

**BIPOLAR**  
KATHRYN YUSOFF, EDITOR

**TheArtsCatalyst**

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# FORECAST FACTORY: SNOW GLOBES AND WEATHER MAKERS WEATHER PERMITTING

## JENNIFER GABRYS & KATHRYN YUSOFF

The model of weather prediction in use today has its origins in part in the work of the British Quaker mathematician, Lewis Fry Richardson. Richardson developed a method for understanding the weather through modeling and statistics, and he imagined a fantastical space where 'computers,' or actual people conducting calculations, would be situated, each assigned to computing weather statistics for specific areas of the planet. 'Forecast Factory' was the imaginative term he assigned to this space:

*After so much hard reasoning, may one play with a fantasy? Imagine a large hall like a theatre, except that the circles and galleries go right round through the space usually occupied by the stage. The walls of this chamber are painted to form a map of the globe. The ceiling represents the north polar regions, England is in the gallery, the tropics in the upper circle, Australia on the dress circle and the antarctic in the pit. A myriad computers are at work upon the weather of the part of the map where each sits, but each computer attends only to one equation or part of an equation.<sup>1</sup>*

Richardson proposes a weather globe, inhabited from the inside, as an ideal space in which to imagine, visualize and predict the weather. This globe was at once a space and technology for prediction, as well as a space and technology for imagining and control.

Another globe, the snow globe, presents a compelling space in which to explore weather imaginaries. The snow globe is an ornament that emerged together with other glass instruments, many of which were used for weather observation. At the same time, the snow globe is a kind of imaginary weather modification device: shake it and snow falls. Through the snow globe, the blurry continuum between weather prediction and control settles into view. Prediction allows for the promise of eliminating uncertainty, not just through

*Weather and glass. Arctic landscapes (Fieldwork film, Weather Permitting, Gabrys and Yussoff)*



knowing what the weather will be tomorrow, but also more ambitiously by even controlling the weather outright by simply encapsulating ourselves in an ideal climate. Futuristic and utopian schemes often consist of cities captured under a glass dome, where the vagaries of weather exist only outside, beyond the well-regulated interior of sunny and moderate conditions, with light breezes and blue skies.

But the trajectory from prediction to control does not end with schemes for futuristic domes. It encompasses weather modification technologies that range from 19th Century rainmaking machines to 20th Century cloud seeding and geo-engineering fantasies that now critically inform our present-day proposals for dealing with climate change. At first, weather modification may appear to be an attempt to bend nature to our will or whim, but perhaps what weather modification instead demonstrates is the way our understanding of climate emerges from what we so urgently feel needs to be modified. In the 19th Century, rainmakers were desperate to control precipitation, often to improve agricultural yields. This momentum carried into the 20th Century, but weather modification also took on possible deployments for warfare, as well as large-scale geo-engineering projects that included melting large tracts of permafrost and ice in the North Polar Regions. Today, we would modify the weather to avert catastrophe and to harness energy.

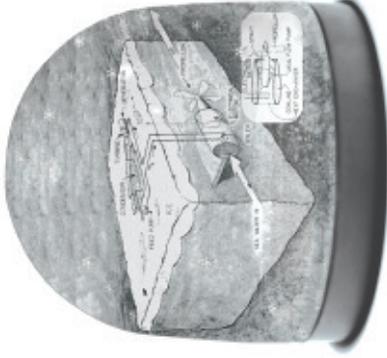
From cloud seeding to weapons of war, weather modification during post-World War II gained real momentum. The 1957-58 International Geophysical Year (IGY) was one event in particular that allowed for the development of unusual weather modification schemes. Projects ranged from altering the ocean currents to engineering and redirecting cyclones. The aim was not only to be able to predict weather events to the minute, but also within a few decades to have complete and total mastery over the weather. One special area of focus for both the US and Russia concerned the Arctic, and the possibility of warming these regions to make them more arable and productive, and to gain access to the many resources that were hidden away under the ice and permafrost. In the late 1950s and early 1960s, the Soviets were especially preoccupied with how to melt the North Pole, as an ice-free Arctic would surely make for a more pleasant climate all around. Proposed schemes included decreasing the reflectivity, or albedo, of the Arctic ice and snow, and thereby increasing solar radiation in the north; as well as spreading a thin film of alcohol over the surface of the northern branch of the Gulf Stream in order to reduce surface evaporation; using satellites and space mirrors to control solar radiation; and redirecting Arctic rivers away from the Barents Sea in order to increase salinity and the time it takes for water to freeze over.

Following the initial grand imaginings of Cold War weather modification projects, there was a gradual abatement of enthusiasm or general caution toward the subject. But the prospect of grand climate alteration did not lie dormant for long. Schemes were resuscitated for towing icebergs to arid regions. Imaginative proposals abounded at the “Iceberg Utilization”

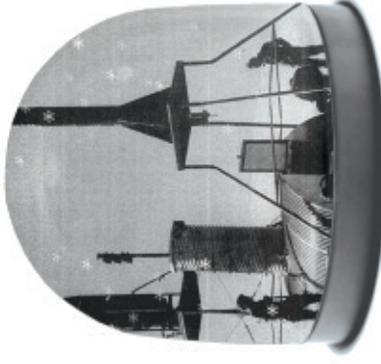
Weather forecasting apparatus, which provides a visual weather forecast based on inputting current weather conditions. (Snow globe by Weather Permitting, Gabrys and Yusoff)



Self-propelled iceberg, showing electrical motor and propeller installation for transportation. With this scheme, icebergs could be towed to arid regions to provide irrigation and other modern amenities. (Snow globe by Weather Permitting, Gabrys and Yusoff)



Radio-controlled silver iodide smoke generator with Santa Claus chimney. Silver iodide has been in use since 1946 as a method for cloud seeding and generating precipitation. (Snow globe by Weather Permitting, Gabrys and Yusoff)



conference, held at Ames, Iowa and funded in part by the National Science Foundation in the U.S. and the King Faisal Foundation in Saudi Arabia. One paper documents a scheme for a “Self-Propelled Iceberg,” which would overcome the problem of how to tow icebergs to the desert. Rockets were studied for more effective hail suppression at a 1973 conference sponsored by the WMO. More generally, encapsulated cities emerged as possible sites of ideal living. And space mirrors and debris continued to enchant, as an expensive but neatly removed and all-encompassing weather system.

There is an uncanny similarity between these Cold War proposals and some of the geo-engineering proposals currently under consideration as ways to deal quickly with the possible menace presented by climate change, also known in the weather modification literature as “inadvertent” or “accidental” weather modification. These proposals include carbon capture through artificial trees and underground carbon storage; shading the earth with outer-space screens of mirrors or sulfur to control incoming solar radiation; seeding clouds to control albedo; and seeding the oceans with everything ranging from iron to an alkaline substance such as limestone or pumping in phytoplankton. Many of these schemes have the same concerns with altering albedo and solar radiation, whether through orbiting particles or altering land surfaces, which can be found in the previous attempts to alter the weather. And similar to the weather modification technologies of the recent past, the possibility of deploying these schemes exactly to plan remains elusive. In this way, James Rodger Fleming suggests in his critique of the three waves of weather and climate modification—from the 19th Century to the present day—that the “seemingly rational, technical proposals” put forward to deal with climate change today “are only rational without their histories.”<sup>2</sup>

The history of weather modification is suffused with the relation between urgency and technology, to the extent that we do not ask what other figures might guide our understandings of weather, climate and ecologies. Gazing into the less scientific, but equally evocative figure of the snow globe, we find that rain making and snow shaking, and whole earths and incomplete environmental knowledges, can direct us not to extract elusive prophecies from crystal balls, but rather to begin to make commitments to other weather imaginaries.

- 1 Lewis Fry Richardson. *Weather Prediction by Numerical Process* (Cambridge University Press, 1922), 219-220.
- 2 James Rodger Fleming. “The Pathological History of Weather and Climate Modification: Three cycles of promise and hype,” *Historical Studies in the Physical Sciences*, Vol. 37, No. 1 (2006), 3-25.

#### **Kathryn Yusoff**

Dr Kathryn Yusoff is a Lecturer in Human Geography at the University of Exeter, Cornwall. Her research interests include exploring the political aesthetics of environments and re-thinking visual culture in relation to emerging technologies of vision. She co-organised (with Katrina Dean) the Polar Archive events at the British Library and is editor of *BiPolar*.

#### **Katrina Dean**

Dr Katrina Dean is the curator of history of science at the British Library with research interests in aspects of the history of science and technology in the nineteenth and twentieth centuries, broadly geographical themes in the history of the sciences, and science archives. Katrina is co-organiser (with Kathryn Yusoff) of the Polar Archive events.

#### **Denis Cosgrove (1948-2008)**

Denis Cosgrove was Alexander von Humboldt Professor of Geography at UCLA. His geographical research focused on the history of ideas and graphic representations in shaping attitudes to environment and landscape. His books include *Social Formation and Symbolic Landscape* (1984; 1996), *The Palladian Landscape* (1993), *Apollo's Eye* (2002) and *Geography and Vision* (2008). He was editor of *Mappings* (1999), and co-editor of *The Iconography of Landscape* (1988), *Water, Engineering and Landscape* (1990) and *High Places* (2008).

#### **Eric Wolff**

Dr Eric Wolff is an ice core scientist at the British Antarctic Survey in Cambridge, UK. He leads the science group of the European Project for Ice Coring in Antarctica, which successfully drilled and analysed the ice core extending 800,000 years into the past from Dome C in Antarctica.

#### **Heather Frazer**

Heather Frazer is an independent scholar and visual artist based in Los Angeles. Her work focuses on the spaces, materiality, and aesthetics of science, including a recent video entitled, *Core Matters (or, GISP2 chronologies)*.

#### **Nigel Clark**

Dr Nigel Clark is a Lecturer in Human Geography at the Open University. His work focuses on the question of what it is to be a soft, fragile being inhabiting a volatile physical world. He is the co-editor of *Environmental Changes, Global Challenges and A World in the Making*, and is currently working on a book, *Volatile Worlds, Vulnerable Bodies*.

#### **Simon Naylor**

Dr Simon Naylor is a Senior Lecturer in Historical Geography at the University of Exeter, Cornwall. Simon's research interests focus on the historical geographies of science. Simon has also been involved in a three year Leverhulme Trust-funded project that investigated the history of post-war Antarctic geophysics.

#### **Klaus Dodds**

Klaus Dodds is Professor of Geopolitics at Royal Holloway, University of London. He is the author of five books including *Pink Ice: Britain and the South Atlantic Empire* (2002). His research interests include the geopolitics of the Antarctic and the South Atlantic.

#### **Anne Brodie**

In 2006/07 Anne was awarded the British Antarctic Survey / Arts Council Artists and Writers fellowship to Antarctica where she lived and worked for nearly three months. Her most recent work was an installation at the V&A museum in London, based on her Antarctic experience.

#### **Dinah Malloy Thompson, Bernard Stonehouse, Caroline Gunn**

Part of a research group at Scott Polar Research Institute, University of Cambridge, Thompson, Stonehouse and Gunn investigate a range of issues in both the environmental sciences and social sciences of relevance to the Arctic and Antarctica.

#### **Weather Permitting (Gabrys/Yusoff)**

Weather Permitting investigates the phenomena of weather and climate change. Conducted by Jennifer Gabrys and Kathryn Yusoff, Weather Permitting considers the energies and excesses of modern-day climates gone awry. Weather Permitting is currently working on a book-length project, *Zero Degrees*, which investigates the intersection of arts and sciences in relation to climate change.

#### **Jane D. Marsching**

Digital media artist, Jane D. Marsching's current project, Arctic Listening Post, explores our past, present and future human impact on the Arctic environment through interdisciplinary and collaborative practices. Her website is [www.janemarsching.com](http://www.janemarsching.com)

#### **Chris Caseldine**

Chris Caseldine is Professor of Quaternary Environmental Change at Exeter University, Cornwall. Chris's main interests are in the field of Late Quaternary environmental change, particularly in sub-arctic / sub-alpine environments in Iceland and Norway. He is Editor of the *Journal of Quaternary Science*.

#### **Snaebjörnsdóttir / Wilson**

Bryndis Snaebjörnsdóttir and Mark Wilson's work is characteristically rooted in the north, and explores issues of history, culture and the environment in relation to the individual and his/her sense of belonging or detachment. They are authors of the exhibition and book *Nanoq: Flat out and Bluesome*, a survey of British taxidermic polar bears, begun in 2001.

#### **Stephan Harrison**

Dr Stephan Harrison is Associate Professor in Quaternary Science at Exeter University and Senior Research Associate at the Oxford University Centre for the Environment. He has over 20 years research experience in climate change and mountain geomorphology.

#### **Chris Turney**

Professor Chris Turney's main interests are in the timing and magnitude of past climate change and their impact on populations around the world. He is author of *Bones, Rocks and Stars: The Science of When Things Happened* (2006) and *Ice, Mud & Blood: Lessons from Climates Past* (2008).

#### **Marko Peljhan**

Marko Peljhan is the founder of the art/science/tactical media organisation Projekt Atol and professor of interdisciplinary studies at the University of California Santa Barbara. In the framework of the Interpolart Transnational Art Science Constellation he is coordinating the projects for the Polar research mobile habitats.

#### **Rita Cachao + Ines Nisa Rato**

Inês Nisa Rato, is biologist and designer. Rita Cachão is currently undertaking a MA in Design, by the University of Wales. Cachao and Rato are collaborators on Ectopia, an art-science experimental laboratory at the Gulbenkian Science Institute at Lisbon. Both are authors, curators and designers of *Nullius\_ Antarctic Landscape* exhibition.

#### **Rachel Weiss**

Rachel Weiss is a curator and writer whose recent projects include *Global Conceptualism: Points of Origin 1950s-1980s* and *To Build the Sky: To and From Utopia in the New Cuban Art*. She is a Visiting Curator at Queens Museum of Art, NY and at Biblioteca Luis Angel Arango, Colombia and is a Professor at the School of the Art Institute of Chicago.

#### **London Fieldworks (Gilchrist/Joelson)**

London Fieldworks' art projects typically engage with technology and the methodologies of science in order to probe the tensions between data and narrative. Their projects are concerned with the mediation of experience and the exploration of ecology as a complex inter-working of social, natural, and technological worlds.

**Jean De Pomereu**

Jean de Pomereu is a photographer who's work has focused on the Antarctic since 2002. He has traveled to Antarctica on numerous occasions and his images have been exhibited in galleries in Paris, Brussels, Madrid, and Christchurch, N.Z. Jean also works for the International Polar Foundation (IPF) and writes for the IPF's scientific information website [www.sciencepoles.org](http://www.sciencepoles.org).

**Simon Faithfull**

In 2004, Faithfull was invited to travel to Antarctica with the British Antarctic Survey as part of The Arts Council's International Fellowships Programme. He emailed back 56 drawings to 3000 in-boxes around the world. An exhibition of video works from his journey was presented by The Arts Catalyst, simultaneously at Stills Gallery (Edinburgh), Cell (London) and Parker's Box (New York) in 2006. Artists' website: [www.simonfaithfull.org](http://www.simonfaithfull.org)

**Matthew Kurtz**

Dr Matthew Kurtz was a postdoctoral research fellow in the Geography Department at Open University. His research is about neocolonialism's cultures and the early history of economic analysis in America's insular territories in the twentieth century. Most of Matthew's fieldwork over the last eight years has been in arctic Alaska.

**Michael Bravo**

Dr. Michael Bravo is Head of the Circumpolar History and Public Policy Research Group at the Scott Polar Research Institute, University of Cambridge. He has 25 years of experience working in the Arctic. Michael is currently writing about public spaces of knowledge and governance in the Arctic.

**Emilie Cameron**

Emilie Cameron is a Ph.D. Candidate in Cultural-Historical Geography at Queen's University, Kingston. She is interested in the geography of stories relating to the Canadian Arctic and in histories of encounter, emotion, and science.

**Sverker Sorlin**

Sverker Sorlin is professor in the Division of History of Science and Technology at the Royal Institute of Technology, Stockholm. He currently serves as the President of the Swedish National Committee for the IPY. His ongoing research focuses on the scientific discourses on, and disputes over, climate change in the Arctic and how knowledge claims relate to fieldwork and notions of precision and authority in the field.

**Bradon Smith + Benjamin Morris**

Bradon Smith and Benjamin Morris are both Ph.D. candidates at University of Cambridge. They have curated the recent CRASSH seminar series in, Cultures of Climate Change.

**Adrian S. Edwards**

Adrian S. Edwards is Head of Collection Coordination and Interpretation, British and Early Printed Collections, The British Library.

**Aqqaluk Lyngø**

Aqqaluk Lyngø is the current President of the Inuit Circumpolar Council (Greenland). He is a former member of the Parliament of Greenland and one of the founders of the Greenlandic political party Inuit Ataqatigiit. An indigenous Kalaallit, Lyngø is a member of the United Nations Permanent Forum on Indigenous Issues, which is an advisory body to the U.N.'s Economic and Social Council. The Forum examines indigenous issues such as economic and social development, culture, the environment, education, health and human rights.

**Editors Acknowledgements**

Many people have contributed both to this publication and the events that led to this collection. It is with great sadness that I acknowledge the contribution of the late Denis Cosgrove. His generosity in participating with this project and many other collaborative engagements across the humanities is remembered here.

I would like to thank the Open University for providing financial support for the Symposium and public talks at the British Library, and Arts Council England for supporting the publication of this archive. Also, thanks to the University of Exeter for providing that scarce resource, time, to work on this publication. Finally, many thanks to my collaborators, Katrina Dean at the British Library, Nicola Triscott and Gillean Dickie at The Arts Catalyst, Paul Khera and all the contributors to this book and the audiences at the British Library events. Finally, a personal debt of gratitude is owed to Jennifer Gabrys, Joanna Rae at the British Antarctic Survey, Pauline Jackson, and Todd Hinkley at U.S. National Ice Core Laboratory. Finally, "To the Ice".

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