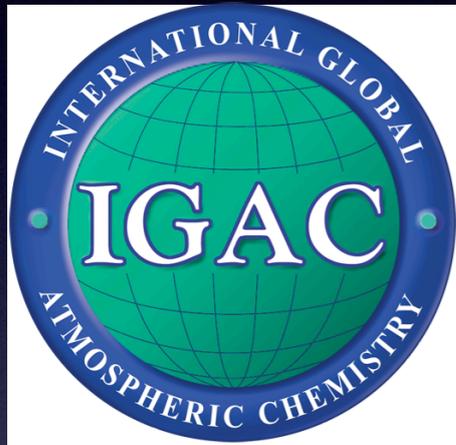


# Science Community Input for The Cryosphere and Atmospheric Chemistry (CATCH)

*An Emerging IGAC Activity on Chemistry, Biology and Physics in Cold Regions*

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& Implementation Team\*



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# The CATCH community - Who?

67 scientists provided input to the survey

## Science Community Input for Initiative on Chemistry, Biology and Physics in Cold Regions

Please answer some or all of the questions below. Leave personal details blank if you prefer to remain anonymous. Your input is greatly appreciated.

1. Who are you? (First Name, Last Name)

Your answer

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2. What is the name and location of your home institution?

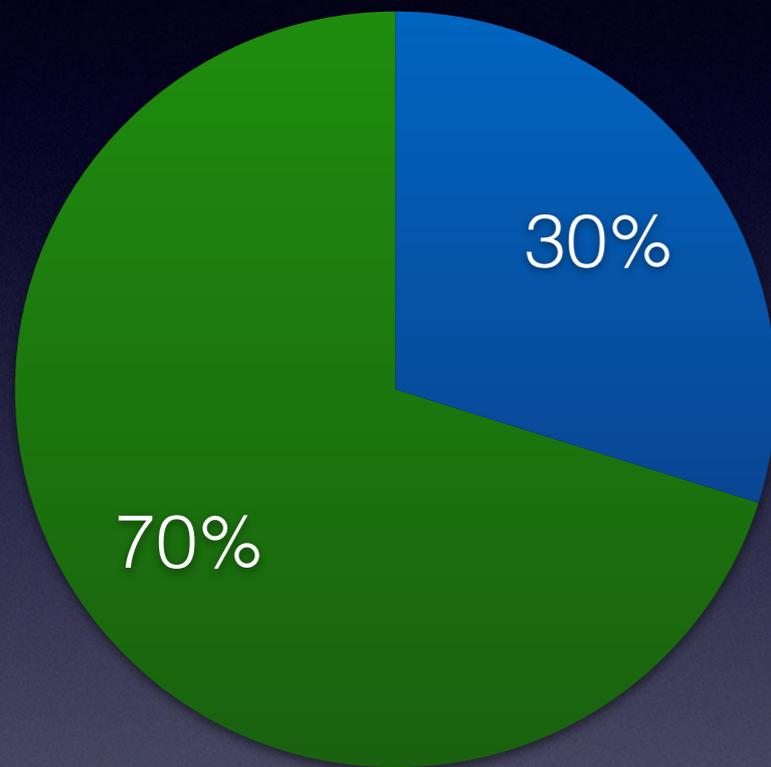
Your answer

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# The CATCH community - Who?

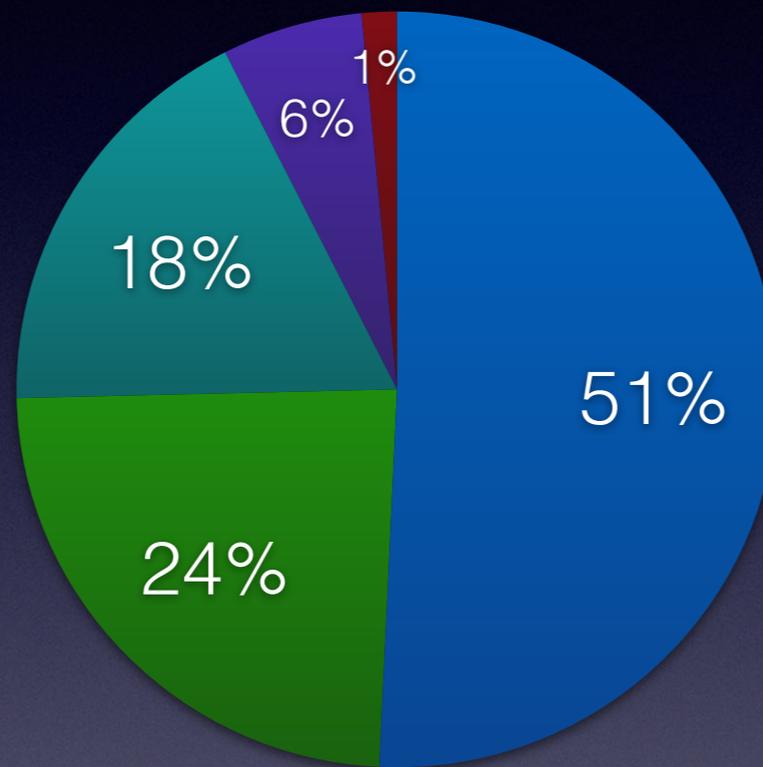
67 scientists provided input to the survey

## Gender



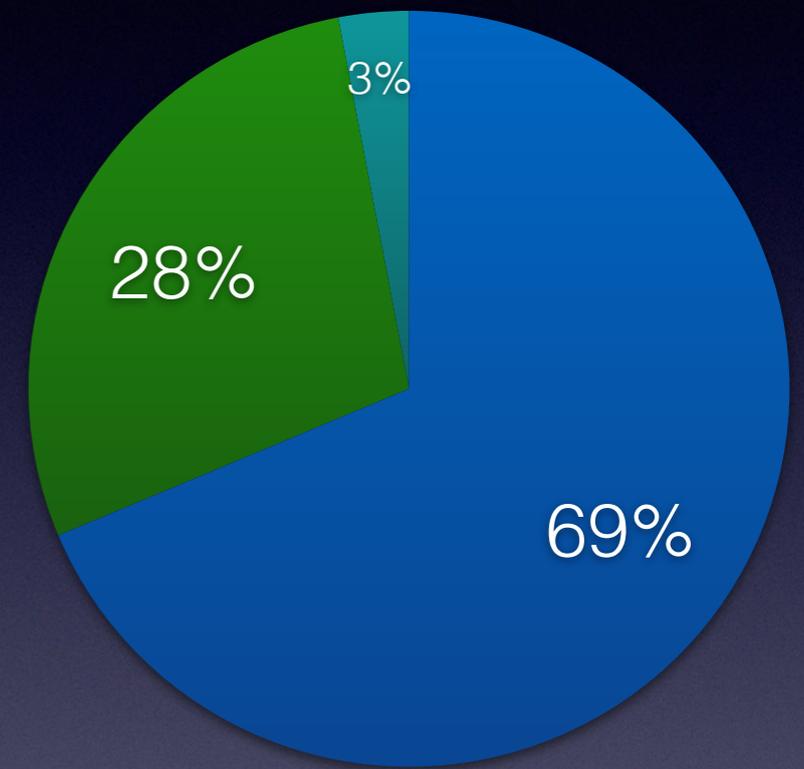
- Female
- Male

## Position



- Professor
- Research Scientist
- Early Career
- PhD
- Other

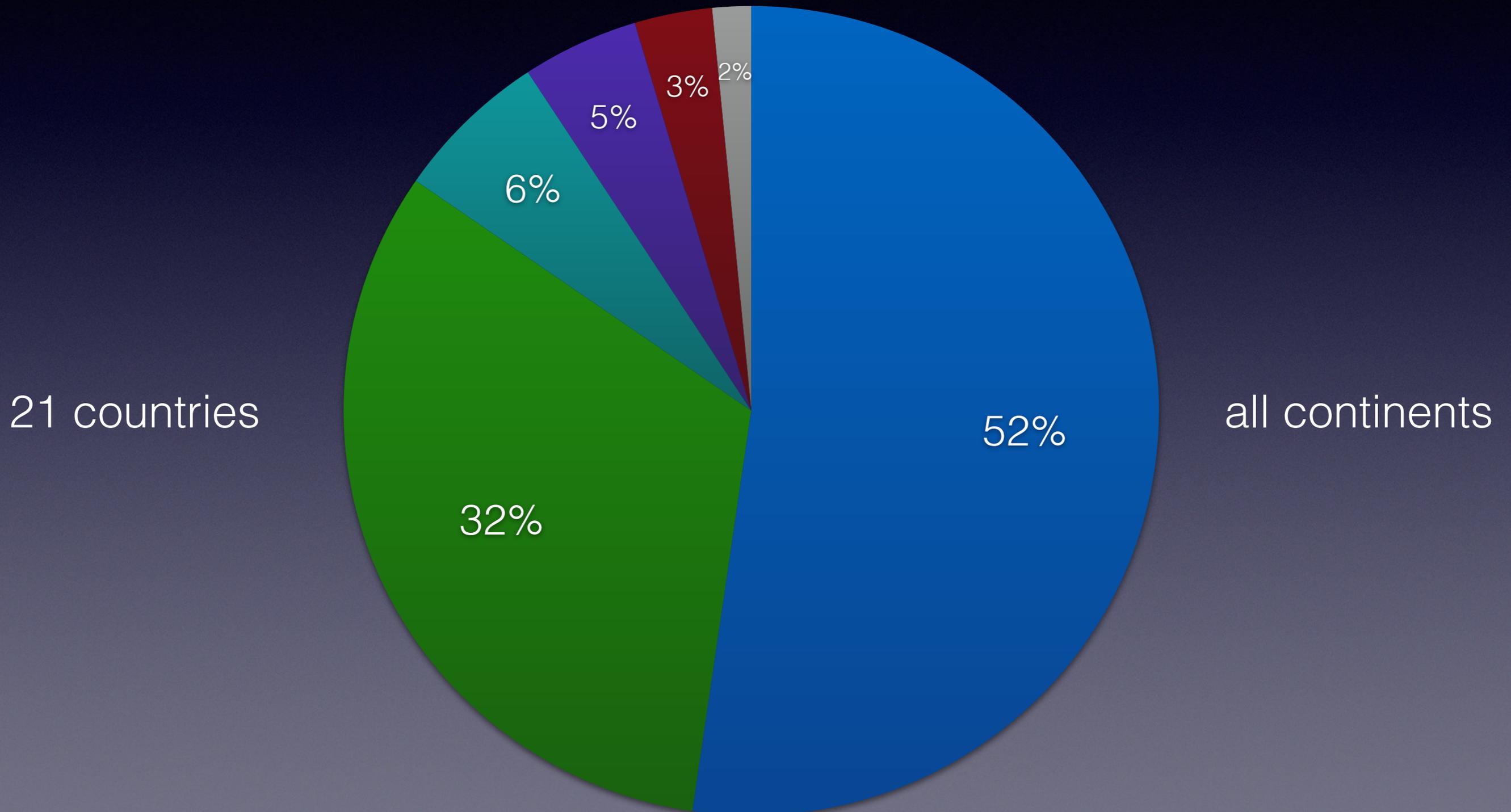
## Institution



- University
- Gov. /Research Inst.
- Priv. Sector / NGO

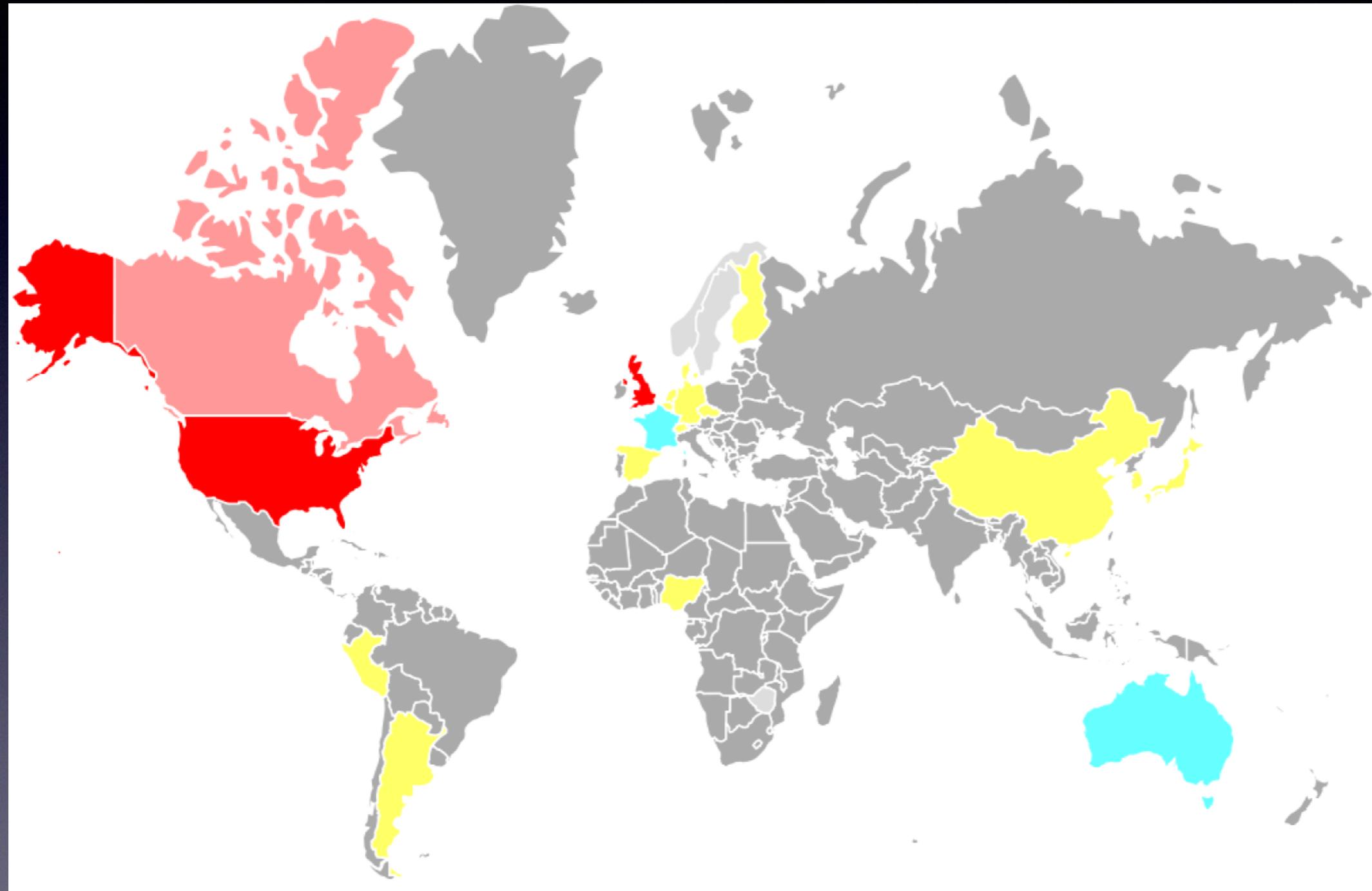
# The CATCH community - Where?

● Europe ● N-America ● Australia ● Asia ● S-America ● Africa



# The CATCH community - Where?

21 countries



9-15

6-9

3-6

1-3

none

## 5. What are your scientific research interests related to processes & linkages of Chemistry, Biology and Physics in cold regions?

### ATMOSPHERE

Cloud micro physics & aerosol interactions  
Aerosol physics/chemistry & climate impacts (radiation & clouds)  
Aerosol formation & growth, nucleation, bio-aerosol  
Climate Feedbacks (albedo, CCN/IN)  
Polar Meteorology, BL physics  
Oxidation Capacity  
biosphere - atmosphere interactions  
transport & deposition: background & pollutant chemistry  
Arctic air quality & economic activity

### SNOW / (SEA) ICE

biogeochemistry, photobiology  
microbiology, communities, adaptation, metagenomics  
photochemistry, halogen activation  
snow & (sea)ice physics/morphology  
transformation, emission, preservation  
ice core proxies (sea ice)  
heterogeneous chemistry (surfaces, kinetics)  
acid deposition to surface waters

### OCEAN

ocean physics in marginal ice zone  
CO<sub>2</sub>-Carbonate chemistry of polar oceans  
air-sea exchange, biology, marine biogenic particle (IN/CCN) source

### CYCLING

#### sinks & sources

Carbon (BC, CO<sub>2</sub>), Ozone, Sulfur,  
Halogens, Nitrogen, Hg, VOCs,  
biogenic organics, dust,  
microplastic particles

### Laboratory, Field, Modelling

remote sensing, sea ice  
simulator, lab kinetics

## 6. What do you see as the main benefit of past/ongoing internationally coordinated research activities (AICI, OASIS, PACES, BEPSII, IASOA, etc.)?

### 1) Coordinated & focussed research across disciplines & borders

- research initiatives on key questions e.g. polar climate change, sea ice & biogeochemical cycles
- identify/focus on/ address novel 'big picture' science questions
- joint proposals / projects / campaigns / new initiatives
- maintain long-term coherent direction of research

### 2) Integration of field,lab & model scientists to better understand complex systems

- create sense of community / common language
- networking /new international research collaboration / meetings / workshops
- collaborative reviews
- present a combined, cohesive and collegiate voice to policy-makers and people outside of academia

### 3) Model development & validation

### 4) Coordinated field campaigns (lower cost/ widely used data sets)

### 5) Access to data & knowledge

- research dissemination & technology transfer

### 6) Shared use of research platforms & instruments

## 7. What would you like to see in the new activity that was not a part of past & ongoing activities?

### 1) Science Focus

- focus on sources & impacts of IN/CCN in cold regions
- focus on processes: Arctic rain vs snow formation, persistence of clouds, cloud processes, aerosol-cloud interactions
- more effort on "reactive" trace gases & isotopes (hydrocarbons, oxygenated compounds & their isotopic abundances)
- improve process-level understanding of atmospheric deposition (to snow): pollutants, BC in the Arctic
- non-polar cryospheric environments: lakes, snow on land, high altitude mountains
- anthropogenic pollution and climate change
- fill gaps in understanding land-sea cryospheric interactions

## 7. What would you like to see in the new activity that was not a part of past & ongoing activities?

### 2) Observations

- coordinate measurements of cloud droplet, IN, CCN, aerosol and trace gas composition as a function of latitude and altitude in the Arctic
  - collect samples for DNA extraction; encourage open-access microbial sequencing datasets to link biology & chemistry (Hg / S cycles)
  - gas measurements at air-sea ice interface
  - continuous atmospheric Hg measurements (total gaseous, reactive, and particulate)
  - emphasis on long-term monitoring to put intensive campaigns into context
- 
- creation & maintenance of data sets
  - community sampling platform / station for long-term and/or campaign-based measurements
- 
- Earth System model development with coupled chemistry climate studies
- 
- focus not only on pre-campaign coordination, but also on post-campaign analysis maintaining open environment

## 7. What would you like to see in the new activity that was not a part of past & ongoing activities?

### 3) Community

- be more welcoming / inclusive
- better integration of disciplines (e.g. microbiology) / break down silos
- support for science at the interfaces of atmospheric chemistry and terrestrial/marine geochemistry/microbiology
- better involvement of young scientists
- More focused and regular communications
- web-enabled (and archived) meetings & options for remote participation
- inclusion & two-way communication to the broader community (e.g., K-12, non-scientists, policy groups)
- inform early & widely about new collaboration and funding opportunities
- better coordination of field, lab & modelling studies
- ice laboratory scientist workshop to critically evaluate environmental relevance of model lab systems
- update review on snow physics (theory, methods & protocols, uncertainties, field observations)

## **8. What are the big picture science questions in the cold regions that require international and/or trans-disciplinary coordination to address?**

### **1) What are the impacts of a changing sea ice regime?**

- ocean biology (productivity, ecosystems)
- sea surface emissions
- atmospheric chemistry
- climate

### **2) What is the impact of changes in snow & ice cover on atmospheric composition & climate?**

- reactive trace gas fluxes
- mass, energy, particles
- atmospheric oxidation capacity
- role of mid latitudes, high mountains (Andes, Himalayas)

### **3) What controls clouds at high latitudes?**

### **4) What are the sources, formation mechanism & impacts on ecosystems and climate of aerosol (Arctic, Southern Ocean)?**

- relative role of biogenic S versus marine organic compounds to new particle formation & climate
- mixed-phase cloud processes (precipitation, radiation balance)
- particle deposition to snow/ice & albedo

### **5) What are sources, sinks and processes relevant to cold region biogeochemical cycles of C, S, N, Hg and halogens? Consider chemistry, physics & (micro)biology**

- how does microbial life adapt to cold environments and how do they impact biogeochemical cycles?
- what is the role of the sea ice CO<sub>2</sub> pump in the polar oceans?
- CO<sub>2</sub> sink in the Southern Ocean
- where does reactive halogen chemistry take place (aerosol, snow/ice surfaces)?

## **8. What are the big picture science questions in the cold regions that require international and/or trans-disciplinary coordination to address?**

### **6) How do changes in atmospheric circulation impact biogeochemical cycles & atmospheric transport?**

- change of Arctic front
- ozone hole & sea ice

### **7) What are the impacts of anthropogenic activities on cold region air quality & climate?**

- shipping, mining, oil & gas development, tourism
- BC deposition on snow & ice; is BC significant in the local or regional energy budget?
- contaminant cycling & accumulation

### **8) How have atmospheric composition & climate changed in the past based on ice cores?**

- past sea ice conditions (proxies: MSA, SSA, Halogens)
- past atmospheric organic chemistry (wildfires, fossil fuel combustion)
- past atmospheric oxidation capacity

### **9) What are the impacts of a melting permafrost?**

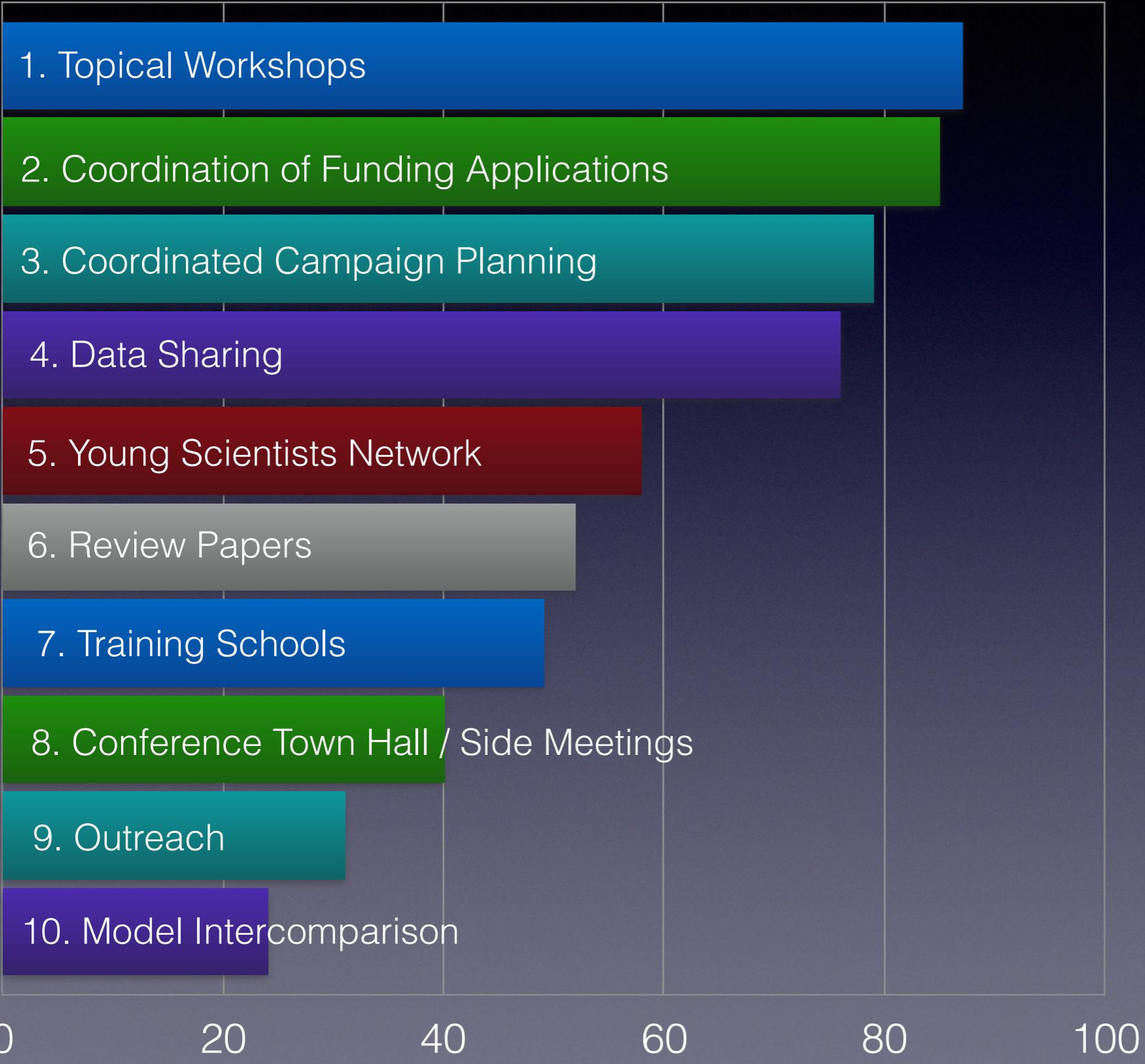
- GHG emissions
- ecosystems, C & N cycles, BVOC emissions

### **10) How do physical snow/ice processes at the macro & micro scale impact chemical air-ice exchange?**

### **11) Are there viable geoengineering methods to slow down Arctic warming?**

### **12) What are the cold region climate feedbacks (regional & with mid/low latitudes) linked to biogeochemical cycles? Are they predictable?**

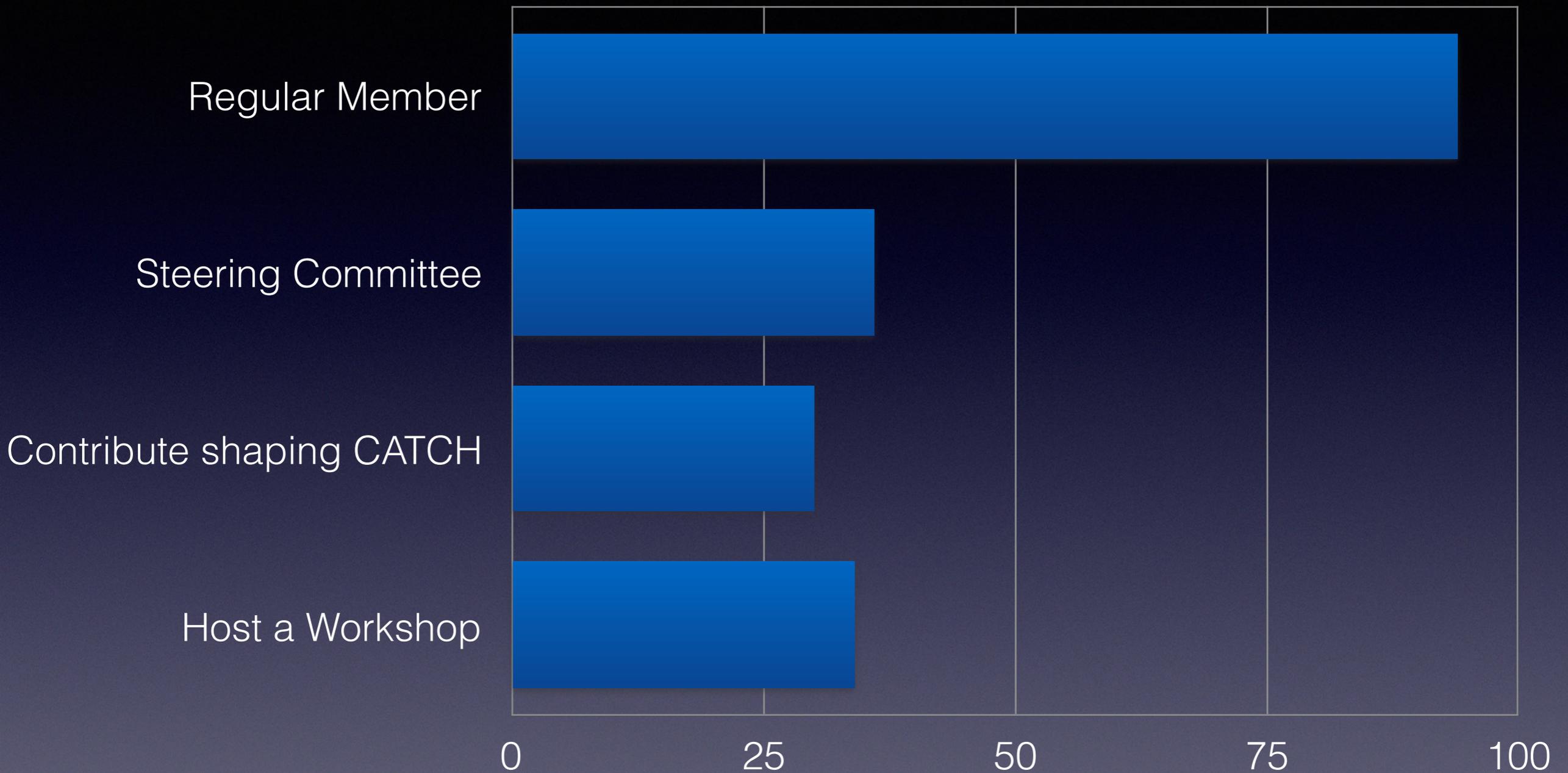
# 9. What are the main purposes that a new internationally coordinated activity can serve to increase success and impact of your science?



**Other**

- model / data inter-comparison
- advocacy to funding organisations to support CATCH research
- link existing national organisations
- reports & policy papers

## 10. How would you like to be involved in the new effort?

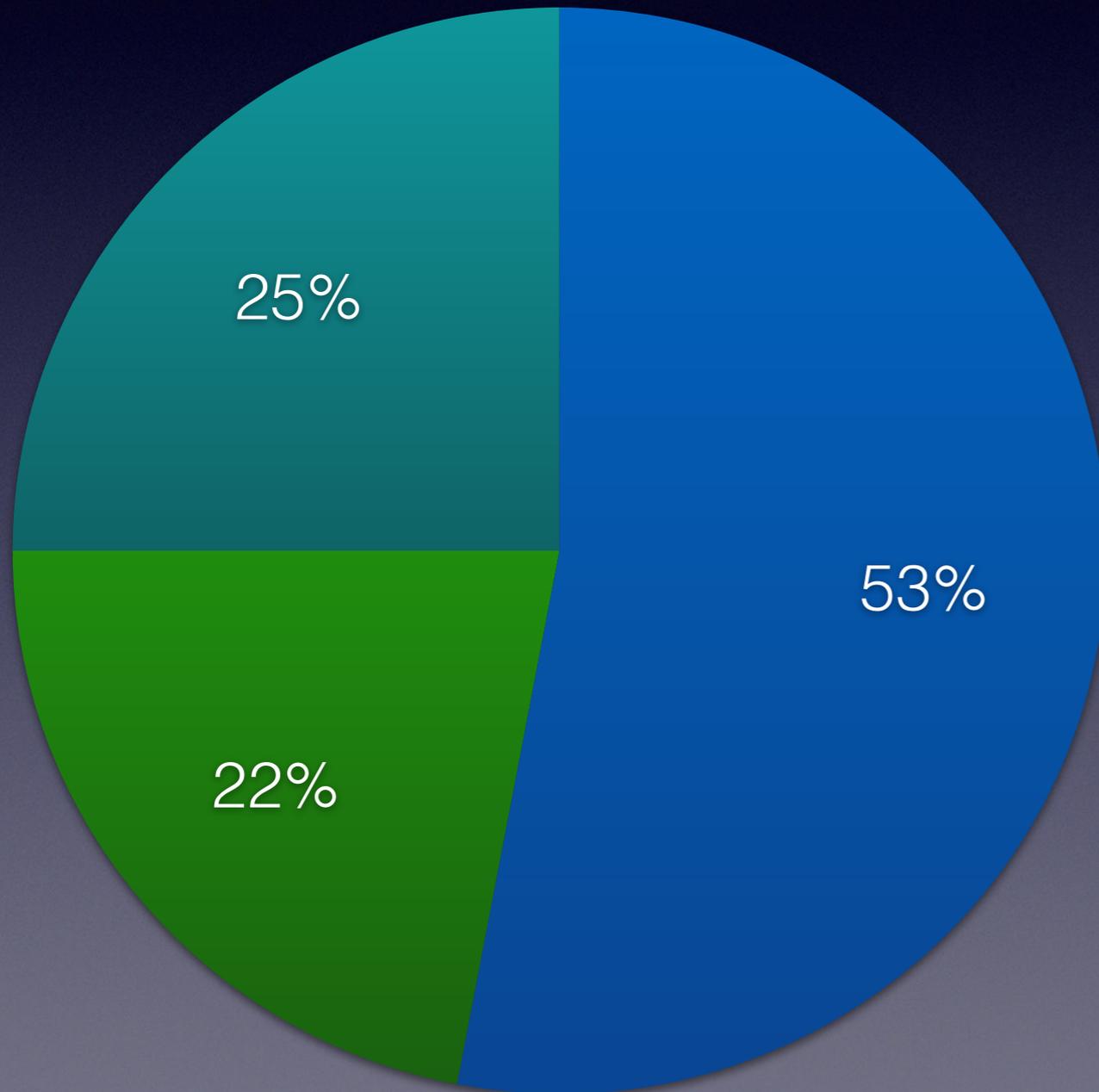


### **OTHER**

- closer links to IASAO
- potential meetings via the Aerosol Society

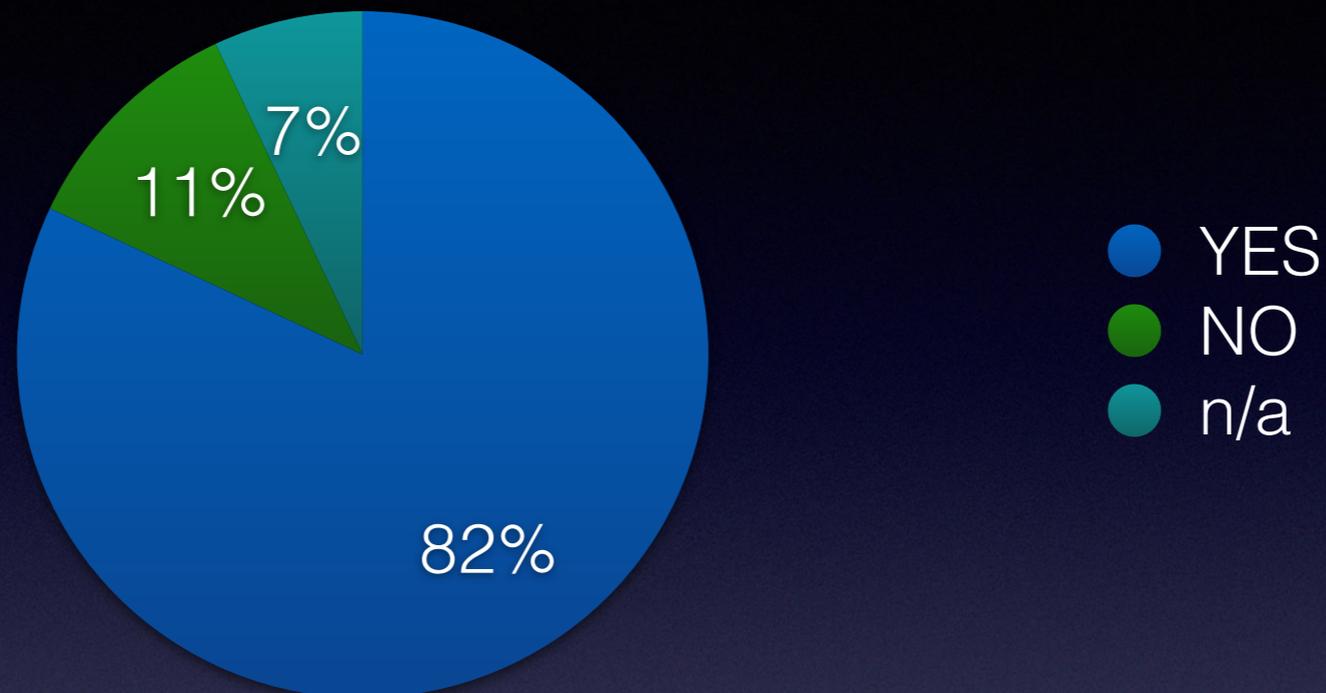
**11. The working title for our activity is "CATCH" - Cryospheric Atmospheric Chemistry. Do you feel that this title accurately reflects the research that you hope is included in the new activity? If not, do you have other name suggestions?**

● YES      ● NO      ● n/a



- Include
- biology
  - particles
  - snow
  - transport

## 12. Are you interested in attending a science meeting/scoping workshop to further these efforts (planned in April - June 2017)?



Facilitating atmospheric chemistry research towards a sustainable world



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### 2017 CATCH Workshop

#### Community Workshop on the Development of CATCH

Jointly sponsored by [SOLAS](#)

##### Workshop Goal

The first CATCH workshop focuses on current and future science relevant to atmospheric chemistry in the cold regions. The main aim of the workshop is to develop wider trans-disciplinary research questions and establish linkages to neighboring disciplines including ocean, ice, snow, biology, clouds, dynamics, and fundamental chemistry.

##### Dates

19-20 April 2017

Thanks for your input & attention ...  
Now look around & meet your fellow CATCH scientist!!

