· Article ·
doi: 10.13679/j.advps.2016.3.00139

Advances in Polar Science
September 2016 Vol. 27 No. 3: 139-145

China's climate policy: does an Arctic dimension exist?

Gørild Heggelund* & Cheng Han

The Fridtjof Nansen Institute (FNI), Fridtj of Nansensvei 17, Lysaker 1326, Norway

Received 10 February 2016; accepted 30 July 2016

Abstract The article discusses whether and to what extent an Arctic dimension in Chinese climate policy exists, and whether there are signs of potential linkages between China's engagement in the Arctic and its domestic climate policies. Although the Arctic is not directly addressed in domestic climate policy, the article concludes that an Arctic dimension exists, in the following areas: the growing awareness in China of energy-related greenhouse gas emissions, climate risk, resilience and vulnerability, which has contributed to increased attention to climatic change in the Arctic and its impact on China; polar scientific research, which is largely climate related, plays a significant role in determining China's Arctic climate agenda; China's climate policymaking and domestic institutional set-up is a contributing factor to climate engagement in the Arctic; China's status as an observer nation in the Arctic Council might potentially raise the profile of domestic climate policies and lead to the addition of an Arctic pillar to national climate change strategies.

Keywords **China, domestic climate policy, GHG emissions, climate risk and resilience, Arctic, climate policy, Arctic Council**

Citation: Heggelund G, Han C. China's climate policy: does an Arctic dimension exist? Adv Polar Sci, 2016, 27: 139-145, doi: 10.13679/j.advps.2016.3.00139

1 The Arctic in China's climate policy

1.1 Introduction

China's climate policy and efforts are of global relevance given that it is the world's largest greenhouse gas (GHG) emitter. Furthermore, the Arctic is regarded as an important source of knowledge for future climate development. In recent years, China has shown growing interest in the Arctic region and a number of studies and reports have discussed whether China has geopolitical intentions in the Arctic linked to global security, shipping routes and resource interests[1-6]. However, these studies have not looked into a possible climate policy aspect in China's engagement in the Arctic. This study aims to fill this knowledge gap.

The overarching question is whether and to what extent an Arctic dimension in Chinese climate policy exists, and whether there are signs of potential linkages between China's engagement in the Arctic and its domestic climate policies. To this end, this article analyses China's climate change policy developments, and institutions involved in Arctic policymaking and research. Equally important, this paper explores the possible implications of climatic change in the Arctic for Chinese domestic climate policy by examining the evidence of climate-related engagement in the region.Trends related to rapidly evolving policy contexts, such as progress in China's scientific research in the Arctic, are evaluated. Based on climate science and policy prospects in relation to the Arctic, the paper discusses the signs of possible linkages and their potential implications.

China has a long history of engagement in the Arctic and considers itself a near-Arctic country[7]. China's presence in the Arctic comprises the first Chinese Arctic research station, Chinese Arctic Yellow River Station on the Svalbard Archipelago, which is under Norwegian sovereignty[5]. A milestone in China's Arctic history came in 2013 when the country obtained observer status in the Arctic Council; in addition Japan, South Korea, India, Singapore and Italy were granted observer status at the Ministerial meeting in Kiruna, Sweden in 2013[4,8]. That same year, the China-Nordic Arctic Research Center was established in Shanghai to strengthen research collaboration between China and Nordic research institutions on Arctic matters[9]. In addition to engaging with smaller Nordic states (e.g., Norway, Denmark, and Iceland), China also collaborates with bigger Arctic states (U.S., Russia, and Canada)[4].

* Corresponding author, E-mail: Goerild.heggelund@fni.no

1.2 Rationale for China's engagement

China is regarded as a 'near-Arctic' country situated in the peripheral region near yet outside the Arctic region[7]. Scientific literature discusses the Arctic region as having great influence on China's climate, environment, agricultural production, as well as economic and social development. Research shows that Arctic warming is linked with extreme weather events in China[7], as well as precipitation patterns and temperature rise[10]. For instance, the sea ice melt in the Arctic sends cold streams towards South China and causes the summer monsoon to move north[11]; the 2016 January low sea ice extent allowed cold air outbreaks in many regions of the world, including Asia and the Pacific[12]. Additionally, simulated ice thickness data were used to investigate the relationship between Arctic sea ice distribution and the climate of China. The results imply that Arctic sea ice thickness is closely related to various rainfall patterns in different areas of the country[13]. It is thus necessary for China to keep close watch on global warming impacts in the Arctic, and incorporate its interest into the country's climate science and policy efforts.

The Arctic is very sensitive to global climate change. Natural variations in the Arctic will result in climate instability in the world, especially in the climate system of the northern hemisphere. Atmospheric changes in the Arctic therefore have a direct impact on China's weather and climate, ecological environment, and agriculture[10,13]. Moreover, melting in Greenland has accelerated global sea-level rise, which will severely threaten the socio-economic development of China's east coast[14]. Consequently, many aspects of Arctic climate affairs are of China's core policy concern.

Climate science: Climate change in the Arctic has global implications. As part of the northern hemisphere, China is also heavily affected by shifting climate conditions in the Arctic, with concerns,including its national ecosystem, agriculture, and coastal security[10,13].

Natural resources: The Arctic is rich in energy, mineral and fishery resources that are of economic interest to China, and climate change has generated natural conditions conducive to prospective resource exploration in the region.

Despite China's gradually slowing annual economic growth rate under the 'new normal', estimated at approximately 6.5% (13th Five-Year Plan, FYP) according to estimates[15], the demand for energy, resources and animal protein has encouraged investment in research, economic and political capital toward involvement in future Arctic affairs.

Shipping routes: The acceleration of ice melting in the Arctic has opened up new shipping routes for commercial use that could have a significant impact on China's global trade patterns. Among other potential targets and gains, developing the new shipping routes is one of China's most achievable and viable pursuits in the Arctic.

2 Policies and institutions

2.1 China's climate policy agenda and governance

Climate policy in China has evolved in recent decades from largely focusing on mitigation and energy-related issues to a growing awareness of resilience, adaptation and vulnerability to climatic change. China's mitigation challenges come as a result of heavy reliance on coal, which has led to excessive GHG emissions. In recognition of the need for mitigation efforts, climate change was introduced as a topic in the 10th FYP in 2001 (2001–2005) when energy targets were introduced. In 2007, China was ranked as the world's largest overall emitter of GHG, although its per capita emissions were lower than the global average[16]. The period 2000–2013 was an energy-intensive growth period when China's coal consumption nearly tripled[17]. Attempts to control emissions became a priority in the 11th and 12th FYPs. Coal constituted 66 % of China's overall annual energy consumption in 2015. Approximately 90 % of China's carbon emissions are attributed to the consumption of fossil fuels, 68 % of which comes from coal combustion alone[18-19].

Adaptation and resilience to reduce climate risk increased in importance in climate policy, particularly since 2007 in the National Programme for Addressing Climate Change of China. China has experienced considerable warming with a mean temperature rise of about 1.4 degrees Celsius for the whole year between 1951 and 2009[20]. In particular, the Tibetan Plateau, part of the so-called Third Pole in the Himalayas, has seen rising temperatures (ICIMOD)[21]. The period 2005–2014 was marked by extensive retreating of glaciers in the Tibetan Plateau. China launched the National Adaptation Strategy in November 2013, which demonstrates a more strategic approach to managing climate risk, and advancing the priority work areas outlined in the 2007 National Programme[16]. A follow-up to the strategy is the recently issued Action Plan for Climate Change Adaptation in Cities (National Development and Reform Commission (NDRC) 2016)[22]. China's Third National Assessment Report published in 2015 illustrated the severity of the climate impact for China (The Third Assessment 2015)[23]. The report compiles the latest science and policy options from state-appointed experts[23-24] and highlights China's vulnerability to climate change, exemplified by rising sea levels, as well as shifting rainfall and snow patterns. Recent reports state that the biggest emitters are also among the most threatened, with China's coastal cities being among the most vulnerable in terms of socio-economic developments and assets[25].China now views climatic change as a serious threat to the nation's socio-economic development, and has incorporated the issue into the country's development policy[16].

On the climate governance side, the need for deeper understanding among policymakers for climate change saw the establishment of China's National Coordination Committee on Climate Changein 2007 during the 11th FYP (2006–2010), led by the Chinese Premier[16]. This demonstrated the importance of climate issues at the highest levels of the Chinese government. Several of the stakeholders involved in Arctic climate research are members of the leading group such as the State Oceanic Administration (SOA), the Chinese Academy of Sciences (CAS) and the

China Meteorological Administration (CMA)[26].

China's international engagement through the United Nations Framework Convention on Climate Change (UNFCCC), along with multilateral and bilateral collaboration, has been important for domestic climate policymaking[27-29].Recent policy developments are found in its Intended National Determined Contribution, which was submitted to the UNFCCC in 2015 before 2015 United Nations Climate Change Conference (COP21) in Paris (NDRC 2015)[30]. Of topmost priority was China's pledge to curb its CO_2 emission growth by 2030 or earlier. The INDC goals are to lower CO_2 emissions per unit of Gross Domestic Product (GDP) by 60%–65% from the 2005 level; to increase share of non-fossil energy up to 20 percent by 2030; to increase its forest stock volume by around 4.5 billion cubic meters from the 2005 level; and to control coal consumption by setting a cap on coal use. Less attention was paid to other objectives that have direct relevance for the research question of this article: enhancing risk and resilience work, including strengthening assessment and risk management of climate change, and improving national monitoring, early warning and communication systems on climate change (NDRC 2015)[30]. Additionally, it is important to strengthen research on the mechanisms and assessment methodology of climate change impacts and risks. China approved the Paris Agreement, which further cements commitments to emissions reductions and resilience building (UNFCCC 2015)[31]. The 13th FYP, approved in March 2016 at the annual session of the National People's Congress (NPC), further consolidates efforts to work on adaptation and mitigation in parallel. Following the endorsement of the final draft of 13th FYP by the NPC, provincial, local and district governments, as well as ministries, government agencies and industry regulators are then expected to draft their five-year and thematic plans, within the guiding principles detailed in the national five-year plan, and implement the plan over the subsequent years. It is anticipated that the national-thematic sub-plans will be released in the first year of the 13th FYP, and the follow-on implementation documents will be released in the coming months and year[32].

2.2 The Arctic in national policies

China's strategic and trade interests are perceived to be main drivers for its diplomacy in the Arctic[4,26]; however, China is eager to maintain a low profile in the Arctic region and around its Arctic interests[33]. As of 2016, China has not issued a national policy regarding the Arctic region, although Ministry of Foreign Affairs (MoFA) may be developing an Arctic Strategy/Policy according to stakeholders (in 2016). China's Assistant Minister of Foreign Affairs, Hu Zhengyue, stated in 2009 that "China does not have an Arctic strategy"[34], and no significant policies have been announced since then. In later years, MoFA and SOA officials have made statements on China's Arctic-related interests and activities, such as China's Special Representative for Climate Change Negotiations Gao Feng from MoFA[35]. Gao highlighted the need to understand natural science, political environment and the legal environment as China lags behind other countries. Gao also emphasized the need to protect the Arctic environment and climate system that influences China's domestic climate, as well as protecting the Arctic[33,36].

China becoming an observer nation in the Arctic Council highlights its interest in the region. Attention to the Arctic has largely been reflected in China's national plans for scientific expeditions as well as science and technology development plans, albeit only in general terms. For example, in the 12th FYP, the Arctic is mentioned mainly in two documents. First, in the National Oceanic Development section of the 12th FYP (2011–2015), there is a chapter titled "Deepening Polar Scientific Expedition" in which the Arctic is mentioned:

Implementing comprehensive studies of the Antarctic continent and its surrounding waters, as well as the Arctic marine environment and Deepening the polar scientific investigation and research, focusing on scientific research on glaciers, oceans, atmosphere, geology and geophysics, astronomy and other basic areas.

Second, the 12th FYP on Science and Technology focuses on "*Strengthening ecological, resource and environmental scientific investigation of the three poles* (*Antarctica, the Arctic, the Tibetan Plateau*)".

China's involvement in the Arctic has mainly been linked to scientific research[4,7]. China's climate-related policies in the Arctic have been fairly consistent over the past few decades, focusing on scientific expeditions and basic scientific climate research. The government has been investing its resources mainly in understanding the biological and climatic conditions of the region, as well as building the country's scientific capacity in climate research in the region.

One recent change noted in the policy chapter in the National Oceanic Development 12th FYP, however, is the government's evident interest in Arctic shipping routes and in collaborating internationally for potential development. This trend shows that the Chinese government has started to link its long-time climate research in the Arctic with its global policy development and international economic engagement. Climate change impacts in the Arctic are likely to draw increasing policy attention from the Chinese government.

The 13th FYP, which puts equal emphasis on the need to address adaptation and mitigation, is a general document that does not explicitly refer to the Arctic. The specific FYPs for various sectors/themes are being developed and introduced in the coming year[32]. Nevertheless, China's objectives for climate-resilient, green, low-carbon development paths to tackle climate change challenges are coherent, referring to both its domestic and international actions. These aspects are relevant for the Arctic, and it is likely that these will be hammered out in specific FYPs as discussed above.

3 China's climate research in the Arctic

3.1 Institutional structure and stakeholders

A number of stakeholders influence policymaking processes

in China, and it is useful to understand whether they contribute to an Arctic dimension in China's climate policy. Multiple government, research and business bodies are involved in the policy development process relating to Arctic issues. The policy formation process of China's Arctic policy is largely dominated by input from experts and scholars engaged in polar science. Any analysis focusing on China's Arctic policy should start from understanding its polar research.

The main managing institution for Arctic affairs is the SOA. It proposes policies and plans, and oversees overall Arctic activities. The subordinate Chinese Arctic and Antarctic Administration founded in 1981 (formerly named the Office of the National Antarctic Expedition Committee) is responsible for the implementation of planned activities, organizing expeditions, and engaging with international treaties and conventions. The official Chinese research programme of the Arctic was formally established in 1989 when the Polar Research Institute of China (PRIC) was founded as a research arm for the Chinese Arctic and Antarctic Administration (CAA)[37].

The Chinese Advisory Committee for Polar Research was set up in 1994 by the Ministry of Science and Technology and now has 16 member institutions, including MoFA, the National Development and Reform Commission, the Ministry of Education, the Ministry of Industry and Information Technology, the Ministry of Finance, and the Ministry of Land and Resources. The Advisory Committee is led by the SOA[38]. The Advisory Committee monitors, consults, and evaluates scientific expeditions and research. There is broad participation of institutions engaged in Arctic matters, ranging from economic development, science, climate change and meteorology to foreign policy issues. Interestingly, a number of these stakeholders are also members of China's National Coordination Committee on Climate Change.

China's primary Arctic-focused research institutions are: PRIC in Shanghai, with a staff of 142 people, which is in charge of polar expeditions on R/V *XUE LONG* icebreaker and conducts comprehensive studies of polar regions; the China Institute for Marine Affairs, the research department of the SOA in Beijing, which mainly does research on international maritime law and China's ocean development strategy; and the Institute of Oceanology, a multidisciplinary marine science research and development institute under the Chinese Academy of Sciences[39].

The SOA, the main government agency in charge of China's Arctic activities, sits on China's National Coordination Committee on Climate Change, and in this capacity takes part in China's design and implementation of climate change policies. China's National Climate Change Programme launched in June 2007 identified marine and coastal zones as one of its four adaptation focus areas, from which the SOA was given the mandate of incorporating climate change into its oceanic planning and management[40]. The SOA immediately followed the national directive with its own work plans to address climate change issues in oceanic zones. In 2014, the Chinese government released its National Plan on Climate Change for 2014–2020 (NDRC 2014)[41], which specifically discussed work relating to oceanic areas. These include prevention and reduction of natural disasters, capacity building of monitoring and forecasting, and treatment and restoration of sea islands[42]. Although the Arctic is not mentioned in any of these key documents and action plans, the SOA appears to be strongly involved in climate change policymaking and implementation. This indicates a possibility that an Arctic dimension can be included in China's national climate agenda via the SOA.

3.2 China's Arctic research and expeditions

China's Arctic research activities largely focus on environmental issues, such as the impacts of melting polar ice on China's continental and oceanic environment, and implications for the country's agricultural and economic development[34]. Specifically, China's research in the Arctic has centred on aerial physics, climate change, ecology, and marine aspects[7]. China formally joined the International Arctic Science Committee in 1996 and established the research station Yellow River Station in 2004 in Svalbard[7]. Since its first official scientific expedition to the Arctic in 1999, China has successfully completed five expeditions to the region for multidisciplinary research on the polar environment, as well as systematic observation of the sea ice, ocean and atmosphere[43]. These expeditions have allowed exploration of the relationship between the rapid changes in the Arctic oceanic environment and climate change in China, revealing the role of the Arctic in global climate and environmental systems, and improving China's understanding and capability to respond to climate change.

Although there is no Chinese institution devoted specifically to research on Arctic politics, there are individual researchers who have published articles and book chapters that focus on Arctic strategies and geopolitics[19,44]. As a major step to enhance China's understanding of the political, legal and military dimensions of the Arctic, in September 2007, the SOA launched a research project entitled "Arctic Issues Research", which involved scholars and officials from around China and focused on 10 research topics, including climate-related topics[40].

The sixth, and most recent, expedition carried out in 2014 was the first expedition since China joined the Arctic Council as an observer. The expedition focused closely on the rapid changes taking place in the Arctic and their impact on China's climate[45]. The scientific findings provide basic information and support for further research on global climate change, Arctic waterways and polar ocean databases.

The Chinese government released the 12th FYP for Polar Expeditions, which also announced the State Council's special project of comprehensive investigation and evaluation of the Antarctic and Arctic environment, the largest study in China's three-decade history of polar studies[46]. The focus was environmental and climate research, including three Arctic expeditions from 2011 to 2015, and the purpose was

to study major areas in the Arctic Ocean as well as impact of climate change in the Arctic on China and the rest of the world. More importantly, this special project was expected to lead to a strategic assessment of China's national interest in polar regions[47]. The participating institutions in China's Arctic expeditions are mostly direct affiliates of the SOA and national research bodies, such as the CAS, CMA, or various ministries (of Education and Land and Resources).

China's climate research in the Arctic is transitioning from the previous stage of ad-hoc observation and data collection to formalized systematic knowledge production to provide better understanding of domestic climatic changes. It also indicates the transition in the function of China's Arctic expedition teams, from purely scientific research to a mixture of research, development and policy formation.

4 China's climate change policy and the Arctic

Through expeditions and research, China has gradually improved its understanding of the Arctic climate through initiatives such as the State Council's special project mentioned in the previous section. Over the years, China has established a preliminary observation system of Arctic atmospheric physics, climate, ecology and ocean, supported by a growing team of experts. Reports also illustrate the numerous activities being carried out by Chinese institutions, such as the annual reports issued by the Chinese Antarctic and Arctic Administration[48]. There is a long tradition in Chinese climate policymaking of including advice from scientists and scholars,including the climate expert group[49]. As argued in earlier sections, much of China's science activities in the Arctic have enhanced awareness, understanding and significance of the climate change agenda more comprehensively.This was done through contributions into government-led research projects, policy discussions and reports, even if there is no concrete evidence showing direct input from such scientific findings from the Arctic into China's domestic climate policy. Yet, we do see a connection between climate science and climate policymaking through China's domestic institutional climate arrangement. The members of China's National Coordination Committee on Climate Change are line ministries of the State Council, coordinated by NDRC. The formation of China's Arctic climate science research is largely dominated by government-affiliated research bodies, experts and scholars engaged in polar science research over a number of years. Research findings and recommendations are provided to decision-makers and officials through established communication channels. These are central to the formation of the climate change agenda in the Arctic and to future Arctic strategy. MoFA is responsible for coordinating the work and inputs for such a strategy. It is also one of the key ministries involved in climate change negotiations. The SOA also plays a role and has incorporated climate change into its oceanic planning and management. The SOA has several institutes under its authority that are involved in polar research, and is a major contributor to the growing capacity in climate science.

Furthermore, a growing number of Chinese experts contribute to global research on climate change, e.g., through the IPCC processes[50-51]. It is therefore very likely that Chinese experts will also be able to contribute to research through the Arctic Council's working groups.The IPPC for instance adopted the global climate model of the National Climate Center under the CMA[50]. Likewise, Chinese experts will possibly 'bring home' relevant expertise for Chinese climate efforts from working group research. Black carbon is a research topic for the Arctic Council that is also an issue in China[52-53]. A framework for "Enhanced Black Carbon and Methane Emissions Reductions" was agreed upon at the Arctic Council Ministerial in Iqaluit in April 2015, in which "each Arctic Council Observer States were invited to join the actions described in the framework including sharing a national report"[54]. To date, only one developing country, India, has submitted a national report[54]. However, a parallel taskforce on short-lived climate pollutants, including black carbon, was undertaken in 2015 by the China Council for International Cooperation on Environment and Development (CCICED), a high-level policy advisory body[53]. It refers to the Arctic Council efforts and framework on this issue, as part of a broader discussion of relevant international policy actions. China's involvement in Arctic affairs thus appears to play a role in raising the profile of some domestic climate policies. An extensive assessment regarding China's role in the Arctic Council may be premature at this time. The Arctic Council is the region's key intergovernmental forum. The Arctic Council has an opportunity to leverage China's interest in the Arctic and to encourage China to add an Arctic pillar in its national climate change strategies. There is a vast underexplored space for Arctic countries to explore and build a climate dialogue and partnership with China and other non-Arctic observer countries.

5 Concluding remarks

Initially, we asked whether there is an Arctic dimension in China's climate policies. This paper has therefore explored a number of signs, based on publicly available evidence, where recent development and future prospects of China's Arctic-climate nexus may be put in perspective. We have found that an Arctic dimension exists in domestic climate policy, although the link is not direct. However, there are points of convergence between Arctic climate and China's domestic climate policymaking summarized in the following points.

Climate change continues to climb up the political agenda in China. On a global level, China has showed growing ambition, leadership and practices in climate change through international negotiations and collaboration. China's achievement of Arctic Council observer status in 2013 is a milestone in this regard. The Council's work is closely linked with China's key domestic policies and priorities on the environment and climate change. Domestically, China has recently approved the 13th FYP that further strengthens

policies to address climate change. China's vulnerability to climatic change and the subsequent social impacts and economic losses have brought to the fore the challenges of adaptation, climate risk and resilience that increasingly play a role in domestic climate policymaking as illustrated in the Third Assessment Report for China. The 13th FYP places equal emphasis on mitigation and adaptation. The need to better understand climatic impacts on China has made the Arctic an attractive area for scientific research. Moreover, the rapid climatic changes in the Arctic and their impact on China's climate are receiving mounting attention, and policymakers have become increasingly aware of the complexities and risks of climate change.

China's engagement in the Arctic thus far has been dominated by scientific climate and polar research; polar scientific research plays an important role in determining China's Arctic climate agenda. China's climate research in the Arctic is now transitioning into systematic knowledge production to provide better understanding of climatic changes at home. In addition to scientific research, we anticipate that social science research and geopolitical research will be further strengthened, for instance, through the work of the China-Nordic Arctic Research Center in Shanghai.

Acknowledgement This paper is a product from the research project AsiArctic, funded by the Norruss programme of the Research Council of Norway. Views expressed in this report do not necessarily reflect the views of our funders, nor should they be attributed to them. The authors would like to thank Arild Moe at the Fridtjof Nansen Institute for his support and valuable comments and guidance. We are grateful to Li Yan for assistance with input, material search and editing. Questions and comments on the paper are welcome in English or Chinese, to Goerild (goerild.heggelund@fni.no) and/or Han (chenghan528@gmail.com).

References

1 Chaturvedi S. Chapter 15: Arctic geopolitics then and now//Nuttall M, Callaghan T V. The arctic: environment, people, policy.Amsterdam: Harwood Academic Publishers, 2000: 441–458
2 Blunden M. Geopolitics and the northern sea route.Int Affairs, 2012, 88(1): 115–129
3 Lunde L. Potential for co-operation over Arctic. Financial Times. 2013. http://www.ft.com/intl/cms/s/0/d37c2824-6262-11e3-bba5-00144feabdc0.html#axzz418ze42Le
4 Peng J C, Wegge N. China's bilateral diplomacy in the Arctic. Polar Geogr, 2015, 38(3): 233–249
5 Stensdal I. Coming of age? Asian arctic research, 2004-2013. Polar Record, 2016, 52(2): 134–143
6 Su P, Lanteigne M. China's developing arctic policies: myths and misconceptions. JCIR, 2015, 3(1): 1–25
7 Zhang P, Yang J. Changes in the arctic and China's participation in arctic governance//Lunde L, Yang J, Stensdal I. Asian countries and the arctic future. Singapore: World Scientific Publishing, 2015: 292
8 Milne R. China wins observer status in Arctic Council. Finanical Times. 2013. http://www.ft.com/intl/cms/s/0/b665723c-bd3e-11e2-890a-00144feab7de.html#axzz418ze42Le
9 China-Nordic Research Center (CNARC). http://www.cnarc.info/
10 Wang X Z, Sun Z B, Hu B H, et al. Relationship between Arctic sea ice thickness distribution and climate of China. Acta Meteor Sin, 2012, 26(2): 189–204, doi: 10.1007/s13351-012-0205-1
11 Vihma T. Effects of arctic sea ice decline on weather and climate: a review. Surveys Geophys, 2014, 35(5): 1175–1214
12 Miller B. Amid higher global temperatures, sea ice at record lows at poles. 2016. http://edition.cnn.com/2016/11/18/world/sea-ice-arctic-antarctic-lows/
13 Wu B Y, Zhang R H, D'Arrigo R, et al. On the relationship between winter sea ice and summer atmospheric circulation over Eurasia. J Climate, 2013, 26(15): 5523–5536
14 Middlehurst C. Chinese cities most at risk from rising sea levels. 2016. https://www.chinadialogue.net/blog/8529-Chinese-cities-most-at-risk-from-rising-sea-levels/en
15 Mark M. China's economic growth in 2015 is slowest in 25 years. The Wall Street Journal. 2016. http://www.wsj.com/articles/china-economic-growth-slows-to-6-9-on-year-in-2015-1453169398
16 Heggelund G, Nadin R. Climate Change Policy and Governance// Sternfeld E. Routledge Handbook of environmental policy in China. Routledge, 2017
17 Green F, Stern N. China's changing economy: implications for its carbon dioxide emissions. Climate Policy, 2016: 1-15, doi: 10.1080/14693062.2016.1156515
18 Liu Z. China's carbon emissions report 2015. Sustainability Science Program and Energy Technology Innovation Policy Research Group, BelferCenter Discussion Paper #2015-02. Cambridge, MA: Harvard Kennedy School of Government. 2016. http://belfercenter.ksg.harvard.edu/files/carbon-emissions-report-2015-final.pdf
19 Chen G. China's emerging Arctic strategy. Polar J, 2012, 2(2):358–371
20 Nadin R, Opitz-Stapleton S, Xu Y L. Climate risk and resilience in China. Routledge: Taylor and Francis Group, 2016
21 ICIMOD. 2016. What is the third pole. http://www.icimod.org/?q=3487
22 NDRC (National Development and Reform Commission), MOHURD (Ministry of Housing and Urban-Rural Development). (2016-02-04[2016-07-31])Action Plan for Climate Change Adaptation in Cities FGQH [2016] No. 245.http://bgt.ndrc.gov.cn/zcfb/201602/t20160216_774739.html (in Chinese)
23 The Third National Climate Change Assessment Report Writing Committee. The third national assessment of climate change assessment report. Beijing: Science Press, 2015 (in Chinese)
24 Buckley C. Chinese report on climate change depicts somber scenarios. The New York Times. 2015. http://www.nytimes.com/2015/11/30/world/asia/chinese-report-on-climate-change-depicts-somber-scenarios.html
25 Doig A, Ware J. Act now or pay later: protecting a billion people in climate-threatened coastal cities, Christian Aid. 2016. http://www.christianaid.org.uk/Images/act-now-pay-later-climate-report-may-2016.pdf
26 Brief Introduction of national coordination committee on climate change. http://en.ccchina.gov.cn/list.aspx?clmId=104
27 Denyer S. China tries to recast itself as a global leader in climate-change fight. The Washington Post. 2015. https://www.washingtonpost.com/news/worldviews/wp/2015/11/02/china-tries-to-recast-itself-as-a-global-leader-in-climate-change-fight/
28 Goswami U, Bureau E T. Brazil, South Africa, India and China chalk out plan for climate negotiations. The Economics Times. 2014. http://articles.economictimes.indiatimes.com/2014-08-08/news/52594309_1_green-climate-fund-climate-change-major-economies-forum
29 Parlapiano A. Climate goals pledged by China and the U.S. The New York Times. 2014. http://www.nytimes.com/interactive/2014/11/12/

world/asia/climate-goals-pledged-by-us-and-china-2.html?_r=0
30 NDRC. China's intended nationally determined contributions enhanced actions on climate change. 2016. http://www4.unfccc.int/submissions/INDC/Published%20Documents/China/1/China's%20INDC%20-%20on%2030%20June%202015.pdf
31 UNFCCC. Adoption of the Paris agreement. Proposal of the President. 2015. http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf
32 Pin K F, Nadin R, Liu J. Mapping the drafting process of China's 13th five-year plan. 2016. https://www.linkedin.com/pulse/want-know-who-how-chinas-13th-five-year-plan-drafted-rebecca-nadin
33 Kopra S. China's arctic interests. Arctic Yearbook. 2013. http://www.arcticyearbook.com/images/Articles_2013/KOPRA_AY13_FINAL.pdf
34 Yao D Q. Join the Arctic Council, China's test has only just begun-exclusive interview with Foreign Ministry Special Representative for Climate Change Negotiations. China Economic Weekly. 2013. http://news.xinhuanet.com/fortune/2013-05/21/c_124740289.htm (in Chinese)
35 Jakobson L. China prepares for an ice-free arctic. Stockholm, Sweden: Stockholm International Peace Research Institute, 9. 2010. http://books.sipri.org/files/insight/SIPRIInsight1002.pdf
36 Wright D C. China dismisses accusation of its activities in Arctic.The Dragon Eyes the Top of the World. Washington, DC: U.S. Naval War College China Maritime Studies Institute, 28-32. Beijing Times. 2013. http://english.people.com.cn/90883/7719474.html
37 Alexeeva O, Lasserre F. China and the Arctic. Arctic Yearbook. 2012. https://www.researchgate.net/profile/Olga_Alexeeva/publication/259042084_China_and_the_Arctic/links/0c960529ce2575a172000000.pdf
38 Jakobson L, Peng J C. China's arctic aspirations. SIPRI Policy Paper 34. 2014 . https://www.sipri.org/sites/default/files/files/PP/SIPRIPP34.pdf
39 Zhao G. Research center for marine developments of China will launch 40 research topics this year. China Ocean Paper, 2009 (in Chinese)
40 Yang X. State Oceanic Administration has taken measures to strengthen the capacity to address climate change in the marine sector. 2008. http://www.gov.cn/gzdt/2008-04/29/content_957843.htm (in Chinese)
41 NDRC. National plan on climate change (2014-2020). 2015. http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/33978/35364/xgzc35370/Document/1514527/1514527.htm (in Chinese)
42 State Oceanic Administration (SOA). SOA Office issued Division of labour regarding work for National plan on climate change (2014-2020). 2015. http://www.soa.gov.cn/xw/hyyw_90/201505/t20150512_37312.html
43 Chinese Antarctic and Arctic Administration (CAA). China's Arctic Expeditions. 2015
44 Li Z F. Analysis of China's strategy on arctic route. China Soft Sci, 2009, (1): 1–7(in Chinese)
45 State Oceanic Administration (SOA). Tour to begin exploring the relationship between Arctic marine environment and climate change. 2014. http://www.soa.gov.cn/xw/dfdwdt/jsdw_157/201407/t20140715_33071.html (in Chinese)
46 China News. Polar environment comprehensive survey and special assessment have started. 2012. http://news.sina.com.cn/c/2012-02-24/201023989363.shtml (in Chinese)
47 State Oceanic Administration (SOA). The 12th Five-year development plan for China's polar expeditions. 2011. http://www.soa.gov.cn/zwgk/hygb/gjhyjgb/2011_2/201508/t20150827_39802.html (in Chinese)
48 Chinese Antarctic and Arctic Administration (CAA). 2015 national annual report on polar programme. Beijing: CAA. 2015. http://www.chinare.gov.cn/caa/userfiles/chinare2015en.pdf
49 Wübbeke J. China's climate change expert community-principles, mechanisms and influence. J Contemp China, 2013, 22(82): 717–731
50 IPPC. Working Group II, final draft assessment report V, Chapter 24. 2014. http://ipcc.ch/pdf/assessment-report/ar5/wg2/drafts/fd/WGIIAR5-Chap24_FGDall.pdf,
51 Poppick L. Black carbon soot greater in China, India Than Thought. Live Science. 2014. http://www.livescience.com/42872-black-carbon-exposure.html
52 CCICED. Coordinated actions for addressing climate change and air pollution-with a focus on short-lived climate pollutants and non-road mobile sources. A Report to the China Council for International Cooperation on Environment and Development (CCICED) Special Policy Study Program. 2015. http://www.cciced.net/encciced/policyresearch/report/201511/P020151117574524303949.pdf
53 National Report by India. Enhanced black carbon and methane emissions reductions-an arctic council framework for action. 2016. https://oaarchive.arctic-council.org/bitstream/handle/11374/1169/EDOCS-3137-v1-India_2016_Black_Carbon_Methane_National_Report.PDF?sequence=26&isAllowed=y
54 Arctic Council Observer States 2015 National reports on enhanced black carbon and methane emissions reductions. 2015. https://oaarchive.arctic-council.org/handle/11374/1169