

Sixty years of the International Journal of Biometeorology

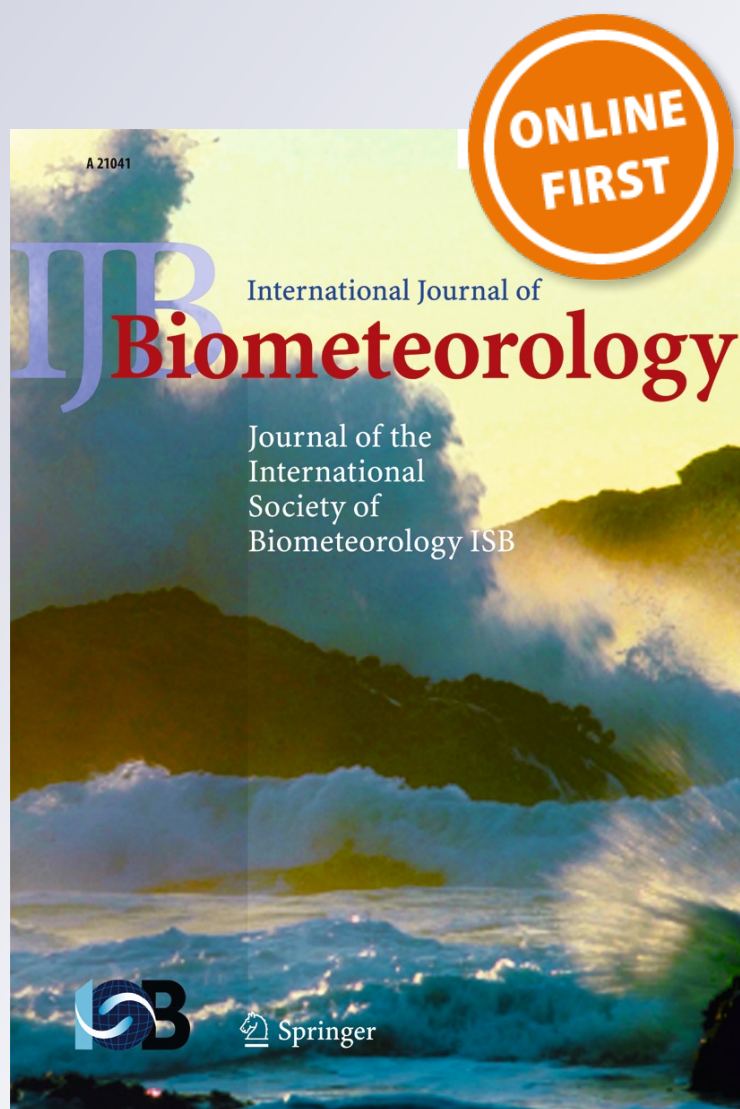
Scott C. Sheridan & Michael J. Allen

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Sixty years of the International Journal of Biometeorology

Scott C. Sheridan¹ · Michael J. Allen²Received: 22 February 2017 / Revised: 26 April 2017 / Accepted: 26 April 2017
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Abstract The International Journal of Biometeorology (IJB) has continuously evolved since its first publications in 1957. In this paper, we examine these changes using a database that includes all manuscript titles and author information. A brief history considers the development of the journal and shifts over time. With an interdisciplinary focus, publications draw on a wide array of subdisciplines. Using content analysis, we evaluate the themes found within IJB. Some research themes have maintained prominence throughout the journal's history, while other themes have waxed or waned over time. Similarly, the most influential manuscripts throughout the past 60 years reveal that human biometeorological papers, particularly regarding thermal comfort, have been influential throughout the journal's history, with other themes, including phenology and animal biometeorology, more concentrated in specific periods. Dominated by North America and Europe in the early years, publication authorship has shifted over the last decade to be more globally representative. Recent inclusion of special issues devoted to regional biometeorological issues, as well as to Students and New Professionals, offer insight into the future direction of the IJB.

Keywords Biometeorology · International Journal of Biometeorology · Publishing · Journal · International Society of Biometeorology

✉ Scott C. Sheridan
ssherid1@kent.edu

¹ Department of Geography, Kent State University, Kent, OH, USA

² Department of Political Science and Geography, Old Dominion University, Norfolk, VA, USA

Introduction

In 2016, the International Society of Biometeorology (ISB) celebrated its 60th anniversary, and the *International Journal of Biometeorology* (IJB) published its 60th volume. Previous articles on the history of the Society and Journal may be found elsewhere (Sargent and Tromp 1966; Weihe 1997; Dirmhirn 1991; Johnson 1997; Höppe 1997), along with companion publications in this Special Issue. As a way to reflect on the 60-year history of the journal, we explore the journal's history, analyzing the titles of all IJB publications from 1957 to 2016, as well as metadata for these publications from 2007 to 2016. We reflect upon the early days of the journal, as well as the temporal trends in terms of themes of publications, and conclude by discussing its transition to a fully global journal.

All manuscripts, titles, and author information are available since the start of the journal on the Springer website for IJB (<http://www.springer.com/environment/journal/484>). In addition, further metadata on all submissions since the journal migrated to the Editorial Manager online submission system in 2006 were downloaded from that system. As 2006 was a transitional year, annual analyses from the Editorial Manager are restricted to the 2007–2016 period. Using all publication titles, word clouds were generated by WordItOut (<http://worditout.com>). Word clouds are visualization tools that differentiate font size based on the frequency of particular words. In this analysis, the output included the most common 50 words for each decade, with common words (e.g., the, or, and) removed as they offer little substantive content. Plural words were combined for the analysis and similar words (e.g., biometeorology, biometeorological) were combined for comparison purposes.

The early development of the journal

Touted as one of the first international organizations to consider the *interrelation of life and the physical environment*, the ISB was organized as a way to unify interested participants around a common goal (Kornblueh 1959). In the early days of the ISB, it was recognized that an international journal would greatly amplify the message of biometeorological research and allow it to influence the international community with greater ease, and broader reach, than the triennial conferences alone (Tromp 1976). Hence, the *International Journal of Biometeorology and Bioclimatology* (IJBB, as it was known until adopting its current name in 1961), with its core mission of *interactions between living organisms and factors of the natural and artificial environment*, was first published in December 1957 following the first Congress of the ISB, which took place in Vienna, Austria, 23–27 September 1957.

A common struggle in the formative years, which in some sense continues today, has been to define the scope of the journal that must represent a very interdisciplinary society and expansive body of work. Over the course of the journal's history, the structure of the editorial board has reflected the overarching themes of the journal and the society. In these early days, the society was then partitioned largely into three groups in addition to “general” biometeorology: phytological, zoological, and human biometeorology (Tromp 1976); the initial editorial board had three members in each category, with S.W. Tromp as the first Editor-in-Chief (then known as the Scientific and Managing Editor; Table 1).

The earliest issues organized manuscripts based on an expanded version of this partition, with article types that also included Cosmic Bioclimatology and Miscellaneous Bioclimatological Data in addition to the categories above. Building interest across disciplines, IJB(B) included topics such as paleo-bioclimatology and grain mineralogy (Opdyke 1959; Nigra 1974). Early committee reports included nautical bioclimatology (d'Avanzo 1957), chemical tests (Piccardi 1958), allergic diseases (Alemanny-Vall 1958), ecological climatography, and ionization of the air (Beckett 1958).

These early volumes also included materials that reflect the development of the society. Publications included reports and updates from the president, secretary, and treasurer, along with book reviews and in-memoriam publications. These reports generally became less common over time, largely disappearing or shifting to being a part of ISB newsletters by the 1990s. Early IJB issues also highlight summaries of relevant national and international workshops and conferences such as the Japanese Society of Biometeorology and smaller biometeorology conferences in Poland and Czechoslovakia. Kornblueh (1961) reported on the first international conference on ionization of the air.

Many early publications focused on building the case for biometeorology, reaching across disciplines and drawing on the

Table 1 Editors-in-chief of the *International Journal of Biometeorology*

Solco Tromp (Netherlands)	1958–1961
Wolf Weihe (Switzerland)	1962–1981
R.W. Gloyne (UK)	1982–1986
H Lieth (Germany)	1987–1993
I.F.G Hampton (UK)	1994–1995
M. Iriki (Japan)	1996–2003
Masaaki Shibata (Japan)	2004–2007
Scott Sheridan (USA)	2008–

common interest of living organisms and the environment. For instance, Page (1958) and Olgyay (1967) discussed architectural relationships with biometeorology. Weihe (1976) highlighted the intersections of meteorology within medical sciences. Juszat (1966) discussed the topic of geomedical human ecology. Sargent (1958, 1964) published several articles on the role of education both at the graduate level and across disciplines.

During this very different era, the physical act of publication was quite different, and it was not until 1961 (Volume 5) that a formal, bound volume first appeared, and 1964 (Volume 8) that the IJB first appeared as part of a formal publishing house, Swets & Zeitlinger; the journal moved to Springer in 1988. In addition to English, 22% of the publications in the first decade were penned in German and French, although the percentage falls precipitously to 5% in the second decade of IJB, and only 5 non-English papers appear thereafter. The last French publication appears in 1986 (Fauconneau and Xande 1986) and the final German publication in 1987 (van Eimern 1987).

Together, these early volumes established the framework for the discipline of biometeorology: international, interdisciplinary, and focused on explaining biological interrelationships with weather and climate. Studies focusing on the interaction of all life—flower, insect, rodent, cattle, and other animals—are found within the IJB. Though only eight provided reports, the journal cited the existence of 10 study groups in 1975: effects of heat and cold on animals and man; biological rhythms; effects of altitude on animals and man; effects of weather and climate on human health and disease; effects of climate on animal diseases and reproduction; effects of weather on plants; biological effects of natural electric, magnetic, and electromagnetic fields; and the physicals and therapeutic effects of ionized air and electroaerosols (Folk et al. 1975; Stolwijk 1975; Mazess and Eagan 1975; von Deschwanden and Jungmann 1975; Hyslop and Stott 1975; Barger and Reifsnnyder 1975; Reiter and Lott 1975; Wehner 1975).

Temporal trends in publication quantity

With a multi-disciplinary focus, the international journal has 3259 total publications from 1957 to 2016 (Fig. 1), including

82 in German and 29 in French. For the first several years, a single volume was published each year, but in 1962, the IJB increased to three issues per year. Following the initial flurry connected to the first Congress, throughout much of its history, the IJB maintained a relatively stable level of publications, with an average of 45 published articles per year between 1963 and 2005.

An analysis of journal articles by country across all scientific journals (National Science Foundation 2016) show a roughly 3–5% increase per year through much of the past half century. However, in the early 2000s, the annual total of journal articles worldwide jumped at around 10–15% per year for several years, reflecting the maturity of the electronic age in the review and publishing process. For IJB, the review process had begun migrating to e-mail in the late 1990s, and the first online publication appeared in 2002. However, the inflection point in Fig. 1 is connected directly to the migration of the IJB to the online Editorial Manager system in 2006, which streamlined the process for editors and authors alike in terms of submission, review management, and communication with publishing. Following this implementation, IJB publications well outpaced the global increase, averaging an increase of 25% per year from 2005 to 2014. This large increase necessitated a rapid increase in issues, from four per year, the standard over decades, to six per year starting in 2004; in 2015, IJB began publishing a monthly issue. A total of 203 publications appeared in 2014, the most of any single year.

Trends in journal themes

The general three-part partition of biometeorology remained in place through much of the history of the journal in terms of its editorial board structure, with the branches only changing in name to more common terms (i.e., from phytological to plant and zoological to animal), and the occasional addition of certain themes, such as a short-lived Engineering field editorship that commenced in 1997 to deal with biometeorological implications of dealing with global environmental

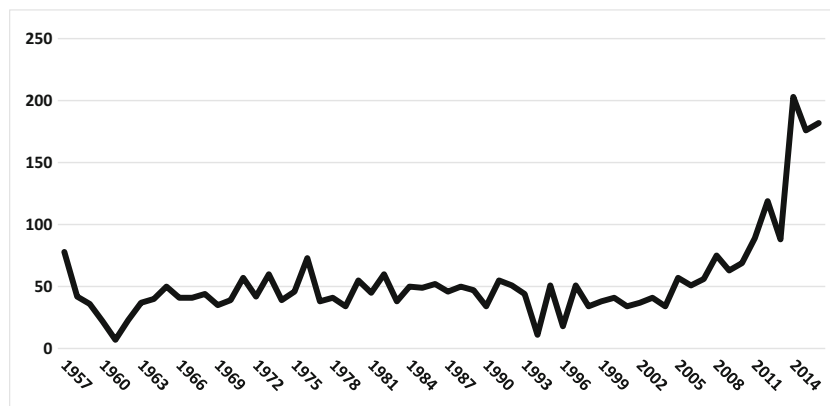
changes. It is within the last 15 years, commensurate with the large increase in submissions and publications, that the number of field editors has increased dramatically (to its present 16), across an increased diversity of fields. Some of these topics have represented clear dichotomies in a subdiscipline, such as the Epidemiology field editorship that split off from Humans in 2002, and Agriculture and Forestry, splitting off from Plants in 2004. Others, such as Phenology (created in 2004), Aerobiology (2014), and Thermal Comfort (2014), represent core areas of research that cross more than one of the traditional subdisciplines of biometeorology. Commensurate with the increased study of the human influence on the landscape, field editorships have been devoted to anthropogenic biometeorological impacts; this includes the local scale, such as Urban Biometeorology (first called Artificial Systems, then Built Environment) in 1999, along with two specific Climate Change field editorships, for Public Health and for Ecology, both created in 2011.

In terms of the publications themselves, content analysis (of the English language titles) offers a quantitative assessment of IJB titles (Fig. 2). By evaluating the frequency of the most common words per decade, we examined how specific terms changed over time. Comparing the top 10 words across the decades, a total of 34 distinct terms were found (Table 2).

The first decade reflects the beginning of the journal with many of these publications appearing as reports, conference notes, and analyses that communicated the utility of biometeorology and bioclimatology. Approximately 15% of all titles included the term *biometeorology* or *bioclimatology* from 1957 to 1966, but the usage slowly decreased over time. The terms were not found within the top 10 after 1987.

Common for two decades, ion-related publications were not as prevalent after 1986. Similarly, the term *rats*, which accounted for 4.6% of all titles from 1977 to 1986, was not studied as often after 1996. In the last decade, 4.9% of all publications included *China*. Along with Japan, primarily for the early Reports of the Japanese Society of Biometeorology, and Spain, these three countries were the only geographic locations found in the

Fig. 1 Publications of the International Journal of Bioclimatology and Biometeorology (1957–1959) and International Journal of Biometeorology (1960–2016)



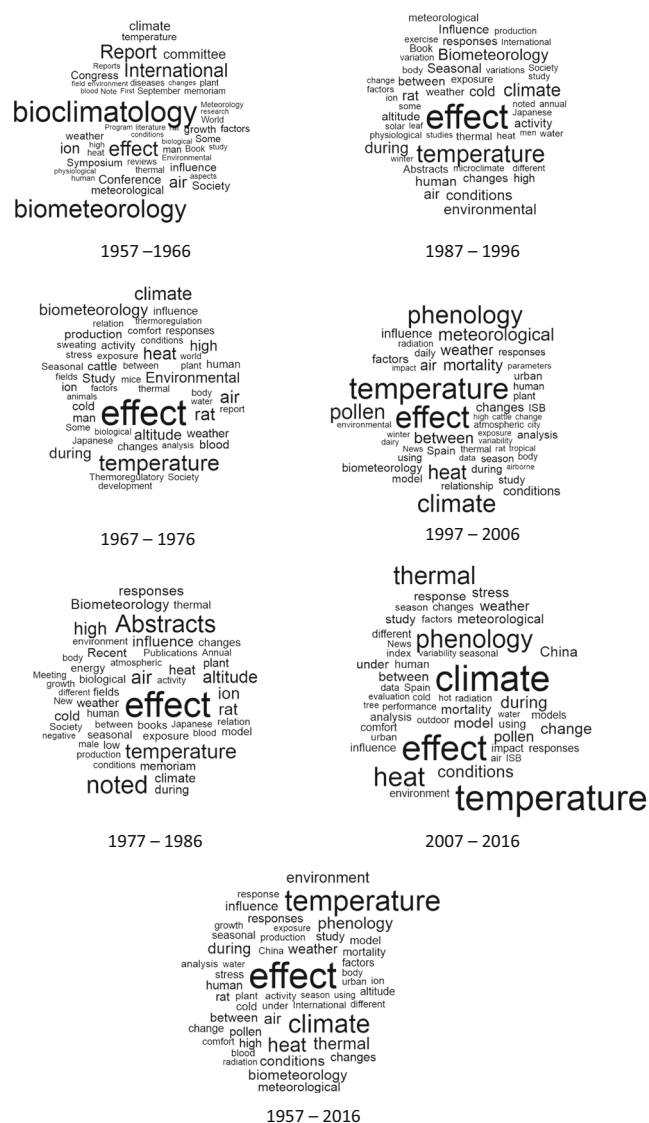


Fig. 2 Word clouds of International Journal of Biometeorology publication titles, using English language publications only

analysis. Commensurate with the new field editorships, the terms phenology and pollen both have become more commonly used over the last 20 years.

More recently, the term *model* appeared. With technological innovation, a new era of research has been advanced by larger data sets and new computational methodologies to explain the relationships between plants, animal species, and humans (Höppe 1999; Matzarakis et al. 2010; van Vliet et al. 2003; Hudson et al. 2011). Additionally, other techniques such as geographic information systems and visualization are being published in IJB (Svensson et al. 2003; Schindler et al. 2012; Höppe et al. 2004).

Only one term was consistently found to be common across all six decades: effect(s). The term appeared in nearly 15% of all IJB titles. The term *temperature(s)* appeared in the top 10 after the first decade.

Additional analysis regarding two-word phrases such as *climate change* and *human health* were done. Included in 60 publications, *climate change* was the most common two-word term. While Zagwijn (1960) first used the term *climatic change* in the very early period of the journal in reference to paleoclimate, it is Reed and Desanker (1992) who first published with the term *climate change* in the ISB in 1992. *Heat stress* and *air temperature* were also common occurrences, as both terms may be applied to a wide range of biometeorological processes including plant growth, human health, and animal reproduction. *Physiological effect* was not commonly found after the first decade.

In examining the journal articles that have been most widely cited (Table 3), several interesting patterns emerge. The most persistent theme in highly cited articles throughout the journal's 60-year history is human thermal comfort and balance, with "The perception of thermal comfort" from 1965 (Chatonnet and Cabanac 1965) the most widely cited article in the first decade, and Peter Höppe's introduction of the physiological equivalent temperature in 1999 (Höppe 1999)—the precursor to the UTCI—as the most widely cited manuscript in IJB history. Indeed, more than half of the most widely cited manuscripts in IJB over the past two decades involve some aspect of thermal comfort, from the derivation and the justification of indices (e.g., Jendritzky et al. 2012) to the calculation of radiative fluxes (e.g., Matzarakis et al. 2007) along with

Table 2 Ten most commonly used phrases in the publication titles of the International Journal of Biometeorology. Words are ranked by percent of titles using word. The total number of English language publications for each decade are noted

1957–1966 (376)	1967–1976 (476)	1977–1986 (462)	1987–1996 (407)	1997–2006 (418)	2007–2016 (1120)	1957–2016 (3259)
Bioclimatology (8.2)	Effect(s) (16.4)	Effect(s) (20.3)	Effect(s) (19.7)	Effect(s) (11.2)	Effect(s) (15.4)	Effect(s) (14.3)
Biometeorology (6.9)	Temperature(s) (9)	Noted (9.7)	Temperature (9.1)	Phenology (9.1)	Temperature(s) (12.7)	Temperature (8.3)
International (6.6)	Air (6.7)	Abstracts (9.5)	During (6.1)	Temperature(s) (8.9)	Climate (12.5)	Climate (7.1)
Report (6.6)	Heat (6.3)	Air (6.9)	Conditions (5.7)	Pollen (7.2)	Heat (9.8)	Heat (6.4)
Air (5.6)	Biometeorology (5.9)	High (6.3)	Biometeorology (5.2)	Climate (7.2)	Thermal (9.1)	Phenology (5)
Effect(s) (5.3)	During (5.5)	Altitude (5.6)	Air (5.2)	Heat (6.7)	During (6.3)	Thermal (4.9)
Committee (4.3)	Altitude (5)	Influence (5)	Climate (4.9)	Meteorological (6.5)	Phenology (5.9)	Air (4.8)
Society (3.7)	High (4.8)	Temperature(s) (4.5)	Cold (4.9)	Between (5.5)	Conditions (5.7)	During (4.8)
Influence (3.7)	Rat(s) (4.6)	Ion(s) (4.5)	Human (4.9)	Air (5.0)	Change (5.4)	Biometeorology (4.1)
Conference (3.5)	Climate (4.2)	Cold (4.5)	Seasonal (4.7)	Mortality (4.8)	China (4.9)	Conditions (4.1)

Table 3 The 10 most highly cited articles from each decade in IJB history. Citation totals were obtained from Google Scholar

Title	First author	Year	Citations
1957–1966			
The perception of thermal comfort	J Chatonnet	1965	120
Environmental temperature and lactation (with special reference to cattle)	HD Johnson	1965	100
Detrimental effects of high ambient temperature on fertility and early embryo survival in sheep	RH Dutt	1964	57
Effect of air ions on bacterial aerosols	G Phillips	1964	55
Climatic stress indices for domestic animals	DHK Lee	1965	53
Heat tolerance in cattle—its concept, measurement, and dependence on modifying factors	W Bianca	1961	42
A survey of human biometeorology	F Sargent	1965	40
Periodicity analysis A potential tool for biometeorologists	F Halberg	1963	38
The ionization state of the atmosphere as a function of the meteorological elements and of various sources of ions	N Robinson	1963	37
Some effects of air ions on the activity of rats	CH Bachman	1966	35
1967–1976			
A biometeorological time scale for a cereal crop involving day and night temperatures and photoperiod	GW Robertson	1968	238
Diurnal activity in a small desert rodent	A Shkolnik	1971	133
The significance of meteorology in animal production	W Bianca	1976	98
Thermoregulation in exercising man during dehydration and hyperhydration with water and saline	B Nielsen	1972	87
World patterns of the distribution of the monthly comfort index	WH Terjung	1968	85
Lag responses in mood reports to changes in the weather matrix	MA Persinger	1975	83
Experimental evaluation of standard effective temperature a new biometeorological index of man's thermal discomfort	RR Gonzalez	1974	81
Comparison of the comfort conditions in different urban and suburban microenvironments	JF Clarke	1971	79
The pineal gland and geographical distribution of animals	CL Ralph	1975	78
Effects of 72-hour heat stress on semen quality in boars	JI McNitt	1970	75
1977–1986			
Towards a psycho-physiological model of thermal perception	A Auliciems	1981	282
Vegetation effects on microclimate in lowland tropical forest in Costa Rica	N Fetcher	1985	150
Aerial dispersal of biological material from Australia to New Zealand	RC Close	1978	132
Environmental management of cattle to minimize the stress of climatic change	HD Johnson	1980	108
Assessment of human bioclimate based on thermal response	CR Freitas	1985	87
Temperatures of expired air under varying climatic conditions	P Höppe	1981	82
Photoperiod and ambient temperature as environmental cues for seasonal thermogenic adaptation in the Djungarian hamster, <i>Phodopus sungorus</i>	G Heldmaier	1982	77
The biological effects of air ions	AP Krueger	1985	75
Probit analysis of thermal sensation assessments	ER Ballantyne	1977	73
Role of photoperiod and melatonin in seasonal acclimatization of the Djungarian hamster, <i>Phodopus sungorus</i>	S Steinlechner	1982	70
1987–1996			
Ambient temperature: a factor affecting performance and physiological response of broiler chickens	A Donkoh	1989	232
Environmental profile and critical temperature effects on milk production of Holstein cows in desert climate	MO Igono	1992	195
Thermal comfort in the humid tropics: Field experiments in air-conditioned and naturally ventilated buildings in Singapore	RJ De Dear	1991	178
Area-averaged vegetative cover fraction estimated from satellite data	KP Wittich	1995	175
Biological activities caused by far-infrared radiation	S Inoué	1989	156
The potential effects of climate change on winter mortality in England and Wales	IH Langford	1995	129
Monitoring global change with phenology: the case of the spring green wave	MD Schwartz	1994	110
Climate change and the incidence of food poisoning in England and Wales	G Bentham	1995	100
A tree-ring densitometric transect from Alaska to Labrador	FH Schweingruber	1993	98
Too hot for comfort: the heatwaves in Greece in 1987 and 1988	BD Giles	1990	97
1997–2006			
The physiological equivalent temperature—a universal index for the biometeorological assessment of the thermal environment	P Höppe	1999	953
Higher northern latitude normalized difference vegetation index and growing season trends from 1982 to 1999	CJ Tucker	2001	629
Applications of a universal thermal index: physiological equivalent temperature	A Matzarakis	1999	617
Trends in phenological phases in Europe between 1951 and 1996	A Menzel	2000	498
Computer prediction of human thermoregulatory and temperature responses to a wide range of environmental conditions	D Fiala	2001	409
An examination of the relationship between flowering times and temperature at the national scale using long-term phenological records from the UK	TH Sparks	2000	380
The importance of phenology for the evaluation of impact of climate change on growth of boreal, temperate, and Mediterranean forests ecosystems: an overview	K Kramer	2000	340
Tourism climatology: evaluating environmental information for decision making and business planning in the recreation and tourism sector	CR de Freitas	2003	320
The impact of growing season length variability on carbon assimilation and evapotranspiration over 88 years in the eastern US deciduous forest	MA White	1999	315
Spring phenology trends in Alberta, Canada: links to ocean temperature	EG Beaubien	2000	288
2007–2016			
Modeling radiation fluxes in simple and complex environments—application of the RayMan model	A Matzarakis	2007	613
Modeling radiation fluxes in simple and complex environments: basics of the RayMan model	A Matzarakis	2010	362

Table 3 (continued)

Title	First author	Year	Citations
Tourism climate and thermal comfort in Sun Moon Lake, Taiwan	TP Lin	2008	240
The urban heat island and its impact on heat waves and human health in Shanghai	J Tan	2010	239
A second generation climate index for tourism (CIT): specification and verification	CR de Freitas	2008	199
UTCI—Why another thermal index?	G Jendritzky	2012	194
Heat wave impacts on mortality in Shanghai, 1998 and 2003	J Tan	2007	185
Comparison of UTCI to selected thermal indices	K Blázquez	2012	175
A survey of public perception and response to heat warnings across four North American cities: an evaluation of municipal effectiveness	SC Sheridan	2007	157
UTCI-Fiala multi-node model of human heat transfer and temperature regulation	D Fiala	2012	160

applications to tourism (de Freitas 2003). The incorporation of human comfort and radiative balance is critical to many other commonly cited papers in the past decade, particularly with several highly cited papers that have examined heat waves and their human impacts (e.g., Tan et al. 2010; Sheridan 2007).

Other research themes have had periods of IJB history in which they have been more prominent. For instance, a number of animal biometeorology papers from the first two decades were very widely cited, particularly with regard to production animals (e.g., Johnson 1965), but also animals in the natural environment (e.g., Shkolnik 1971); in the last two decades, no animal-themed papers have been in the top 10. Similar to our content analysis, ion-themed publications predominate in the earlier years as well. Several phenology papers from 2000 and 2001 (e.g., Tucker et al. 2001; Menzel 2000; Sparks et al. 2000; Kramer et al. 2000, Beaubien and Freeland 2000) are among the most widely cited papers, with only one highly cited phenology paper from another period (Schwartz 1994).

From international to global

In its first decade, the IJB, as discussed above, largely reflected its origins, with 88% of lead authors based either in North America and Europe; four countries (USA, West Germany, the UK, and Switzerland) represented more than half of all publications. Only 34 countries were represented at all, falling to 29 if colonial affiliations are excluded. These articles tended to be penned by few individuals, and it is thus no coincidence that the authors of the greatest number of first authored publications are from its formative period, despite the increase in overall article totals today: Solco W. Tromp (30), Wolf H. Weihe (26), Albert P. Krueger (22), and Frederick Sargent (18).

Over the last decade (2007–2016), the lead authors represented 67 countries (Fig. 3). In the early part of the most recent decade, from 2007 to 2009, the geography of lead author affiliations had not changed substantively from the first decade in many regards, still dominated by North America and Europe (67%), with nearly all of the increase from outside these regions comprised of Japan and Australia. In contrast, in the 2014–2016 period, North America and Europe together

make up less than half of the lead authorship, with substantial increases from Latin America, Asia, and the Middle East.

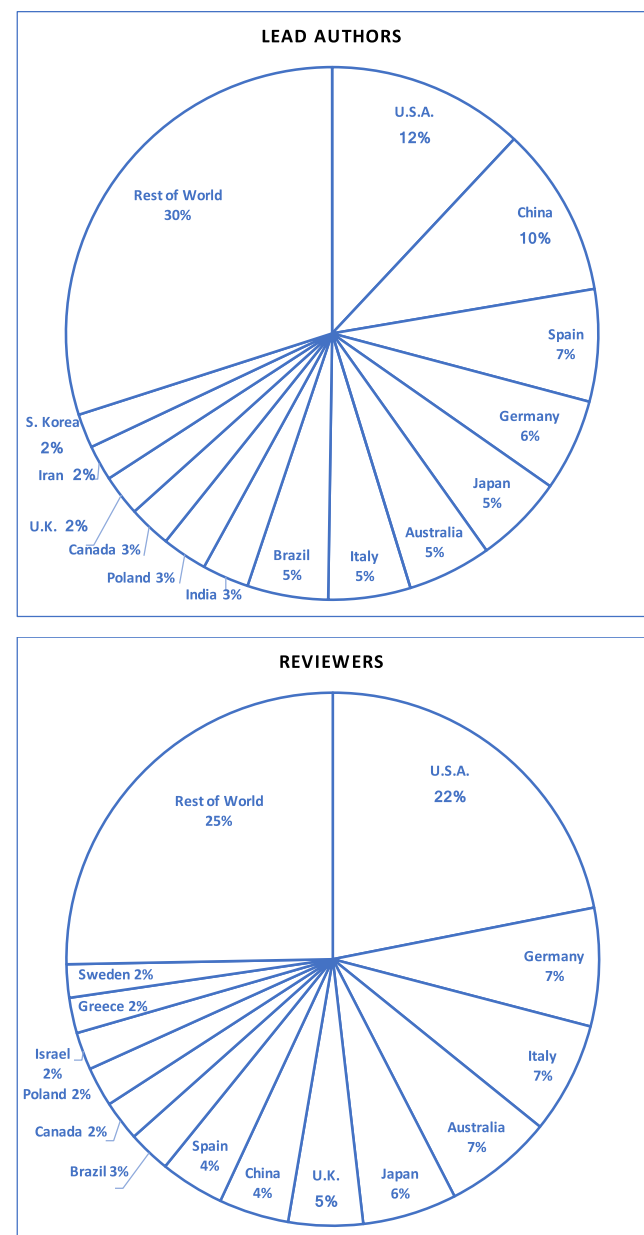


Fig. 3 The distribution of lead authors and reviewers by country for 2007–2016

China first displaced the US in 2014 to lead the list of publications by country and represented 15.6% of primary authors in the 2014–2016 period, after averaging only 3% a decade earlier. Other substantive increases in publications can be found coming from Brazil (5.8%), India (4.0%), Iran (3.0%), and South Korea (2.8%). Even within Europe, the national affiliations have changed considerably, with Spain (6.0%) the leading country, displacing historical leaders Germany (3.8%) and the UK (1.6%). Collectively, the IJB now represents a greater dispersion of journal article origins than the scientific literature as a whole (National Science Foundation 2016).

The review process of manuscripts from before the last decade is largely lost to history, as there remains no clear paper trail of unaccepted manuscripts or any substantive details on the review process. Following the move to the Editorial Manager system in 2006, full details on the review process can be explored. It is perhaps unsurprising that trends in reviewer nationalities will lag those of authors, as it takes time for reputations to be established. Nevertheless, with the record of the past decade, a clear trend in the international extent of expertise can be observed. Europeans and North Americans comprised 47 and 28% of all reviewers in 2007–2009, respectively, falling to 41 and 24% by 2014–2016. Increases can be found in all other regions of the world, with the greatest increases in East Asia, the Middle East, and Latin America, fueled by a 3–5-fold increases in the percentage of reviews completed by Chinese, Brazilian, and Iranian scholars. Though the editors-in-chief have only been from North America, Western Europe, and Japan (Table 1), as the number of field editors has grown, their nationalities have reflected the increased global prominence of the journal, with current field editors from Brazil, Taiwan, and Israel.

Concluding remarks

In the past 60 years, the IJB has grown substantially in size and stature and has been agile in changing its focus to reflect larger narratives in biometeorological research. Themes have changed, and the global scope of the journal has only continued to grow, with lead authors representing 67 countries and reviewers representing 84 countries over the last decade. As we develop, we aim to represent the ISB in the years to come. Special issues focusing on regional biometeorology are currently in process for Latin America, from a conference in Havana, Cuba, in 2015, and for Asia, after a conference in Beijing, China, in 2016. Supporting student members and new professionals, the upcoming 21st ICB in Durham will be the third consecutive congress from which a special Students and New Professionals issue is planned. The recent inclusion of citizen science has been highlighted as a way to broaden biometeorological interest (Beaubien and Freeland 2000;

Beaubien and Hamann 2011; Gonsamo and D'Odorico 2014). It is through all of these means that the journal aims to reinforce its global standing and represent the field of biometeorology across all fields over the coming decades.

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