Science questions: SIW 2005

1. Is the arctic system moving to a new state?
2. To what extent is the arctic system predictable?
3. To what extent can recent & ongoing climate changes in the Arctic be attributed to anthropogenic forcing?
4. What is the direction & relative importance of system feedbacks?
5. How are terrestrial and marine ecosystems and ecosystem services affected by environmental change and its interaction with human activities?
6. How do cultural and socioeconomic systems interact with arctic environmental change?
7. What are the most consequential links between the arctic and the earth systems?

Science questions: ISAC 2010

1. How is Arctic Change linked to global change?
2. How persistent is the presently observed arctic change and is it unique?
3. How large is the anthropogenic component of observed arctic change?
4. Why are many aspects of arctic change amplified with respect to global conditions?
5. How well can arctic change be projected and what is needed to improve projections?

Science questions: SIW 2005

1. Is the arctic system moving to a new state?

Activity	Priority/ Phasing	Additional Questions	Section
1. Is the arctic system moving to a new state?			
Observing Activities (Page 9):			
(a) Construct a high-resolution (10^0–10^1 year) multiproxy spatial and temporal paleoclimate network extending back 2,000 years	1	2, 3, 5, 7	4.1.6
(b) Enhance and stabilize the distribution and continuity of the upper-air, surface climatology, and weather observation networks, including integration of cryospheric, hydrologic, and oceanic variables	1	2, 3, 4	4.1.1
(c) On land, initiate at least one intensive site for integrated time series measurements that include climate, surface energy balance, hydrology, glaciology, trace gases, permafrost/active layer, C/N/P budgets, species composition, vegetation structure, and contaminant compounds; apply new technology, numerical analyses, and remote sensing to extrapolate field measurements to high quality circumarctic gridded datasets	1	3, 4, 5, 7	4.1.4
(d) Develop an integrated observation network for identification and long-term monitoring of social and economic indicators of human subsystem changes that drive and/or feed back to arctic physical and biological system changes	1	2, 3, 4, 5, 6	4.1.5
(e) Implement automated monitoring in the ocean and for sea ice of key biological and chemical parameters coincident with physical observations			

Science questions: ISAC 2010

1. How is Arctic Change linked to global change?

Detailed Questions Needing Attention

- What determines the modes of natural atmospheric variability and how are they likely to evolve and affect arctic change over the coming decades?
- To what extent is arctic change driven by changes in temperature and humidity?
- To what extent are emissions of the different greenhouse gases and aerosols (e.g. methane and 'black carbon') outside the Arctic affecting arctic change?
- How will amplified Arctic warming affect the large-scale northern hemisphere atmospheric and oceanic circulation?
- How will the spatially aggregated effect of changes in trace gas fluxes from Arctic surfaces alter global concentrations of greenhouse gases?
- What roles do oceanic exchanges of heat and freshwater between the Arctic and lower latitudes play in arctic-global climate linkages?
- How is the Greenland ice-sheet mass balance changing and how are such changes related to the mass flux from outlet glaciers. Is this accelerating?
- What are the consequences of accelerated melting of the Greenland ice-sheet on global sea-level rise and thermohaline circulation?
- What are the consequences of melting of the smaller ice caps and glaciers?

Science questions: ISAC 2010

2. How persistent is the presently observed arctic change and is it unique?

Detailed Questions Needing Attention

- What conditions govern the presence of the perennial Arctic ice cover and for how long has the perennial ice been present?
- What are the differences in system-scale changes between the current warming, that in the mid 20th century, and that of earlier periods in the Holocene, and in the more distant past (i.e., mid-Pliocene)?
- During the Holocene, did the Arctic experience ecosystem changes similar to those presently observed?
- To what extent were past changes in the human component of the Arctic System coupled to and/or forced by aspects of arctic environmental change and global change?

Science questions: ISAC 2010

6. What are the adaptive capacities and resilience of arctic ecological systems?
7. To what extent are social and ecological systems able to adapt to the effects of arctic change?
8. How does environmental change in the Arctic affect the resilience, adaptive capacity, and ultimately, viability of human communities?
9. How can new insight into arctic change and its impacts be translated into solutions for adaptation, management, and mitigation?

Science questions: UAC 2012

1. How Predictable are Different Aspects of the Arctic System? How Can Improved Understanding of Predictability Help Planning, Mitigation & Adaptation?
2. What Tipping Points & Abrupt Changes are Most Consequential for Ecosystems & Humans?
3. How Will the Critical Intersections Between Human & Natural Systems in the Arctic Change Over the Next Several Decades?
4. What are the Critical Linkages Between the Arctic System and the Global System?
5. How will Cryospheric Changes Drive Changes the Economic, Social, and Environmental Components of the Arctic System?