and without necessary funding (Ruttenberg). Several IGY leaders felt that person-to-person exchanges among colleagues provided sufficient international data access (Mange, Ruttenberg). IPY 4 found "inadequate services, almost no international support, and few solutions" (Carlson 2011: 293) to meet its laudatory goal of free and open data access. In the absence of effective international services, several nations funded specific IPY 4 data coordination efforts, thereby establishing innovative and effective data support for their national programmes. A lack of incentives for data sharing and reluctance to make on-going post-project investments in professional staff, rather than technical or data quality issues, continue to present serious barriers to effective international data management.

Impact on science

Did IPY 1 set a precedent for international science cooperation, as asserted in the *Framework*? According to the evidence here we would have to say "perhaps" for multinational coordination but "no" for full international science cooperation.

Did the IGY fundamentally change how science is conducted? By itself, no. It clearly occurred within a larger and already global scientific and political context, not always acknowledged within the polar or geophysical communities. Both *Globalization* and *History* describe smaller events occurring before and in intervals between the IPYs, focused on global magnetism or Antarctic ice sheets, for example, wherein, in part because of the absence of encompassing international guidelines, substantial multinational cooperation proved necessary and effective (Lüdecke 2010a, *History* Chapter 5; Lüdecke 2010b, *History* Chapter 13; Rothenberg 2010, *Globalization* Chapter 2; Lewander 2010, *Globalization* Chapter 6). These interstitial events had substantial impact on subsequent IPYs and as well on the course of international science. From this broader vantage point, the IGY looks less like an inspired outburst of scientific curiosity and more like recognition by leading upper atmosphere geophysicists of a need to regroup and, frankly, catch up after the delays and disruptions of the recent global war, to apply war-stimulated technologies in rocketry, instrumentation and computation to tangible commercial and political challenges, and to reclaim a prominent role in scientific (and science funding) circles and public attention. Did IGY planners instigate a remarkable and influential geophysical event? Yes! Did their event lead the way forward in global science or global scientific cooperation? Not by itself and not consistently, in light of evidence presented here; in a few instances the IGY failed to meet even its own standards of open scientific cooperation. The question of impact deserves a wider and more critical discussion than we find in these books and than has occurred to date, including information and viewpoints from outside the geophysics community as a first requirement.

What of the Antarctic Treaty, often cited as a globally-important IGY outcome? Authors in both *History* and *Globalization* point out that the treaty basically froze the existing IGY situation—of science as the primary justification for continued Antarctic political presence—while sovereignty claims remained in abeyance (Berguño & Elzinga 2010, *History* Chapter 11; Belanger 2010, *Globalization* Chapter 14). Having experienced the substantial expense (and danger) inherent in Antarctic operations, and having turned up almost nothing of commercial interest, most treaty partners saw continued scientific

cooperation as an expedient political option. Unfortunately for ecosystems of the Southern Ocean, the Antarctic Treaty came into effect long after the commercial whaling of the 1930s. One hopes that, with its hard-won and admirable conventions on ecosystem management and environmental protection, the treaty proves adequate in the face of inevitable and combined challenges of climate change, invasive species, ocean acidification, establishment of protected marine areas and increasing demand for globally-scarce protein and minerals. Does the Antarctic Treaty System have more resilience and relevance than the IGY data centre network? Although this question occurred to me as I read *History* and *Globalization*, I found few clues to an answer.

In opening remarks at the final official IPY 4 Conference in Montreal, in 2012, ICSU President Dr Yuan-Tseh Lee declared IPY 4 "a triumph for global science." Dare we believe such accolades? I credit the *Framework* authors for establishing an accessible and inclusive approach to IPY 4 and recognize the strength and skills of existing polar science institutions in promoting IPY 4 within their national settings. This IPY inherited a positive reputation from the IGY: more than a few nations joined this international event as a mechanism to maintain or restore national scientific prominence. IPY 4 benefitted from fortuitous timing, occurring at the conjunction of IGY commemoration with urgent daily polar news, before the global economic crisis. It caught the attention and stimulated the enthusiasm of international communities of young scientists and educators (Salmon et al. 2011). This IPY also benefitted from a unique scientific and technological convergence. Did the glaciologists or the ecologists dominate this IPY? I neither know nor care, but I do proclaim the fact that, for the first time in an international project of this scale, the myriad threads of Sputnik and of the double helix worked together on shared problems (Carlson 2012). We participants of IPY 4 should acknowledge a visionary plan, claim some skill in management and implementation, and admit good luck in timing and circumstance.

Recommendations

Which of these books do I recommend? Unless Palgrave or Smithsonian chooses to make individual chapters available, one will need to search out or purchase *Globalizing* to access the very important chapter on China. For a useful and enjoyable description and summary of the IPYs in a single volume, I recommend *History*. *Innocents* provides a unique and authentic voice of researchers on the ice in Antarctica during the IGY, and *Opening space* provides rich and well-organized detail about the early days of US space exploration. For the best combination of international research and adventure, set amidst the awesome wind, ocean, ice and darkness of an Arctic winter, I prefer *Tara*.

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