Arctic Partnership Week 2016, Busan, Korea

Towards the Global Sustainable Development through the Arctic Science Partnership

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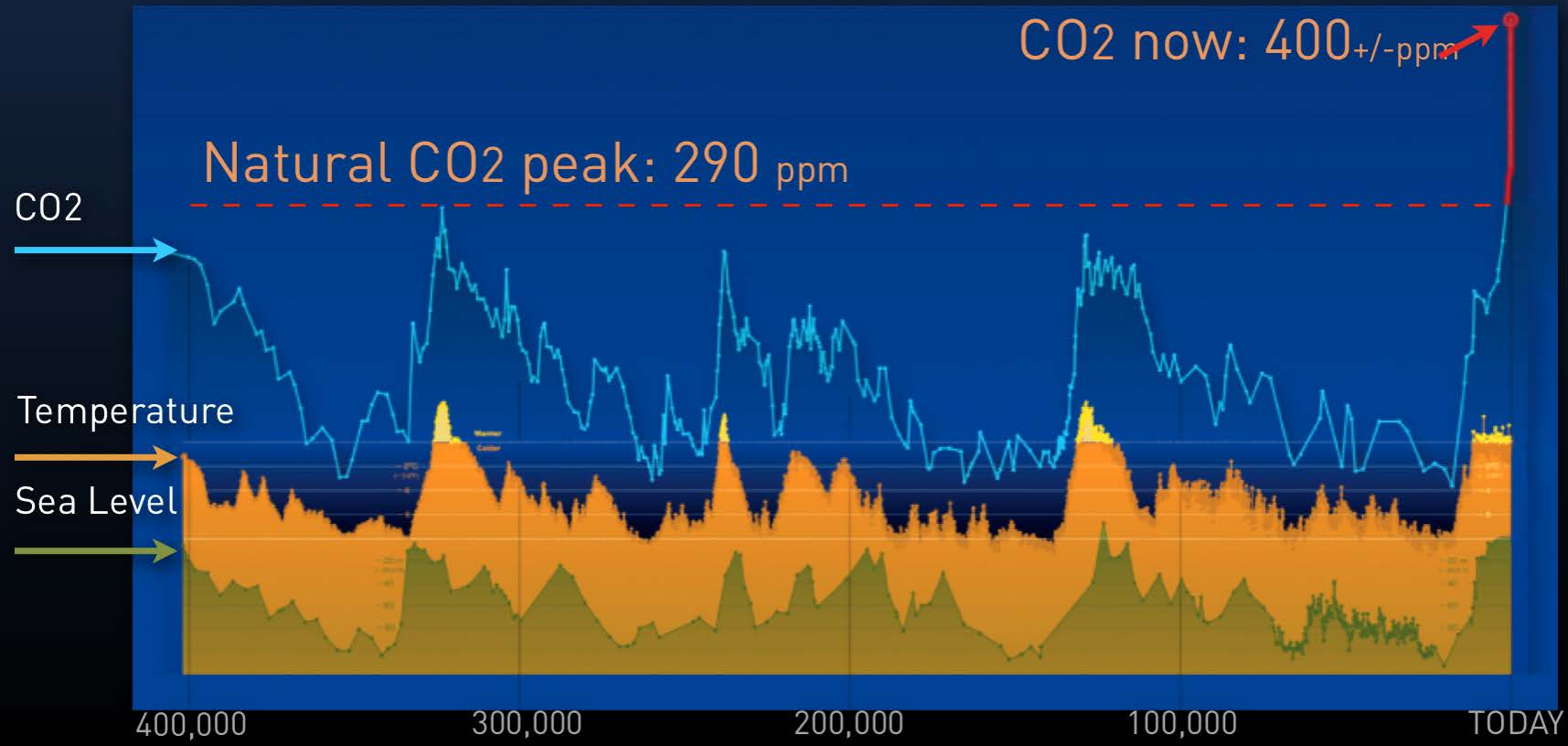


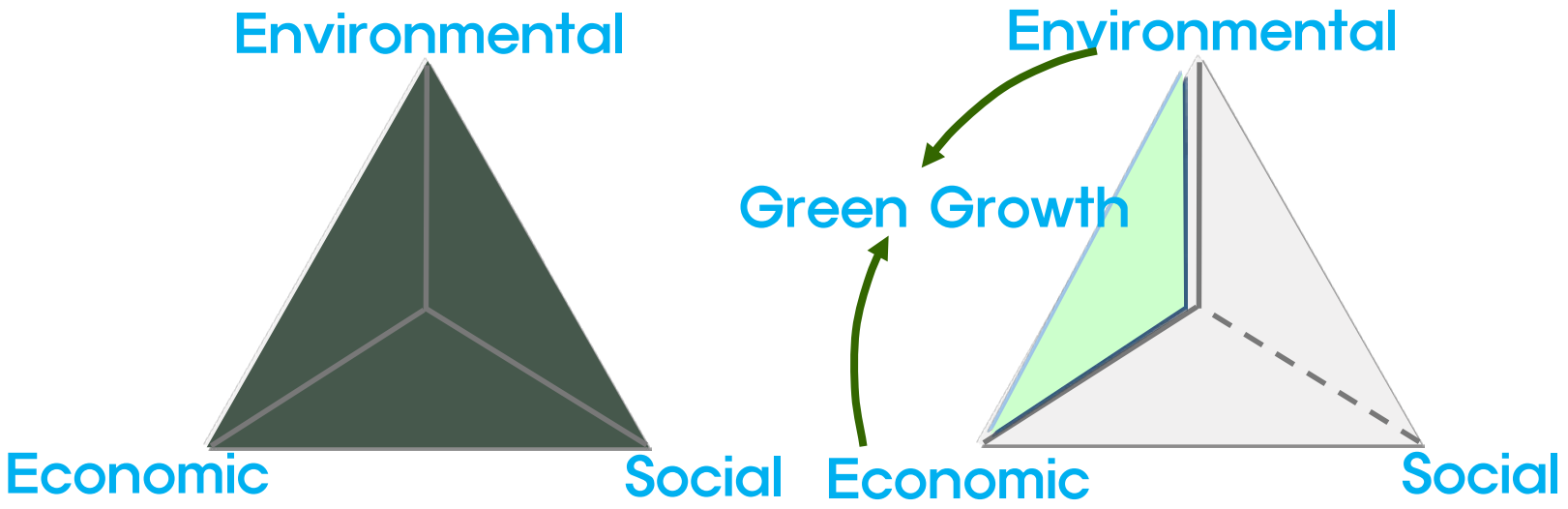
Sources:
National Geographic Society
U.S. Department of Energy
NASA Goddard Institute for Space Studies
Oak Ridge National Laboratory
Scripps Institution of Oceanography

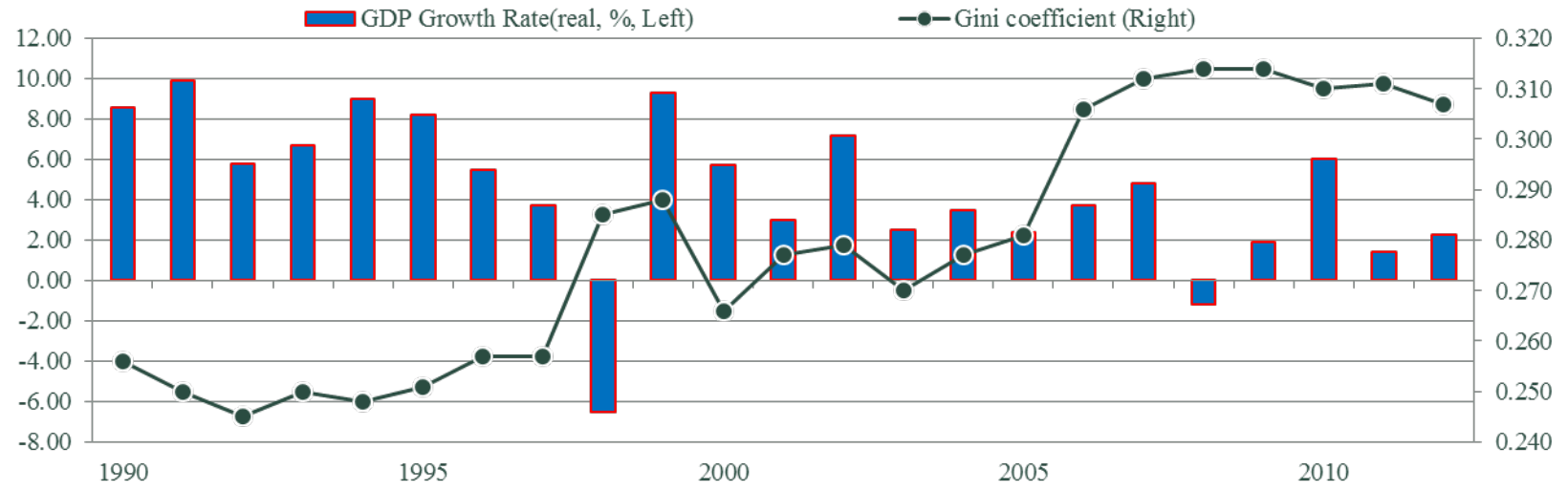
Why the Arctic Is So Hot?

country	Energy risk index	rank	country	Energy risk index	rank
Norway	774	1	Italy	1,043	13
Mexico	802	2	Turkey	1,087	14
Denmark	819	3	Japan	1,088	15
New Zealand	855	4	Netherland	1,106	16
UK	866	5	Russia	1,115	17
US	885	6	India	1,164	18
Canada	893	7	Indonesia	1,164	18
OECD	912		China	1,172	20
France	942	8	South Africa	1,175	21
Germany	944	9	Korea	1,306	22
Australia	962	10	Brazil	1,307	23
Poland	987	11	Thailand	1,616	24
Spain	1,037	12	Ukraine	2,009	25

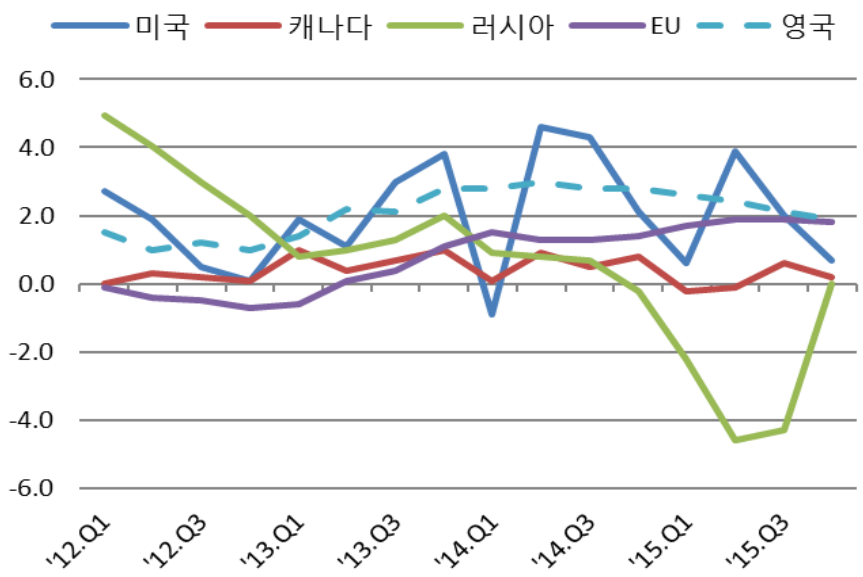
Source: US Chamber of Commerce(2015)

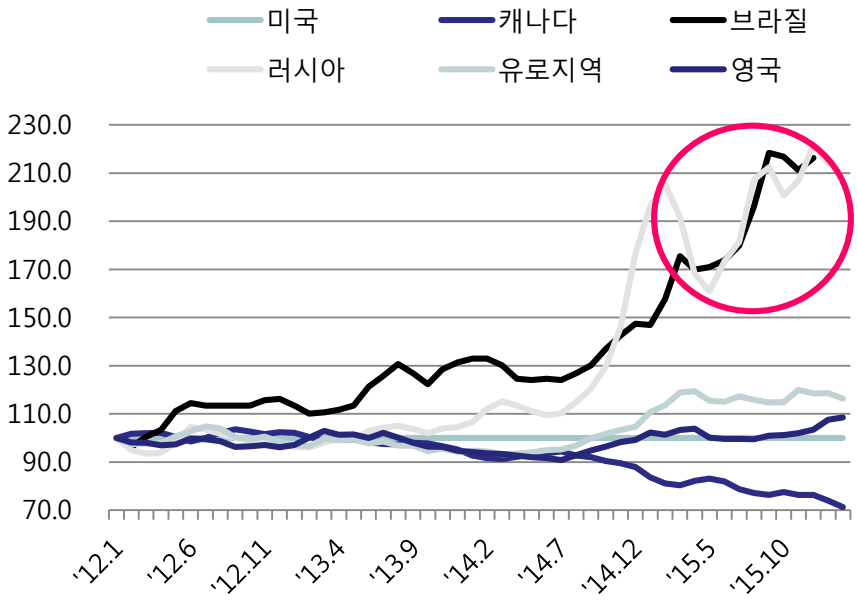
Rethinking New Nexus of Climate and Energy Security





Global Economy: Slower but Shaky





- Economy is still expanding, but growth is weak and uneven due to uncertainties and negative feedback loop
- Emerging-*market currencies* from *China* to Russia dropped against the U.S. dollar, reflecting renewed fears that an economic slowdown and weak oil price

HISTORY

Paris Agreement(2015)

K-ETS(2015)

Warsaw Outcomes
Durban Platform
(2011)

KCF
(2007)

Cancun Agreements

CCF(2006)

Bali Roadmap

KP into force
(2005)

EU-ETS(2005)

JCF(2004)

Marrakeshi Declare
(2001)

ECF(2003)

WB-PCF(1999)

KP(1997)

US SOX
trading(1995)

UNFCCC(1992)

regime

Justification and Standardization

market

Flexible Mechanisms

Evolving New Mechanisms: Non-Market Approaches

Article 6 of Paris Agreement

1. Parties recognize that some Parties choose to pursue voluntary cooperation in the implementation of their nationally determined contributions to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity

2. Parties shall, where engaging on a voluntary basis in cooperative approaches that involve the use of international transferred mitigation outcomes towards nationally determined contributions, promote sustainable development and ensure environmental integrity and transparency, including in governance,

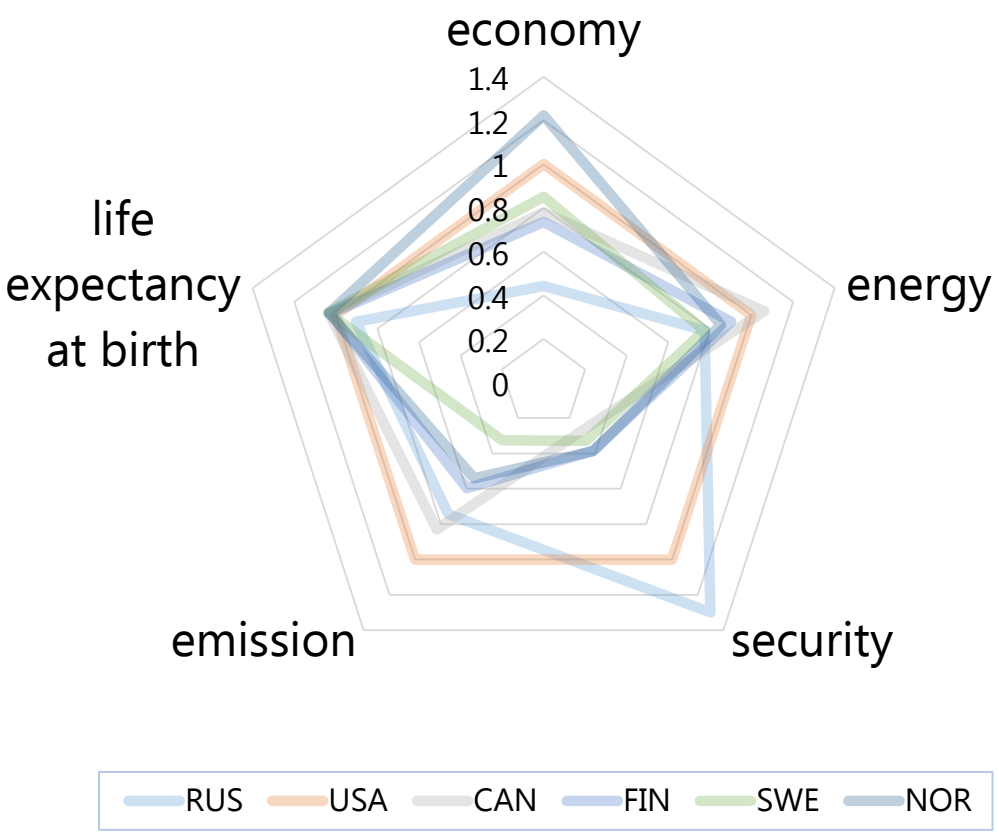
Article 6 of Paris Agreement

8. Parties recognize the importance of integrated, holistic and balanced non-market approaches being available to Parties to assist in the implementation of their nationally determined contributions, in the context of sustainable development and poverty eradication, in a coordinated and effective manner, including through, inter alia, mitigation, adaptation, finance, technology transfer and capacity-building, as appropriate. These approaches shall aim to:

(a) Promote mitigation and adaptation ambition

(b) Enhance public and private sector participation in the implementation of nationally determined contributions; and

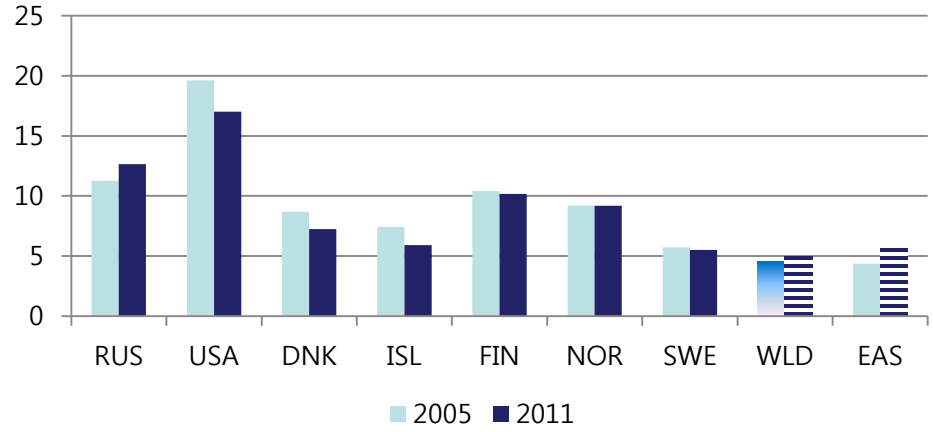
Sustainability Indices of Arctic Community (US=1.00)

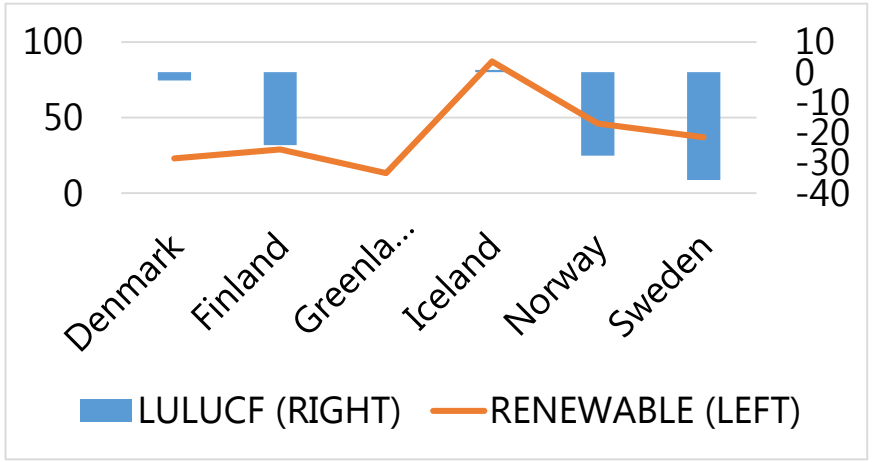


source: WDI (2015)

- Compared to US, Russia spends more on military expenditure and less on health care.
- Canada and Norway outperform US, in terms of mitigation policy and economic growth, respectively.
- However, depressed commodity prices may hurt economy in the Arctic region .

Low-Carbon Policy in the Arctic



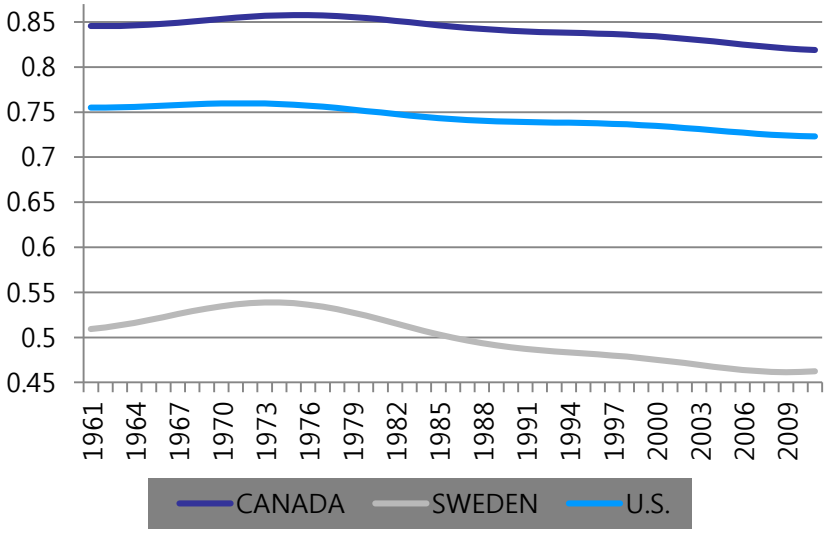


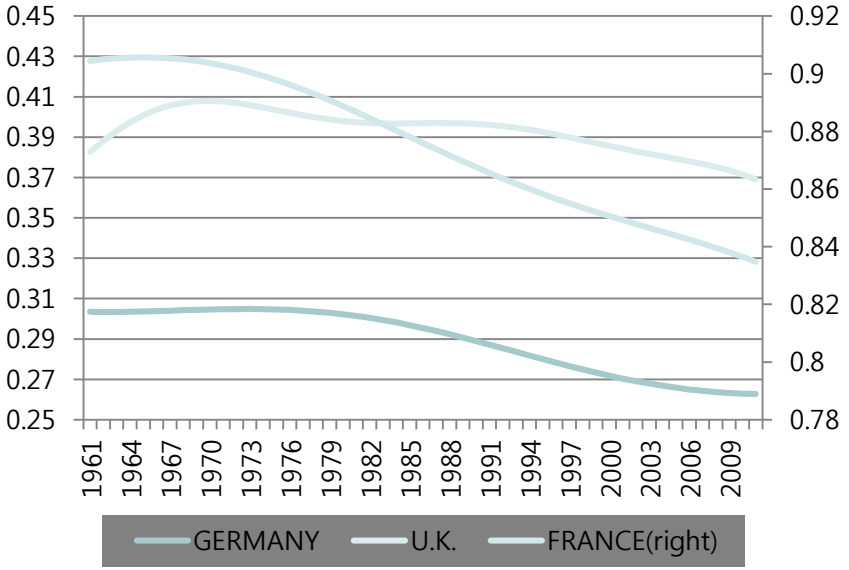
Source: WDI (2015)

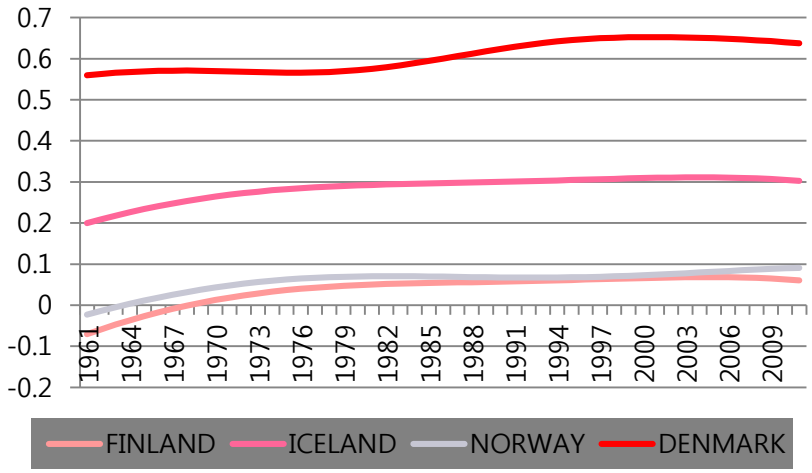
* Renewable Energy as % of Total Energy Supply (2012) and Net Removals (MT CO_2) from LULUCF (2011)

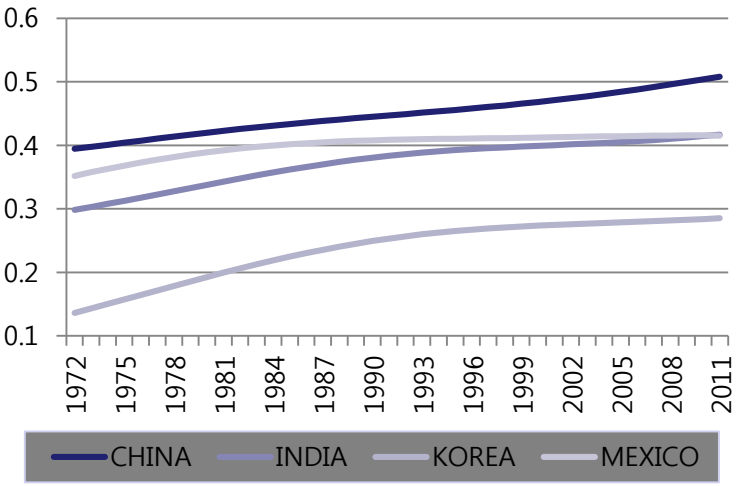
- The Nordic countries have pioneered energy and carbon taxes, which provide incentives for energy-saving and fuel switching to lower carbon energy
- Iceland has high portion of renewables in total energy supply.
- And carbon sequestration such as LULUCF results in decrease of net carbon emissions, by 25% lower than in 1990

Different Kuznets Patterns of CO2 Elasticity of Income: Arctic vs. Arctic



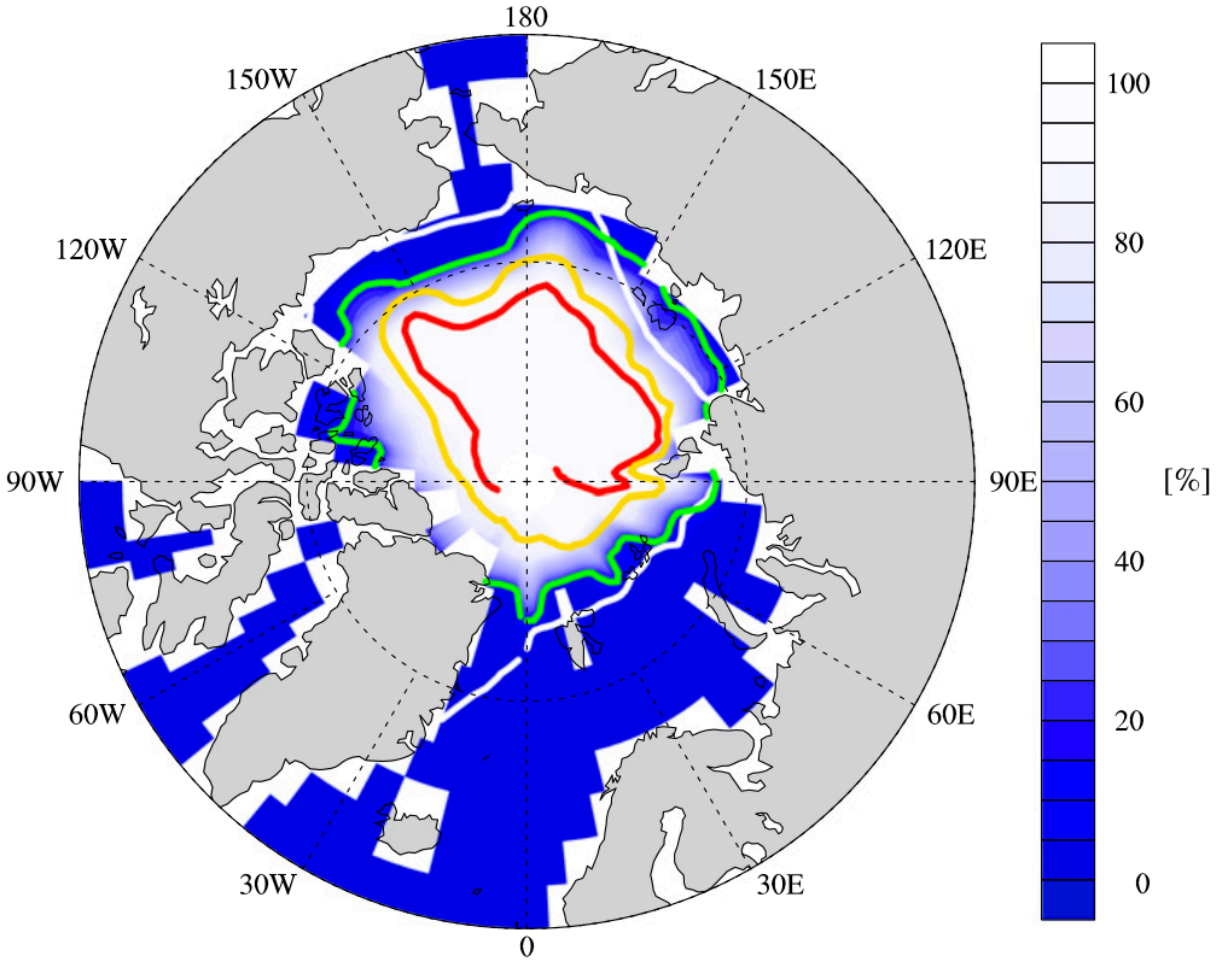






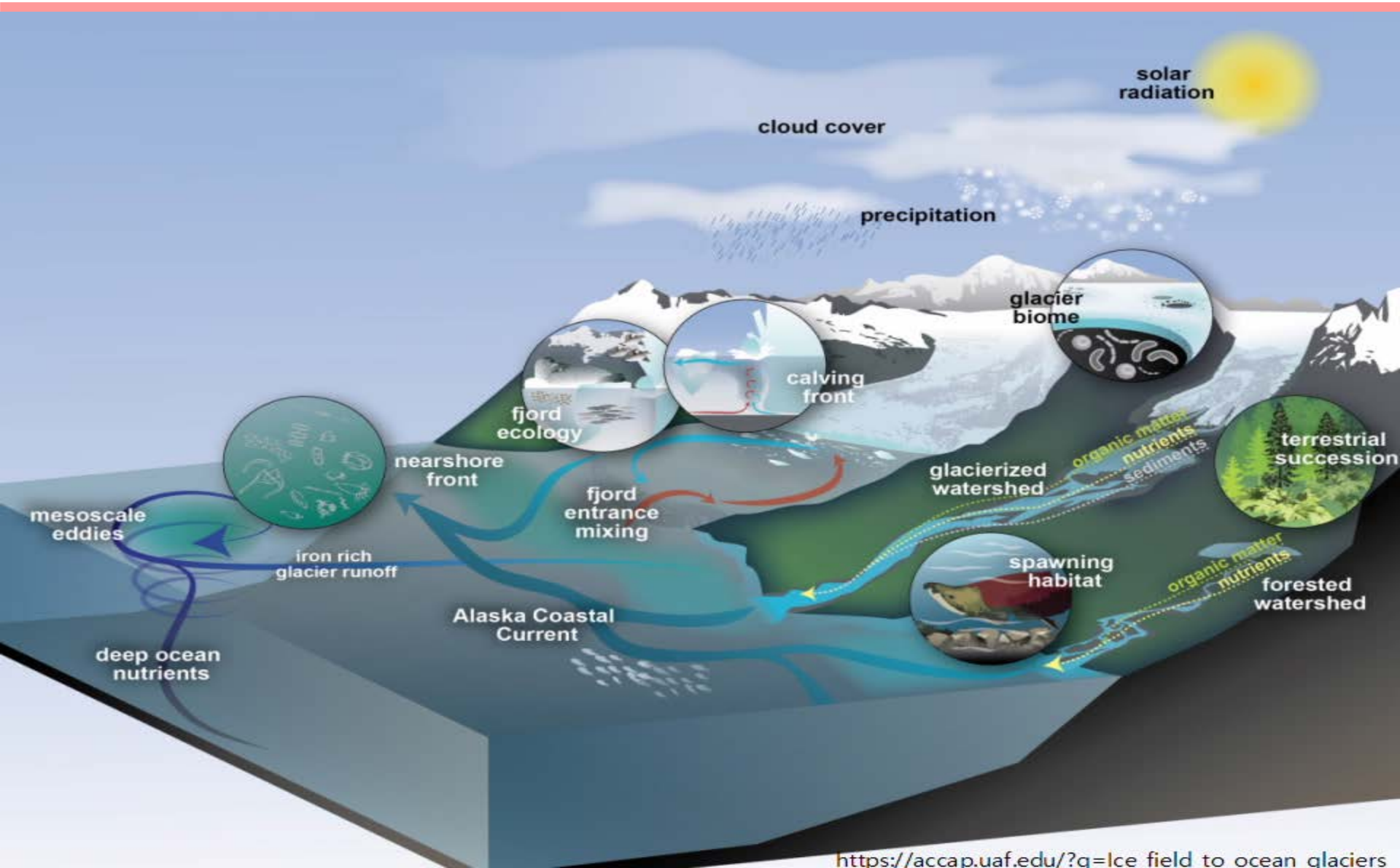
Arctic Changes: Complexity vs. Challenges

Sea-Ice Loss in the Arctic



Sea-level Rise in Tuvalu

Climate Change: Cause and Consequences



Winners

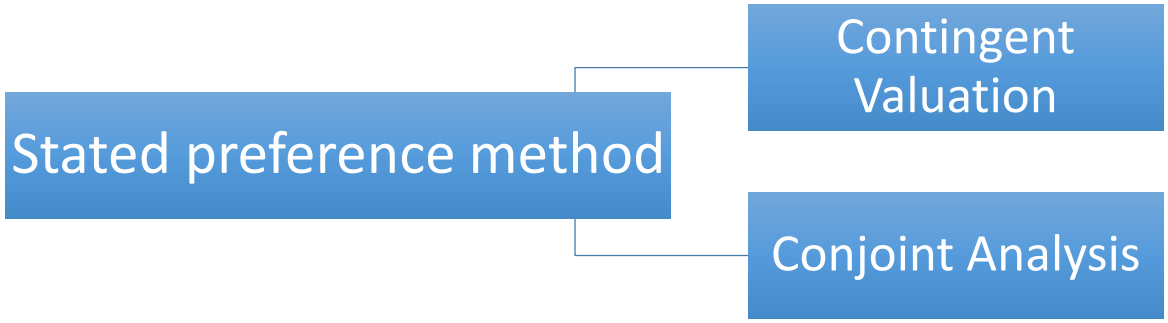
Domestic reindeer. Photo: Alexey Solodov/Shutterstock.com

Losers

Fact sheets: Arctic Biodiversity

- Negative effects on non-migratory Arctic species
- Decreased reproductive success in Arctic seabirds
- Range shift of some Arctic marine species
- Ocean acidification
- Changing relationships among species
- Increase in marine primary productivity
  - increase by 20% from 1998 to 2009, driven by a 45-day increase in the open-ice period and a reduction in summer ice cover of 27% - not spatially homogeneous

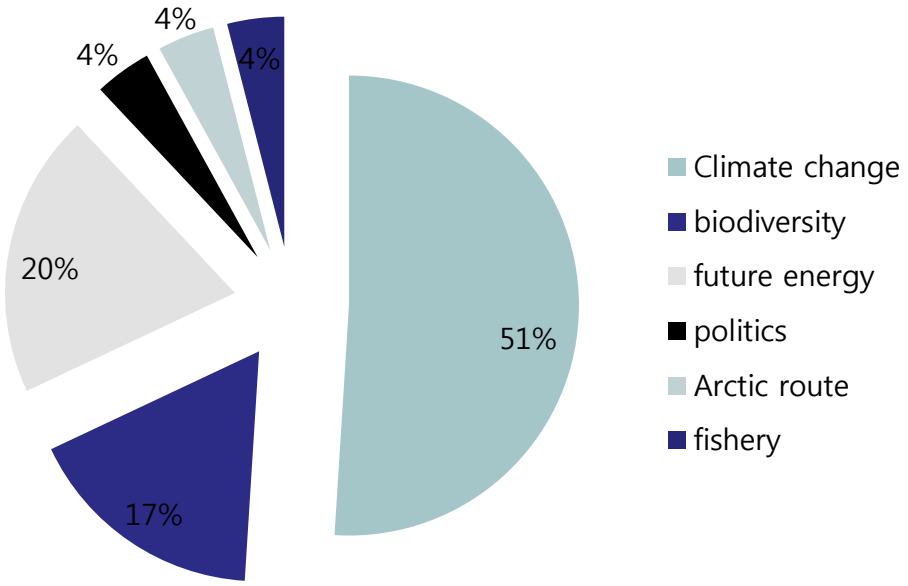
Conceptual Framework

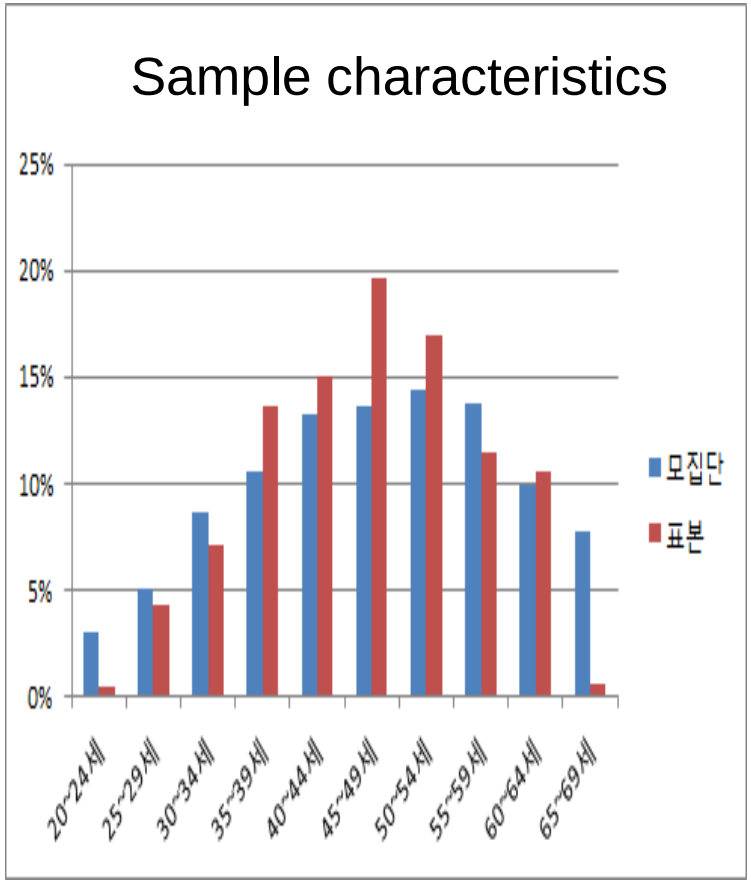


- Hanemann(1984) suggested dichotomous choice question
  - Yes/No: incentive-compatible
  - Using pre-test
  - Less starting point bias
  - Less incentive for strategic behavior
- Face-to-face interview
- WTP, not WTA
- Trade-off between WTP and other expenditure

- WTP: $\ln L = \sum_{i=1}^{N} \{ I_i^Y \ln [1 - G_C(A_i)] + I_i^N \ln G_C(A_i) \}$

Sample distribution





Results

1st WTP ($X)	2nd WTP		PEOPLE
	'YES' ($2X)	'NO' ($1/2X)	# of Sample
$1	$2	0.5	125
$2	$4	$1	125
$3	$6	$1.5	125
$4	$8	$2	125
$5	$10	$2.5	125
$7	$14	$3.5	125
$10	$20	$5	125
$15	$30	$7.5	125
Total			**1,000**

WTP ($)	Willing to Pay	
	Yes	No
$1	80(64.0%)	45(36.0%)
$2	67(53.6%)	58(46.4%)
$3	53(42.4%)	72(57.6%)
$4	47(37.6%)	78(62.4%)
$5	33(26.4%)	92(73.6%)
$7	33(26.4%)	92(73.6%)
$10	24(19.2%)	101(80.8%)
$15	16(12.8%)	109(87.2%)
total	**353(35.3%)**	**647(64.7%)**

What is WTP by Korean Citizen for the Environmental Integrity of the Arctic?

- Total willingness to pay from Korean citizen ranges from 0.319 billion dollars per year to 0.716 billion dollars per year: 5 billion dollars for 100 years
    - Alvarez et al.(2015) and Whiteman and Wadham(2013) predict the social costs of climate change in the Arctic reach 6 trillion dollars
- As Perrings(2010) pointed out, climate change is a cause and at the same time, effects of biodiversity

Guus Hiddink Quotes

"We have picked a squad that is

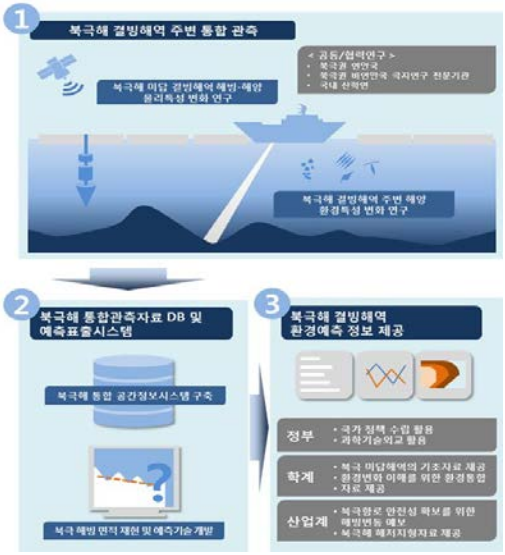
flexible and will be able to adapt!"

KOPRI's Plan-A: Vision & Strategy

Vision	*Global Leading Polar Research Institute*		
Core Values	**Excellency**	**Engagement**	**Enthusiasm**
Goal	**KOPRI, We Build Future for you!** **- To promote climate change research in response to new paradigm** **- To create added-values to the nation through polar research** **- To expand the channel of international partnership & collaboration**		
Strategy	**Clarifying Antarctic's Roles in Global Climate Change**	**Enhancing Arctic Research to lead fthe Cold Rush Era**	**exploring unseen, unknown, and unexplored**
Research Themes	Climate observing platform and restoration technology	**DB on the Arctic Environmental & Resource information**	Exploring unexplored area of the Arctic & Antarctica
	Prediction of marine ecosystem in Antarctica	**Satellite Remote Sensing System to analyze Arctic Sea Ice**	Utilizing organisms from the Arctic & Antarctica
	Melting Iceberg in the Antarctica and its influence on global sea level rise	**Rapid Climate Changes in the Arctic and its impacts**	K-Route Project: land based research in the Antarctica

Theme 1: DB on the Arctic Information

	Korea-Arctic Ocean Observing System(K-AOOS)	Investigation of submarine resource environment and seabed methane release in the Arctic	Circum Arctic Permafrost Environment Change Monitoring, Future Prediction and development Techniques of useful biomaterials(CAPEC)
Purpose	Understand the physical processes of ocean-sea ice interaction affecting on the sea-ice changes and identify sensitivity of climate change prediction.	Through Araon Arctic expeditions with the Arctic countries, - Acquiring basic data and information on geological environment for Arctic submarine resources - Investigating a global issue, subsea CH^4 release in the Arctic causing abrupt global warming	Diagnostic circum-Arctic permafrost environmental change, development of future prediction model and useful substance application technology based on permafrost observation nodes



< 극지연구소 연구팀이 오호츠크해에서 채취한 가스하이드레이트 >

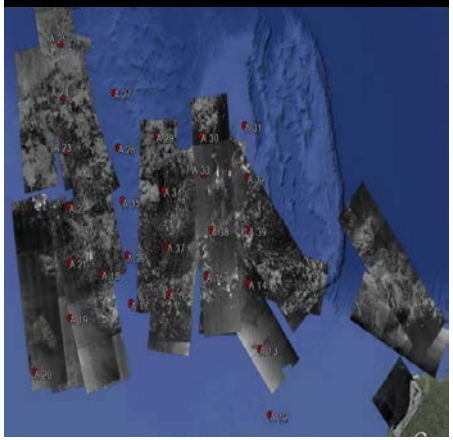
Theme 2 : Satellite Remote Sensing for Arctic Sea Ice Observation

Development of satellite observation and analysis for Arctic sea ice

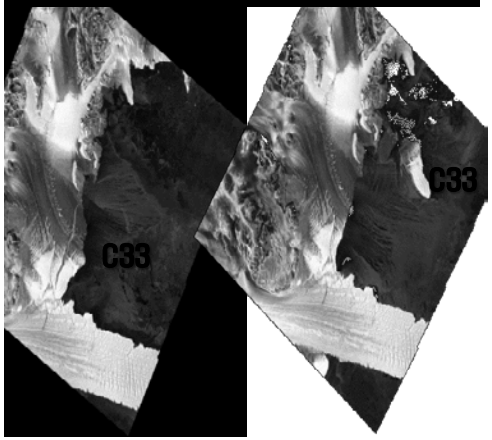
Purpose

- Development of prototype satellite data archive/manage system for Arctic sea ice monitoring
- Development of sea-ice remote sensing data processing and analysis technique
- Development of international satellite observing network for Arctic

2015 Arctic(Arirang 5)



2016 Antarctic(Arirang 5)



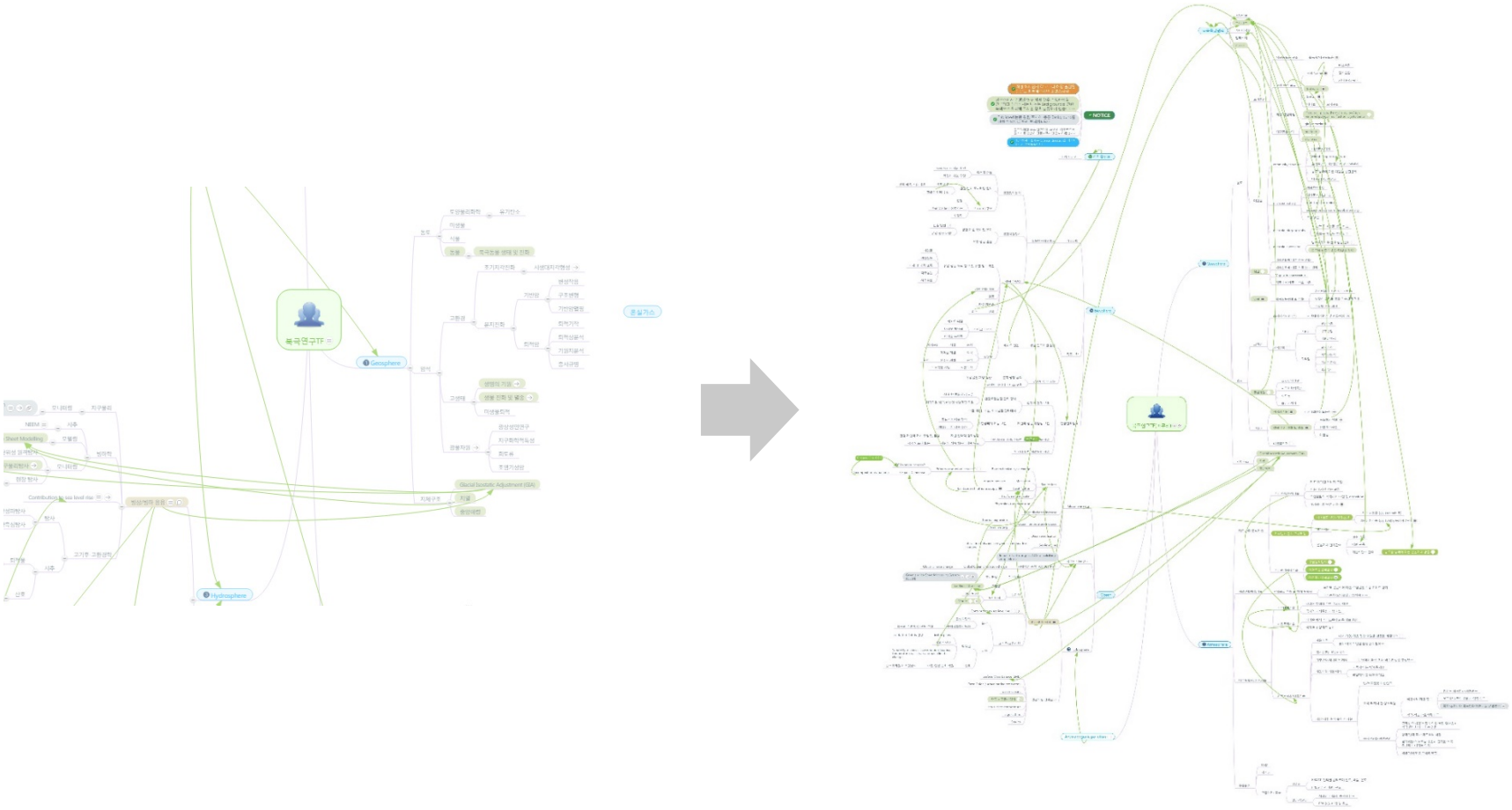
Theme 3 : Rapid Changes in Arctic and its impacts

Rapid Climate Changes in Arctic and its impact on Korea Peninsula

Purpose

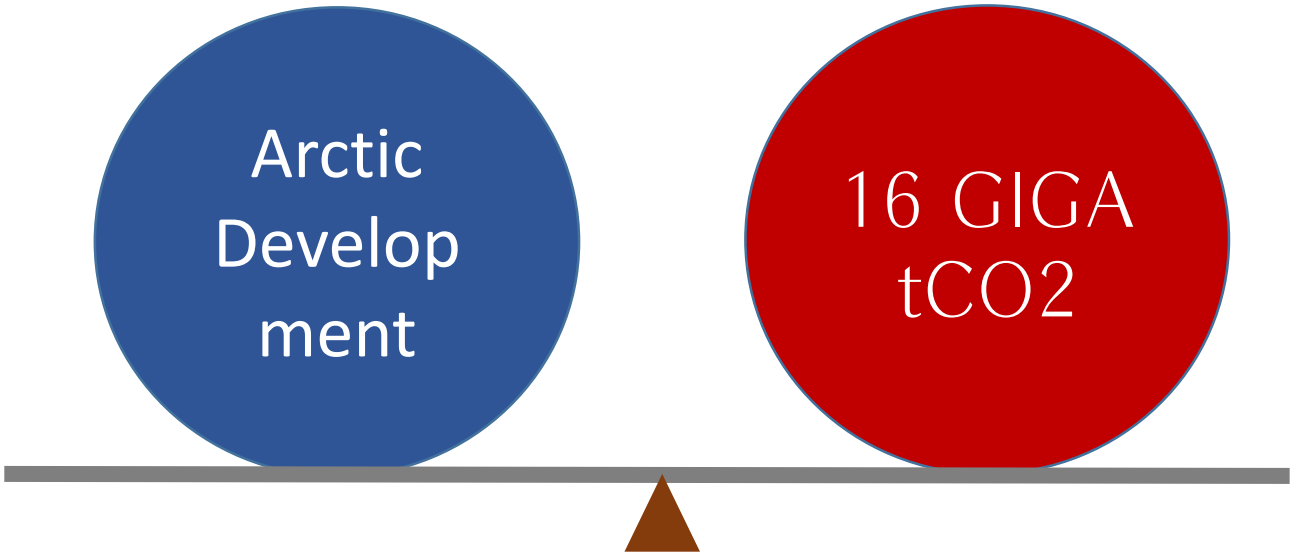
Achieve prediction capabilities of Arctic-mid latitude climate change and weather disasters by developing state-of-art modelling tools and research skills, which are essential for the prediction of the strength and direction of Arctic polar vortex known to cause the global weather disasters (cold surges, heat waves)

Ongoing Project : Mindmap for Arctic Research Roadmap



Concluding Remarks: Balancing in SD Strategy

- Potential in future is huge, but infra and financing are key elements
  - KOPRI proposed the 2nd Korean icebreaker to fulfill growing research demand
- Diverse approaches and channels should be developed for Win-Win Strategy between the Arctic members and neighboring countries: capacity building and technology transfer
- **Balance is a virtue!**




Thanks You!
ARAON
아라온