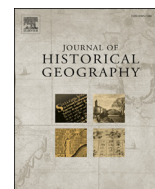




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# Imagining climates past, present and future: Soviet contributions to the science of anthropogenic climate change, 1953–1991

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## ABSTRACT

This paper builds on recent work in the critical geographical literature concerned with advancing a more nuanced engagement with climate change science and linked knowledges. The main aim of this paper is to provide insight into the character of Soviet climate science, and reflect on the contribution of Soviet scientists to the international debate concerning anthropogenic climate change and associated forecasting as it developed from the late 1950s through to the first report of the IPCC in 1990. Such a focus is significant for a number of reasons. First, Soviet contributions are given short shrift in general reviews concerning the development of the basic science underpinning anthropogenic climate change, emerging as a subdued ‘other’ despite their relative importance during this period at the international level. Second, the Soviet contingent also played an influential role in the formation of the IPCC as well as the development of associated debates concerning the establishment of future climate change scenarios. Third, the early IPCC process resulted in the relative marginalisation of Soviet scientific input framed by debates over the most effective way to determine future climate change scenarios. The paper examines the significance of Soviet science for the evolving climate change debate on the international stage, and the related involvement of a handful of Soviet scientists in the activities of international bodies such as the World Meteorological Organisation (WMO). It also examines the role of Soviet scientists in the consolidation of a natural science conceptualisation of anthropogenic climate change during the late 1980s. It is shown how the Soviet contingent came to place an emphasis on the use of palaeoclimatic analogues in order to predict future climates, albeit whilst recognising the value of the computer modelling approach favoured by many Western climatologists. Nevertheless, this preference for an analogue approach and resultant debates surfaced strongly during the early work of the IPCC. The robust advancement of General Circulation Models (GCMs) as the prime forecasting technique within Working Group I resulted in the effective side-lining of the Soviet contingent during the process of finalising the first IPCC report in 1990.

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Historical accounts of the science underpinning notions of anthropogenic climate change trace a path from the circumscribed work of nineteenth-century North American and European physical scientists, through to the later applied and conceptual work of individuals such as Guy Stewart Callendar and Gilbert Plass, and the internationalisation of the climate change issue by various bodies including the World Meteorological Organisation (WMO). An associated tendency to focus on ‘signal moments’ such as the publication of the Keeling Curve, contributes to an underlying narrative characterised by a growing awareness of the role of carbon dioxide (CO<sub>2</sub>) and other anthropogenic greenhouse gases in the functioning of

global geophysical systems, and a strengthening emphasis on the use of climate models in order to anticipate future climate trends.<sup>1</sup> This narrative also draws attention to the convoluted nature of scientific progress, the influence of military and state patronage, and the essential importance of international cooperation for the furthering

<sup>1</sup> R. Hamblyn, The whistleblower and the canary: rhetorical constructions of climate change, *Journal of Historical Geography* 35 (2009) 224; S. Boehmer-Christiansen, Science policy, the IPCC and the Climate Convention: the codification of a global research agenda, *Energy and Environment* 4 (1993) 375–377; A.D. Hecht and D. Tirpak, Framework agreement on climate change: a scientific and policy history, *Climatic Change* 29 (1995) 371–402; J.R. Fleming, *Historical Perspectives on Climate Change*, Oxford, 1998, 107–128; S.R. Weart, *The Discovery of Global Warming*, Cambridge MA, 2003.

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of insight into anthropogenic climate change post-1945.

Geographers have been at the forefront of exploring the limitations of such historical constructions of the climate change debate, placing an emphasis on the need to engage with the multiple knowledges involved in comprehending climatic processes, as well as the significance of different scales of analysis for interpreting past, present and future climates.<sup>2</sup> Furthermore, this critique has been joined by overlapping debate concerning the hierarchy of science evident in key organisations such as the Intergovernmental Panel on Climate Change (IPCC), and the tendency for certain branches of the physical sciences to dominate policy responses, allied to the relative marginalisation of the social sciences and humanities.<sup>3</sup> Drawing inspiration from both areas of discussion, this paper explores the place and role of Soviet science in the broader development of climate change science during the Cold War period.

Soviet climate science is given short shrift in the general historiographical work noted above, emerging as a somewhat marginalised 'other' in the context of the Cold War. The main aim of this paper is to offer a detailed synopsis of the character of Soviet climate science, and to reflect on the hitherto largely overlooked contribution of Soviet scientists to the international debate concerning anthropogenic climate change as it developed from the late 1950s through to the first report of the IPCC in 1990. It should be noted that the Soviet Union also developed an agenda concerning climate change with other socialist countries; however, in view of space constraints, the focus of this paper is on Soviet engagement with the broader international context.<sup>4</sup> A purposeful evaluation of the Soviet Union's efforts in this area as they developed post-WWII promises a more nuanced understanding of the history of climate change science, one that recognises the existence of marginalised layers of understanding within the broader international discourse of anthropogenic climate change. Linked to this, it also assists in opening up key areas of debate concerning the construction of future climate change scenarios during the formative early years of the IPCC process. Broadly speaking, Soviet scientists made significant contributions to the natural science view of anthropogenic climate change that emerged so strongly post-1945, and were responsible for some of the earliest forays into predicting climate futures. Thus, they form a key part of the consolidation of a natural science approach to climate change that crystallised during the late 1980s.<sup>5</sup> At the same time, they accentuated particular approaches to the issue, some of which would bring them into conflict with competing accounts within the international scientific community as will be discussed below.

Soviet scientific commitment to the climate change issue was characterised by a number of broad trends during 1945–1991. First, innovative advances were made with respect to physical and quantitative climatology, and particularly the functioning of the

heat-water balance at the Earth's surface, which provided a basis from which to deepen understandings of the global climate system more generally. Second, certain Soviet climatologists and cognate scientists engaged progressively with the notion of society's growing influence on the climate system from the early 1960s onwards, integrating such understanding with more developed concepts of the global physical system, and this included early work on future climate predictions.<sup>6</sup> Third, Soviet scientists were influential participants in the evolving international agenda, taking an active role in initiatives such as the formative International Geophysical Year event as well as the activities of the WMO and IPCC.<sup>7</sup> Fourth, Soviet work at the international level concerning climate change forecasts tended to be dominated by a relatively small group of scientists who became increasingly marginalised by the Western consensus around climate change futures that emerged during the foundational work of the IPCC in the late 1980s.

In order to explore aspects of these general trends in more detail and focus the analysis, the paper is structured around three main sections, which in turn draw heavily from the work and activities of four key protagonists. These are: climatologist M.I. Budyko (1920–2001), geophysicist E.K. Fedorov (1910–1981), atmospheric physicist K.Ya. Kondrat'ev (1920–2006) and geophysicist Yu.A. Izrael' (1930–2014). Collectively these four scientists produced a large body of work devoted to climate change as well as broader global environmental concerns. Furthermore, they were all highly visible on the international scene and played significant roles in the WMO and related initiatives. It should be borne in mind that the dominance of the protagonists highlighted, particularly on the international stage, drew attention away from the more involved domestic debate in this area. Space precludes a more detailed examination of this domestic debate. Nevertheless, the subsequent analysis does provide insight into some key trends characterising Soviet engagement with the climate change issue post-1945.

The opening section places the paper's empirical findings within the context of recent work related to the environmental history of the Cold War period. The subsequent section moves on to assess Soviet thinking with respect to climate change post-1945 in order to provide a framework for assessing Soviet engagement with the corresponding international agenda. The final section examines the nature of Soviet involvement in international initiatives of significance for the development of climate change science. It does this via a focus on three substantive areas of activity. First, Soviet engagement with the Nuclear Winter debate that emerged strongly during the 1980s is examined in view of this debate's connection with future efforts to model climate processes at the global scale. Second, Soviet interaction with US climate scientists as part of broader initiatives around environmental concerns from the 1970s onwards is explored. The final area of focus offers an insight into Soviet interaction with the WMO and the flurry of activity underpinning the publication of the IPCC's First Assessment Report in 1990. Soviet engagement with the IPCC process is particularly significant in view of this organisation's subsequent emergence as a key consensus-builder with respect to climate science. The empirical heart of the paper falls between 1953 and 1990, sandwiched between the death of Stalin and the publication of the noted IPCC report.

<sup>2</sup> C. Brace and H. Geoghegan, Human geographies of climate change: landscape, temporality, and lay knowledges, *Progress in Human Geography* 35 (2010) 284–302; M.T. Bravo, Voices from the sea ice: the reception of climate impact narratives, *Journal of Historical Geography* 35 (2009) 256–278; S. Daniels and G.H. Endfield, Narratives of climate change: introduction, *Journal of Historical Geography* 35 (2009) 215–222; D.W. Gamble, D. Campbell, T.L. Allen, D. Barker, S. Curtis, D. McGregor and J. Popke, Climate change, drought, and Jamaican agriculture: local knowledge and the climate record, *Annals of the Association of American Geographers* 100 (2010) 880–893.

<sup>3</sup> For example, M. Hulme, Geographical work at the boundaries of climate change, *Transactions of the Institute of British Geographers* 33 (2008) 5–11; M. Hulme and M. Mahony, Climate change: what do we know about the IPCC?, *Progress in Physical Geography* 34 (2010) 705–718; D.M. Liverman, Conventions of climate change: constructions of danger and the dispossession of the atmosphere, *Journal of Historical Geography* 35 (2009) 285–288.

<sup>4</sup> K.M. Lugina, Sotrudnichestvo sotsialisticheskikh stran v oblasti issledovaniya izmeneniya klimata, *Meteorologiya i Gidrologiya* 4 (1988) 134–136.

<sup>5</sup> M. Hulme, Reducing the future to the climate: a story of climate determinism and reductionism, *Osiris* 26 (2011) 245–266.

<sup>6</sup> See J.D. Oldfield, Mikhail Budyko's (1920–2001) contributions to global climate science: from heat balances to climate change and global ecology, *WIREs Climate Change* 7 (2016) 682–692.

<sup>7</sup> V.V. Belousov and V.A. Troitskaya, Mezhdunarodnyi geofizicheskii god, *Vestnik Akademii Nauk SSSR* 7 (1957) 3–7; Akademii nauk, Uchastie sovetskikh uchenykh vo vseimiroi programme issledovaniia klimata, *Vestnik Rossiiskoi Akademii Nauk* 3 (1987) 106–117.

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