

POLAR EDUCATION RESOURCES

Activity or Resource Title	url	Region	Data Type	Data Topics							Audience	Author/ Institution	Activity Type						Developed Curriculum	Data Source	GOAL	Focus
				Permafrost	Sea Ice	Ppl	Glacier	SLR	Marine Eco-system	Other			S	B	W	V	P	O				
A friend acting strangely	http://force.s.si.edu/arctic/	Arct	html version of museum exhibit - web based, movies, images, animations	X	X	X		X		history	General	Smithsonian Institute			X				pdfs of curriculum - teacher resource - data based activities - mainly MS target audience		Images & information from the exhibit	Putting a human face on the warming Arctic
Alaska Stakeholders & Climate Change	http://jukebox.uaf.edu/site/stakeholders/	Alaska (Arct)	Videos	X		X				weather, rivers & lakes, fire, seasonality, plants and animals	General	IARC, ACCAP, SNRAS, UAF,				X			no	Project Jukebox, Alaska & Polar Regions Collections	Use Alaska stakeholders to reach out to others in the community	sharing first hand knowledge and experiences
Alaska's Rivers of Ice	http://online.wr.usgs.gov/calendar/2008/feb08.html	Alaska (Arct)	scientist video, with ppt, graphs				X				General	USGS						video	no	USGS	Impact of Global Warming on the glaciers	Bruce Molnia speaks on changing glaciers as a response to increased climate
Albedo	http://www.nasa.gov/cen/ters/godda rd/mpg/97518main_albedoCU.mpg ; SECOND ANIMATION: http://www.nasa.gov/cen/ters/godda rd/mpg/97511main_Albedo.mpg	Arct, Antarc, Greenland	simulation		X					Albedo	General	NASA Goddard	X						no	n/a	demonstrate concepts of albedo and melting sea ice	shows open water absorbs more heat, accelerating melting

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Antarctic Penguins: Bellwethers of Environmental Change	http://www.penguinscience.com/climate_change.php	Antarc	PenguinScience						X		9-16 grades, general	PenguinScience							story with maps, images	no	PenguinScience, NASA,	As the change in global climate accelerates, species are responding to the change, some more successfully than others, and in different ways at different boundaries of their range	.Show impact of climate change on Adelie penguins
Antarctic Sea Ice	http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.seaice/	Antarc	Microwave Image		X						HS to General	WGBH & NOVA						short movie	Through WGBH	Microwave Satellite imagery	Sea Ice annual changes, role in food systems, temperature, salinity	Narrated movie introduces the role of Antarctic sea ice	
Antarctic Sea Ice	http://www.polartrac.com/resources/presentation/antarctic-sea-ice	Antarc	pdf presentation with graphs, images		X				X		9-16, general	Dr. P. Yager, PolarTrec						pdf presentation	no	graphs, maps images	connection between climate active gases & sea ice	Antarctic sea ice	

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Antarctica: Challenging forecasts for a challenging environment	http://www.meted.ucar.edu/polar/antarctica_ip/	Antarc	images, satellite data, weather models, multimedia								Meteorologic research in Antc., thermalh aline circulation, Antarctica's role in climate	Adult learners	COMET program (passworded site)								multimedia	no	graphs, images, film	The role of weather in Antarctica & its role elsewhere - need to know this as part of understanding climate	weather in Antarctica
Anthropolis Map of the Arctci	http://www.athropolis.com/map2.htm	Arct & Greenland	maps, weather data								Index of Arctic places, weather, sun hours	General	Anthropolis.com								maps, graphs	no	not noted	familiarize user with the varied map representations of the polar regions, weather, sun hours etc.	map & weather literacy
Arctic & Antarctic Living Systems	http://learningcenter.nsta.org/products/symposia_seminars/fall07/IPY_birmingham/webseminarII.aspx	Arct, Antarc, Greenland	webinar	X	X	X				X		Teachers	NSTA								webinar, ppt, pdf	no	webinar	Showcase a wide number of polar programs and resources for teachers	a wide ranging overview of resources, nothing in depth but a nice survey

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Arctic Atlas* - *(a bit like a more static version of the ipad option - - MT)	http://www.teachersdomain.org/resource/ipy07.sci.life.eco.arcticatlas/	Arct & Greenland	Maps	X							precip., solar radiation	HS to General	WGBH & UNEP/GRID-Arendal			X					Through WGBH	UNEP/GRID-Arendal	investigate six different themes: landcover types, permafrost, population density, precipitation, solar radiation, and topography	Interactive map allows zoom in and exploration of the Arctic areas
Arctic Climate Modeling Program Multimedia (ACMP) (NOTE SPECIFIC CURRICULUM LISTED BY TOPIC SEPARATELY)	http://www.arcticclimatemodeling.com/multimedia.html	Arct, Greenland (some Ant)	videos, presentations, lectures, multimedia, graphs and charts		X	X	X	X	X		Albedo	K12 but High School segregated	Univ of Alaska Fairbanks			X		X			yes pdfs of curriculum, range of targets with HS separated	researchers - varied	Provide rich curriculum and topic materials on a variety of subjects	Focus on Arctic youth but applies to any youth
Arctic Climate System	http://www.teachersdomain.org/resource/ean08.sci.ess.eartsys.climatesys/	Arct & Greenland	Map visualization & Film	X	X	X		X			Albedo, Ocean Circulation	HS to General	National Film Board of Canada			X	X			film	Through WGBH	Interviews,	Arctic role in global climate circulation	understand the climate system as interrelated
Arctic Ecosystems	http://www.meted.ucar.edu/oceans/arctic_ecology/	Arct	simulations, visualizations, graphs		X						model scenarios	Adult learners	COMET program (passworded site)	X			X			model	yes	NOAA, COMET generated graphs and data displays	Role of sea ice in the Arctic food web and in climate change	model scenario allows you to change parameters

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Arctic Haze	http://www.teachersdomain.org/resource/ean08.sci.ess.earthsys.arctic.haze/	Arct	Satellite, Film, Oral History								Polluted haze	HS to General	KUAC & WGBH								film	Through WGBH	Satellite imagery, scientists in the field	Air Pollution and in the Arctic & role in global warming	Atmospheric transport of particles
Arctic Sea Ice Graphs	https://sites.google.com/site/arctics/eicegraphs/	Arctic	graphs, images, satellite data, visualizations		X							general	google site - not clear who the owner is		X	X	X				maps, graphs, charts	no	satellites, webcams etc.	Portal for sea ice data from numerous sources and countries	provide current data on sea ice
Arctic Stories	http://www.arcticstories.net/index.html	Arct	video storytelling by researchers		X	X	X		X			General	Paul Shepson - NSF								video	no	video	Show changes in sea ice and the Arctic in general due to warming	Use scientists to tell the story of change
ArcticGIS	http://www.arcus.org/gis/maps-data/index.html	Arct	Maps, GIS and metadata		X		X				Logistics, Barrow, Canadian maps etc.	Adult, general	ARCUS hosts the site but data from many sources								X	no	GIS	Portal for Arctic Maps	get planning and logistics data out to people
Bio Bulletin: As Antarctic Ice Melts, Wildlife Shifts	http://www.amnh.org/education/resources/rfid/race_edguide.pdf	Antarc	Interactive with Satellite imagery		X					X		HS, General	AMNH									no	NASA Satellite imagery	Declining ice linked to declining food web	Role of climate and thus of phytoplankton in Ant. foodweb

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Carbon Footprint (connected to glacial changes)	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_GreenhouseEffect_Carbon_Footprint.pdf	Arct	graph, summary of science articles				X			carbon	HS	Univ of Alaska Fairbanks							X	integrates to standards	Data Graphs, images from International Arctic Research Center	Calculate carbon footprint & connect to climate impacts	impact of carbon footprint, read science articles to understand system variations and responses to climate change
Chill out: All about ice in the Bering Sea	http://www.polartrec.com/files/resources/lesson/13263/chillout.pdf	Alaska (Arct)	photos, maps, video		X					technology	9-16 grades	PolarTrec							website with resources, make an ROV	Yes	NSIDC, UofAlaska	Learn about chemical and physical properties of sea ice - make own ROV	Use ROV construction to engage students in learning about sea ice
Climate Central	http://sealevel.climatecentral.org/	Arct, Greenland, Antarctic	data visualization					X			General	Climate Center	X			X				no	NOAA, USGS, USFWS, US Census	Visualize SLR around the coastal regions of the country	What regions will be impacted by SLR and how much

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Climate Change & Sea Ice Portlet	http://arcticportal.org/climate-and-sea	Arct	satellite data, graphs		X				X		General	Arctic Portal				X		website & graphs, film & videos	No	IARC	Links between climate change and sea ice - points out problems and opportunities	Changes in sea ice and impacts at multiple levels
Climate change and Arctic ecosystems	http://climate.agry.purdue.edu/climate/cc/Files/cc_arctic.pdf	Arctic	maps, graphs		X				X		9-16 grades	Purdue (reviewed CLEAN resource)					X		yes	ACIA scientific reports, NASA, IUCN	How climate change is affecting Arctic ecosystems	calculate sea ice cover and analyze polar bear population
Climate Change Interviews	http://jukebox.uaf.edu/ClimateChange/home.html	Alaska	Video	X		X					General	OLCG project				X			no	Project Jukebox interviews	To capture first hand impacts of climate in the northlands	first hand narration
Climate Change Wildlife and Wildlands: A Toolkit for Formal and Informal Educators: Ecoregion Polar/Subpolar	http://www.globalchange.gov/images/documents/toolkit/Polar_Subpolar/Case_Study/Polar_Subpolar_6_11_09.pdf	Alaska (Arct)	narrative	X					X		9-16 grades, general	US Global Change Research Program						yes but not with this age focus	ACIA scientific reports	Explain the three specific ecosystems identified within the Arctic: terrestrial, freshwater, and marine.	Role of the cold climate is key to this ecoregion	

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Climate Change: Sea Ice 2008	http://climate.nasa.gov/ClimateReel/	Arct, Antarc	satellite data		X						General	NASA				X			No	Satellite imagery	Role of sea ice in climate change	Through narrated imagery see 30 yrs. of sea ice data
Climate Impact	http://www.polarhusky.com/media/cms/climatechaos/ACIA.mov	Arct & Greenland	video, satellite data,	X	X	X	X	X	X	GHG, Greenland ice sheet, ocean circulation, weather, UV	9-16 grades, General	Video Developed by ACIA - viewed through polarhusky.com website portal (password site)						video	no	Uses interviews, narration, video footage, NASA satellite images	Highlight 10 major threats facing the Arctic region	Attempt to show the complexity fo the issues facing the Arctic -
Climate Time Machine	http://climate.nasa.gov/ClimateTimeMachine/ClimateTimeMachine.cfm	Arct	Interactive with Satellite imagery		X			X		Carbon, Average Global Temp	General	NASA	X		X			not directly but can partner with explanatory website: http://climate.nasa.gov/keyIndicators/index.cfm#seaIce	NASA Satellite imagery	Series of data visualizations	Show changes through time	
Coastal Arctic Food Web	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_SealceDynamics_ACoastalArcticFoodWeb.pdf	Arct	Hands on activity, worksheets		X	X			X		HS	Univ of Alaska Fairbanks					physical model	integrates to standards	n/a	Connect food web to sea ice loss	Hands on activity to encourage students to project future impacts to SI loss	

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Cool Cores Capture Climate Change	http://serc.carleton.edu/eet/cores/index.html	Antarc	Antarct. sediment cores							Sediment cores, Polar Ice	9-16 grades	ANDRILL/ SERC site			X				use PISCAT program	standards based	ANDRILL	analyze ocean sed. Cores, use graphing tool, look at how polar ice impacts climate change	Use ANDRILL sediment cores to discuss polar climate change
Discovering Antarctica A-level: Climate Change past and present	http://www.discoveringantarctica.org.uk/alevel_2_3.html	Antarc	interactives							ice cores, fossils	11-16 grades	BAS			X				some activities	graphs, NOAA, IPCC	understand methods for determining past climate, and current trend	understanding paleoclimate as a key to present	
Earth System: Ice and Global Warming	http://www.teachersdomain.org/resource/ess05.sci.ess.earthsys.esglaciers/	Arct	Film, graphs				X			Mass balance	HS to General	NASA Goddard, WGBH				X			Through WGBH	NASA	Impact of Global Warming on the glaciers	Mass Balance of the glaciers	
Earth's Albedo & Global Warming	http://www.teachersdomain.org/resource/ipy07.sci.ess.watcyc.albedo/	Arct	satellite data		X		X			Albedo & Snow cover	HS to General	NASA, USGS, WGBH			X	X			Through WGBH	Animations & visualizations	Albedo or reflectance in the polar regions & SLR	Arctic sea ice decline from 1979-2007	
Earth's Cryosphere: Antarctica	http://www.teachersdomain.org/resource/ipy07.sci.ess.watcyc.cryoantarctica/	Antarc	satellite data		X		X			ice streams, ice shelves, clouds	HS to General	WGBH & NASA				X			Through WGBH	NASA	Impact of warming on Antarctica. Role of sea ice in circulation	examines satellite images of Antarctica	

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Earth's Cryosphere: The Arctic	http://www.teachersdomain.org/resources/ipy07.sci.ess.wa.tcyc.cryoarctic/	Arct, Greenland (some Ant)	satellite data		X						HS to General	WGBH & NASA				X			Through WGBH	NASA	The role of the poles and snow in climate	examines satellite images of the polar regions - albedo etc. is covered	
Earth's Energy Guide: Albedo	http://eo.ucar.edu/educators/ClimateDiscovery/ESS_lesson4_10.19.05.pdf	Arct, Antarc	satellite data				X			Albedo	9-16 grades,	UCAR						X	Activity & worksheet	Yes	NSAS	explore how color relates to warming	Glaciers - although main focus is on non polar glaciers it does discuss Antarctica
Effects of Climate Change Oceans & Ice	http://learningcenter.nsta.org/products/symposia_seminars/UCAR/webseminar4.aspx	Arct, Antarc	graphs, images		X		X	X			Prof. Dev.	NSTA/UCAR							ppt	No	NASA, various research scientists	Effects of climate change in polar regions	glaciers, SLR, sea ice
Elder Insights in Weather & Hunting* (*Arctic students only)	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_ElderInsightsOnWeatherAndHunting.pdf	Arct	Arctic Elder Knowledge	X	X	X					HS	Univ of Alaska Fairbanks						X	Interview	integrates to standards	Arctic Elders	Learn about local conditions from historic knowledge	Interview elders to learn about changes in the environment

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ELOKA - Exchange for Local Observation and Knowledge of the Arctic	http://eloka-arctic.org/resources/	Arctic	Data, interviews	x	x	x	x	x	x		General	ELOKA				X		X	no	multiple sources, research based	Document and share among the northern people data on the changing region	Sharing and Preserving traditional knowledge	
Evidence of Change Near the Arctic Circle	http://mynasadata.larc.nasa.gov/prview_lesson.php?&passid=98	Arctic	data time series		X						HS	NASA						X	Datasets	standards based	NASA	generate graphs, observe parameter relationships & changes	Use graphing software to plot data and Show relationship between Sea surface temp, sea ice etc.
Exchange for local observations and knowledge of the Arctic	http://eloka-arctic.org/data/																						
Exploring Polar Oceanography: Ocean currents & climate connections	http://www.pbs.org/newshour/extra/teachers/lessonplans/science/jan-june08/polar_oceanography.html	Arctic & Greenland	graphs, images								9-16 grades	PBS (reviewed CLEAN resource)						X	webbased exploration	yes	Arctic climate assessment, weather data etc., NASA, WHOI	Examine the polar climate through maps, images and online data tools, explore density & currents, creating graphs & analyzing climate data	working with data & visualizations

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Exploring the Cryosphere Using Data from the National Snow and Ice Data Center	http://serc.carleton.edu/usingdata/datasheets/NationalSnowIceDC.html	Arct, Antarc	satellite data		X						9-16 grades	NSIDC, SERC				X			Datasets	n/a	Satellite imagery	Use of data in teaching	Integrating data sets into curriculum
Features of a Frozen Earth	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_Permafrost_FeaturesOfTheFrozenEarth.pdf	Arct	worksheets, satellite images, photos	X							HS	Univ of Alaska Fairbanks						X		integrates to standards	Satellite imagery	Help students recognize causes & physical features of permafrost & commonality with Mars	worksheet discussion of two ecosystems
Frost Depth Measurements* (*Arctic students only)	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_Permafrost_FrostDepthMeasurements.pdf	Arct	Aerial photo, field data collected by student participants	X							HS	Univ of Alaska Fairbanks					X	Field Activity	integrates to standards	Aerial image, Student collected	Collect field data of frost layer	Teach students to accurately collect their own data in the field, understand the depth of the frost layer	
Future of Arctic Sea Ice and Global Impacts	http://www.arctic.noaa.gov/future/	Arct	satellite data		X						General	NOAA				X				no	Satellite imagery	A Logic chain showing cause and impacts of a warming Arctic on the rest of the Earth	Sea Ice changes

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Glaciers	https://www.as.uky.edu/sites/default/files/elearning/module13swf.swf	Alpine Glaciers	Simulation				X				Types & Models	HS to General	Houghton Mifflin Company for University of Kentucky	X			X				no	visualizations no data	Explain different types of glaciers and glacial processes	Glacial mechanics
Glaciers then and now	http://www.windows2universe.org/teacher_resources/teach_glacier.html	Arct	photos				X					HS to General	Windows to the Universe (reviewed CLEAN resource)						X	game-like matching	integrates to standards	USGS	Match images of then and now for Alaskan glaciers	Demonstrate shrinking glaciers due to warming climate
Global Climate Change	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_GlobalClimateChange.pdf	Arct & Greenland	climate graphs for last century plus				X	X			temperature	HS	Univ of Alaska Fairbanks					X		integrates to standards	IPCC	Look at Greenland and compare warming there to warming in Alaska	Examine IPCC data and use this to create hypotheses	
Global Ice Viewer	http://www.nasa.gov/externalflash/globaliceviewer/	Arct, Antarc, Greenland	photos, animations and video visualizations		X		X	X				General	NASA				X			no	Landsat, Modis, Sea Ice imagery, Radarsat etc.	Show changing ice surfaces	Show evidence of change using satellite imagery	
Global Warming Threatens Shishmaref	http://www.teachersdomain.org/resource/ean08.sci.ess.watcyc.shishmaref/	Arct	Film, Oral History	X	X	X			X			HS to General	Spanner Films						film	Through WGBH	Interviews	Effects of global warming on sea ice conditions, storms, and native hunting	Impact of local changes on Inuit population	

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Go North - Explore (what is climate change to you)	http://www.polarhusky.com/explore/	Arct	Movies, maps, narratives		X	X				X		9-16 grades, general	PolarHusky.com (password site)							website & graphs, film & videos	no	Uses video, maps, photos	Bring the Arctic to life with you traveling along on an annual expedition	sled dog travel in the Arctic - see the environment and changing conditions
Goddard Scientific Visualization Studio	http://svs.gsfc.nasa.gov/search/Keyword/index.html	Arct, Antarc, Greenland	data visualization, remote sensing data, video	X	X		X	X	X		Undergrad, general	NASA					X				no	NASA	A comprehensive library of visualizations including polar processes	Wide range of visualizations, some matched with film and interviews
Google Earth tours of glacial change	http://serc.carleton.edu/NAGTWorkshops/climatechange/activities/21214.html	Arct, Alaska,	google earth				X				9-16 grades					X					yes	google earth data	Students learn key indicators of glacial change & create their own Google Earth tour	A detailed Google Earth tour of glacier change over the last 50 years
Graphing Climate Change	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_GraphingClimateChange.pdf	Arct	temp charts, maps								temperat ure HS	Univ of Alaska Fairbanks							Review sections of DVD	integrates to standards	map and data from Alaska Climate Research Center	graph temps. & compare different regions in Alaska	graphing temp data, look at regional differences	

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Graphing Sea Ice Extent in the Arctic and Antarctic	http://www.windows2universe.org/teacher_resources/graphs/teach_sea_ice_extent.html	Arct, Antarc	Graphing		X						HS	Windows to the Universe (reviewed CLEAN resource)							X		integrates to standards	NSIDC	graphing, hypotheses building, climate	Annual fluctuation of sea ice in both poles and change through time	
Greenland Ice Sheet Project 2: A Record of Climate Change	http://www.tufts.edu/as/wright_center/wdop/products/climate_card/pages/page01a.htm	Greenland	GISP2 Ice core								9-16 grades	UNH								X		D. Zachary Smith, UNH	GISP2 ice core	Demonstrate relations between temp. and methane gas &/or Calcium dust	Reviewing & interpret graphs of data
How does Land Cover Affect Global Temperature?	http://www.classzone.com/books/earth_science/terc/content/investigations/es1504/es1504page01.cfm?chapter_no=investigation	Arct, Antarc	Map visualization		X		X				9-16 grades, general	Exploring Earth								X		No	NCEP/NCAR, TERC, varied	Visualize annual sea ice changes Arctic, Antarc., season, SST, Albedo etc.	Using visualizations to introduce temp. and climate variations on the global Earth
Hunters Navigate Warming Arctic	http://www.teachersdomain.org/resource/ean08.sci.ess.earthsys.hunting/	Arct	Film, Oral History	X	X	X					HS to General	National Film Board of Canada										film Through WGBH	Interviews	Changing Arctic Environment, using traditional knowledge with Western sciencw	Impact on the Inuit population

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Ice Cores: Unlocking Past Climates	http://wosu.org/ice-cores/	Arct, Antarc, Greenland	short films & website ,								ice cores	Undergrad, general	WOSU public media - University Place is a collaborative project of WOSU, WPSU/Penn State and WPT/Wisconsin							X	short films	yes films linked with curriculum activities	University Place/WOSU - provides university-generated content to local audiences and beyond.	Ice Core Research and climate info.	Short films show how ice cores are collected, their use as a climate proxy, ice cores as a timeline etc.	
Ice Shelf and Ice Sheet Simulation	http://www.teachersdomain.org/resource/ipy077.sci.ess.watcyc.icesimulate/	Arct, Antarc, Greenland	Film of physical model		X			X				HS	Texas A&M, WGBH								physical model	Through WGBH	Physical Model	Show difference between Sea Ice and an Ice Sheet	Observation of a physical model	
Ice Stories - climate change media	http://icestories.exploratorium.edu/media/?s=+&idea=climate+change	Arct, Antarc	videos, presentations, multimedia	X	X	X	X	X	X			General	San Francisco Exploratorium			X	X					no	scientists from the field	Exposure to broad concepts integrated with field science	personal connection to the science and the scientists	
Impact of Arctic Climate Change	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_ImpactsofArcticClimateChange.pdf	Arct	Global Climate interactive DVD, ACIA. (2004). Impacts of a Warming Arctic. Canada: Cambridge University Press.	X		X		X				HS	Univ of Alaska Fairbanks								X	Review sections of DVD	integrates to standards	Data from International Arctic Research Center	identify impacts of Arctic warming & positive & negative attributes	After watching DVD and reading article synthesize info into political cartoon

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				Permafrost	Sea Ice	Ppl	Glacier	SLR	Marine Eco-system	Other			S	B	W	V	P	O						
Interview with a Researcher: Let's Talk with Christina Hulbe about Studying Ice Flows for Clues to Climate Change	http://www.amnh.org/education/resources/exhibitions/climatechange/educationresources.php#undertanding	Antarc	Interview				X				HS	AMNH						X		no	Scientist interview	Glacier role in climate, modeling,	Puts Human face on science, explores connection between glaciers and climate	
Interview with a Researcher: Let's talk with Martin Jeffries about Sea ice and Climate in Antarctica	http://www.amnh.org/education/resources/exhibitions/climatechange/educationresources.php#undertanding	Antarc	Interview		X						HS	AMNH							X		no	Scientist interview	Role of sea ice, remote sensing, ice cores in studying climate	Puts Human face on science, explores methods/tools of science & connection between sea ice and climate
Introduction to Permafrost	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_Permafrost_IntrotoPermafrost.pdf	Arct	Data Graphs, Images and Activity	X							HS	Univ of Alaska Fairbanks							X	Physical model	integrates to standards	Data Graphs, images from International Arctic Research Center	analyze graphs, define & identify permafrost, identify active layer	using graphs and images as data source to better understand active layer of permafrost
Inuit Observations of Climate Change	http://www.teachersdomain.org/resource/ipy07.sci.ess.watcyc.inuitobserv/	Arct	Oral History/Film Clip		X	X					HS to General	International Institute for Sustainable Dev. & WGBH						X		Movie	Through WGBH	Interviews,	Resident histories & interviews of climate change	Human impact

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Investigating Ocean Currents (thermohaline circulation) - (ACMP)	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_SealceDynamics_InvestigatingOceanCurrents.pdf	Arct, Antarc	modeling activity, worksheets							thermohaline circulation	HS	Univ of Alaska Fairbanks						physical model	integrates to standards		role of ocean circulation in climate	hands on physical modeling of ocean circulation
Is Greenland Melting	http://serc.carleton.edu/eet/greenlandmelt/index.html	Greenland	photos, maps, GIS data				X			Snow cover	9-16 grades	SERC			X			standards based	Satellite imagery	Use map & data to understand changes in ice cover	Researcher work and the changing ice cover and speed of change in Greenland	
Landsat Image Mosaic of Antarctica: NASA site	http://lima.nasa.gov/	Antarc	satellite data, maps, interactive atlas				X				9-16 grades, general	NASA				X		Maps	yes	Landsat ETM	Understand changing glacier through activities based on the LIMA maps	moving ice streams, changing Antarctic snow and ice cover
Landsat Image Mosaic of Antarctica: USGS site	http://lima.usgs.gov/	Antarc	satellite data, maps, interactive atlas				X				9-16 grades, general	USGS, NASA, BAS				X		Maps	some activities	Landsat ETM	examine snow and ice cover in Antarctica to show changes	Antarctic snow and ice cover

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Life in the Arctic - After Climate Change	http://www.youtube.com/watch?v=ZA_ntcxOsRk	Arct - Bering Sea	video		X				X	water temp.	General	Woods Hole Oceanist						Video	no	scientists from the field	Productivity in the Arctic - food web If the climate warmed what could be the impacts on the foodweb	How Climate Change could impact the Arctic Ecosystem	
Limiting Factors in Ecosystems	http://www.globe.gov/tc/tg/earth_la_seaphen_p7.pdf?sectionId=267&lang=EN	Arctic	maps,							Polar Ecosystems - boreal	HS	GLOBE (reviewed CLEAN resource)						X	graphs	graphs or temp, precip, plant growth	yes	understanding of different ecosystems by understanding the influence of temperature and precipitation	Students correlate graphs of vegetation in vigor with those of temperature and precipitation on data for four diverse ecosystems (including polar)
Losing Permafrost in Alaska	http://www.teachersdomain.org/resource/ean08.sci.ess.watcyc.bakedalaska/	Arct	Film	X							HS to General	Spanner Films & WGBH					X	film	Through WGBH	Scientist & Native interviews	effects of permafrost	complex system of feedbacks in the Arctic	
March of the Polar Bears	http://climate.nasa.gov/keyIndicators/index.cfm#seaIce	Arct	maps, data time series		X				X		HS	NASA						X	data sets, maps	standards based	NASA	analyze maps, data and construct explanations	consider impacts of enviro. Change on Earth and wildlife

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March of the Polar Bears: Global Change, Sea Ice, and Wildlife Migration	http://myNASAdata.nasa.gov/prview_lesson.php?&passid=90	Arct, Alaska, Beaufort Sea	maps, NASA satellite data, Sea Surface Temp, USGS polar bear data						X		9-16 grades	NASA (reviewed CLEAN resource)	X			X			yes	Satellite imagery	Using an array of data show how ice cover data & sea surface data is used to determine impacts on Polar Bears	predictions of polar bear populations depends on polar ice
Melting Ice	http://www.teachersdomain.org/resource/ipy07.sci.ess.watcyc.lpmeltingice/	Arct, Antarc	compiled activity pulling from multiple data types		X	X	X	X			HS	WGBH			X	X	X		Through WGBH	multiple sources - but data based	Role of Ice in the Earth System	Integrating multiple resources to understand the role of ice in climate
Modeled Arctic Sea Ice Thickness From 1940 Through 2060	http://svs.gsfc.nasa.gov/vis/a000000/a001000/a001075/index.html	arctic	data animations and visualizations		X						General	NOAA & NASA Goddard	X			X			no	NASA Satellite imagery	120-year slice of time is modeled, offering a research window on to experimental processes that require longer time frames than human lifetimes	for period from 1940 to 2060 measurable Arctic ice decreases.

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MODIS Antarctica viewer (Moderate Resolution Imaging Spectroradiometer)	http://planet.sr.unh.edu/MOA/	Antarc	Composite satellite data				X				undergrad	multiagency science team - NASA satellite				X			no	(Moderate Resolution Imaging Spectroradiometer)	Provide viewer of compiled data for this region	an open exploration of data
MODIS Greenland viewer (Moderate Resolution Imaging Spectroradiometer)	http://planet.sr.unh.edu/MOG/	Arct, Greenland	Composite satellite data				X				undergrad	multiagency science team - NASA satellite				X		no	(Moderate Resolution Imaging Spectroradiometer)	Provide viewer of compiled data for this region	an open exploration of data	
MODIS Mosaics Antarctic	http://rapidfire.sci.gsfc.nasa.gov/subsets/?mosaic=Antarctica	Antarctica	Composite satellite data				X				undergrad	multiagency science team - NASA satellite				V		no	(Moderate Resolution Imaging Spectroradiometer)	Provide viewer of compiled data for this region	an open exploration of data	
MODIS Mosaics Arctic	http://rapidfire.sci.gsfc.nasa.gov/subsets/?mosaic=Arctic	Arctic	Composite satellite data				X				undergrad	multiagency science team - NASA satellite				X		no	(Moderate Resolution Imaging Spectroradiometer)	Provide viewer of compiled data for this region	an open exploration of data	
NCSE-NASA Curriculum Module - Seasonality	http://www.eoearth.org/article/NCSE-NASA_Curriculum_Module_-_Seasonality	Arctic, Greenland	Remote sensing data		X						undergrad	NCSE-NASA						ppt yes	NASA	Use of satellite imagery to demonstrate	To look at climate seasonality - Part III is polar focused - entire project begins with N. Am. Focus	

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NOAA Climate Services (includes global climate dashboard)	http://www.climate.gov/#climateWatch	Arctic, Greenland	Remote sensing data		X		X				multiple	general	NOAA	X		X	X				no	NOAA	Portal for NOAA outreach	mechanisms and stories around global climate change
NOAA Coastal Inundation Tool	http://www.csc.noaa.gov/digitalcoast/inundation/	Arctic, Greenland, Antarctic	data visualization					X				General	NOAA	X			X				No	NOAA tide gauges	Visualize SLR around the coastal regions of the country	What regions will be impacted by SLR
NOAA Impact Mapper	http://csc.noaa.gov/digitalcoast/tools/slrviewer/	Arctic, Greenland, Antarctic	data visualization					X				General	NOAA	X			X				No	NOAA tide gauges	Visualize SLR around the coastal regions of the country	What regions will be impacted by SLR
NOAA Sea Ice Extent	http://www.nsvl.noaa.gov/education/animation/PolarIce.mov	Arctic, Antarctic	data visualization		X							General	NOAA				X				No	NASA QuikSCAT Satellite	Display 3 years of sea ice data	Demonstrate the North Pole/South Pole differences in extent for a given time of the year

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Northwest Passage	http://serc.carleton.edu/sp/library/google_earth/examples/northwest_passage.html	Arct	google earth		X				X	X	9-16 grades	On the Cutting Edge, SERC							X	yes	google earth data	use satellite, aerial imagery, maps, graphs, and statistics to interpret trends with changes in the Earth system.	Impact of changes on shipping routes, marine ecosystems, economic
NSIDC Data on Virtual Globes: Google Earth	http://nsidc.org/data/google_earth/	Arct, Antarc, Greenland	satellite data	X	X		X			Soil Moisture	9-16 grades	NSIDC						X	krnz files of data	n/a	Satellite imagery - MODIS, Sea Ice Index etc.	help people better understand the cryosphere—	Provide data in visualizations
Observation of Climate Change	http://www.teachersdomain.org/resource/ipy07.sci.ess.watcyc.saobclimate/	Arct, Antarc	Maps, visualization		X	X	X			X	General	WGBH					X			yes	NASA etc.	data gathered through local resident surveys and by remote satellites are complementary tools that help deepen our understanding of the effects of climate change	Various types of data demonstrating climate change

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On Thin Ice in the Bering Sea	http://www.pbs.org/wgbh/nova/extremeice/thinice.html	Bering Sea	video storytelling by researchers		X					X	Yupik Culture, how data is collected	General	WGBH NOVA							film	no	film video	A series of 4 video stories, exploring the past and future of the fast-changing Bering Sea region - the changes in ICE, its culture and people, and the new polar science that is emerging from an expedition on board the Coast Guard cutter Healy.	The essential role of sea ice in the Bering Sea and the changes that are occurring. How we learn about the Arctic, past and present data collection, changes that are occurring in the Bering Sea
Paleoclimatology: The oxygen balance	http://earthobservatory.nasa.gov/Features/Paleoclimatology/_OxygenBalance/	Arct, Antarc, Greenland	text, graphs, diagrams								using oxygen isotopes to understand climate	Teachers, undergrad	NASA							text, graph, diagrams	no	individual researchers	explain the role of oxygen isotopes in understanding paleo climate	isotopes in glacial ice, shells etc.

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Penguin Response to Climate Change	http://www.teachersdomain.org/resource/ipy077.science.penguin/	Antarc	Film						X	Ice Shelf	HS to General	Lloyd Fales & Seetspot Films, Inc & WGBH						film	Through WGBH	Scientist from the field	Changing Antarctic climate & impact on Adelies	Impact of changing environment due to climate on the lifecycle of the penguin	
Polar Bears & Climate Change	http://www.teachersdomain.org/resource/lps077.life.eco.polarbear/	Arctc	WWF video		X				X		HS	WGBH & WWF						X	Through WGBH	WWF Video	Introduce the threat of climate to polar bears	Tagging and monitoring of the bears to understand their range	
Polar Discovery	http://polar.discovery.who.edu/	Arctc, Antarc, Greenland	video, text, stories		X	X	X	X	X		HS to General	WHOI	X		X			X	no	5 WHOI cruises	Introduce both polar ecosystems, circulation patterns, geography, exploration etc.	The unique features of the poles and their differences and similarities.	
Polar Frontier Project real weather forecast maps for the Arctic	http://bprc.osu.edu/resources/pfp/	Arctic	Maps, visualizations							Air temp, Sea surface temp, sea level, pressure	Undergrad, general	Byrd Polar Research Center and the Columbus Zoo							X	no	Byrd Polar Research Center Polar Meteorology Group	Visualize Arctic temperatures	Show differences over land masses and water etc.
Polar Palooza	http://passpartoknowledge.com/polar-palooza/f4/	Arctc, Antarc, Greenland	video presentations (Vodcasts)	X	X	X	X	X	X		General	Polar Palooza-								no	scientists from the field	Exposure to broad concepts integrated with field science	personal connection to the science and the scientists

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Polar Sea Ice Blog	http://neven1.typepad.com/blog/	Arctic	graphs, images, satellite data, visualizations		X						General	Nevins				X			graphs	no	multiple sources, research based	to engage people in discussion of changing sea ice extent and thickness	focus on changing arctic sea ice as a representation of climate change
Science Bulletins: Melting Ice, Rising Seas	http://www.amnh.org/education/resources/exhibitions/climatechange/educationresources.php#undertanding	Greenland	Science Bulletin: Short Movie				X	X			General	AMNH							short movie	no	Scientist interview	SLR from Greenland, how we determine sea level was higher in the past	Role of Greenland in SLR, understanding past climates
Sea Ice Board Game - (ACMP)	http://arcticclimatemodeling.org/lessons/acmp/acmp_58_SeaIce_SeaIceBoardGame.pdf	Arct, Antarc	boardgame		X						designed 5-8 but can scale up (no decision making)	Univ of Alaska Fairbanks		X						integrates to standards	photo images of sea ice	Introduce stages of sea ice formation in a gamelike setting	students getting data into the hands of decision makers and the public
Sea Ice Outlook	http://www.arcus.org/search/seaiceoutlook/	Arctic	Data, reports		X						General	NSF, NOAA, Arcus							graphs, charts	yes	CRREL, NSIDC, AWI, Satellite	Portal for sea ice information	Portal for sea ice information
Sea Level Rise	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_MappingSeaLevelRise.pdf	Arct	Topo maps of Alaska		X		X	X			HS	Univ of Alaska Fairbanks							physical model	integrates to standards	maps of Arctic	use and create topo map, discuss impact of SLR on Alaska	Role of glaciers vs. sea ice in SLR

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SEARCH: Sea Ice Outlook	http://www.arcus.org/search/seaiceoutlook/index.php	Arctic	links to data,								ARCUS						pdfs,	Education page - http://www.arcus.org/search/seaiceoutlook/outreach/index.php	NOAA	Provide community-wide summary of the expected September arctic sea ice minimum	NOAA and community data sets on Sea Surface Temp, Sea Ice Current and Predictions, Ice Drifter Data	
SEARCH: Sea Ice for Walrus	http://www.arcus.org/search/siwo	Arctic	webcams, links to maps of NOAA Sea Ice Analysis & Forecasts		X					X	Undergrad, general	ARCUS, NOAA					webcam	no	NOAA	Provide community-wide summary of the expected September arctic sea ice minimum	NOAA and community data sets on Sea Surface Temp, Sea Ice Current and Predictions, Ice Drifter Data	
Secrets of the Ice: An Antarctic Expedition	http://www.mos.org/sotj/icecore/index.html	Antarc	Simulations, maps, ITASE		X		X (mass balance)				9-16 grades, general	Museum of Science					field logs	no	NASA	Ice Core Research and climate info.	Use multi year and multi parameter of expedition to focus on Antarctica and climate	

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September 2007 Arctic Sea Ice vs 1979-2007 Average with Graph of 1979 to 2008 Ice Areas	http://svs.gsfc.nasa.gov/vis/a000000/a003500/a003573/index.html	Arct	data visualization, graphs		X						General	NASA Goddard				x			no	Satellite imagery	compares the difference between the perennial sea ice minimum area on September 14, 2007 and the 1979-2007 average minimum sea ice.	show declining levels of sea ice
Ssssno Seals	http://www.polarrec.com/resources/lesson/ssssno-seals	Arct (Bering Sea)	student generated						X		9-16 grades, general	PolarTrec						classroom lab activity, ppts	yes	PolarTrec	Look at cycle of life for seal, connection to ecosystem, human impact on this	Connection of seals (and via proxy other animals) to their environment
Stories in the Ice* (*WGBH version is not interactive - and thus not engaging - however the PBS version is interactive & more engaging - MT)	http://www.pbs.org/wgbh/warming/stories/ OR use the PBS Interactive called 'Ice Core Timeline' http://www.pbs.org/wgbh/nova/warnings/stories/	Greenland & Antarctica	Ice Core - Greenland and Antarctic							Ice core	HS to General	PBS & WGBH - based on NOVA's "Warnings from the ice"	X - PB					X	Through WGBH	Antarc. & Greenland ice cores	Explore Earth's climatic history, using polar ice core data	Step by step walk through several ice cores to demonstrate what can be learned

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Studying Snow and Ice Changes	http://mynasadata.larc.nasa.gov/prereview_lesson.php?&passid=69	Arct	maps, data time series		X		X					Snow & Ice	HS						X	Datasets	standards based	NASA	examine how snow and ice cover have changed from 1994 to 2004,	use some of the data analysis tools available at My NASA Data
Take Aim at Climate Change	http://passporttoknowledge.com/polar-palooza/whatyoucando/taacc/	Arct, Antarc	music video		X	X	X	X	X			General	Polar Palooza-							music video	No	researchers - varied	Impact of Global Warming on the polar regions and engage young people in taking action	Young people to encourage and empower them to take action
The book of Ice	http://www.djspooky.com/antarctica/	Antarc	Information put to Music									General - young adults	DJ Spooky										To bring a new perspective to the Antarctic landscape and situation	interviews, photographs, histories, architectural plans, propaganda, sheet music, hyperlinks and a manifesto demanding that you never set foot there.

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The Climate Game	http://www.tufts.edu/as/wright_center/iecws/materials_wright_dev.html listed under Climate Game	Arct & Greenland	GISP2 Ice core								Ice core	HS	Tufts University		X						no but standards listed	GISP2 ice core	Learn more about glaciers and environmental change	
The Cryosphere Today	http://arctic.atmos.uiuc.edu/cryosphere/	Arct, Antarc, Greenland	maps, animations, charts, graphs		X							HS to General	Polar Research Group, Univ. of Illinois at Urbana-Champaign	X			X			graphs, charts	no	Snow and ice data provided by the National Center for Environmental Prediction /NOAA, NSIDC, U. Bremen	Provide current data on sea ice cover in both poles	showing trends, discrete data sets, seasonal visualizations
The heat is on	https://www.cresis.ku.edu/education/k-12/teacher-workshops	Arct, Antarc, Greenland	videos, presentations, lectures, multimedia, graphs and charts		X	X	X	X				Undergrad, general	CRISIS						video, ppt, pdfs	no	Uses video, graphs, images	Resource bank for teachers and undergrad	Series of talks by scientists on Communicating climate change	
The Melting North Pole: Satellites Reveal Changes in Arctic Sea Ice	http://www.nvl.noaa.gov/MediaDetail.php?MediaID=83&MediaTypeID=2	Arct	Video of satellite data - microwave data		X							General	NOAA						video	no	DMSP data - Satellite imagery-2007-2008	Show decline of sea ice since mid 1990S	Sea Ice changes	
Tour of the Cryosphere	http://svs.gsfc.nasa.gov/vis/a000000/a003100/a003181/index.html	Arct, Antarc	video	X	X		X				solar radiation	General	NASA							no	Satellite imagery	Introduce complexity of the cryosphere	overview of Polar processes	

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Tour of the Cryosphere	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_SealceDynamics_TourOfTheCryosphere.pdf	Arct, Antarc	worksheets based on NASA video	X	X		X				solar radiation	HS	Univ of Alaska Fairbanks						X		integrates to standards	NASA Satellite imagery	Introduce complexity of the cryosphere	Integrate key points into Venn Diagram of Cryosphere processes		
Track A Polar Bear	http://www.teachersdomain.org/search/?q=Polar&fq_grade=PK&fq_grade=PS	Arct	Radio & Satellite data		X							General (slated lower but easily can be used for general)	WGBH & USGS							X	X		Through WGBH	USGS Alaska Science Center	Show the range of the bears through radio data and threat from shrinking sea ice	Examines migration patterns of polar bears
Trends of Snow Cover and Temperature in Alaska	http://mynasadata.larc.nasa.gov/preview_lesson.php?passid=19	Arct (Alaska)	data sets								Snow & Temp	HS	NASA							X		Datasets	standards based	NASA	Data collection, correlations and predictions	examine 2 different data sets and compare trends
UMASS - IPY STEM Connections : Polar Connections	http://umas12.net/ipy/materials/	Arct, Antarc	ppts, worksheets, video files of teacher presentations		X		X	X	X		Albedo, Insolation & Climate	HS student/ppts and some activities could be undergrad	UMASS							X		ppt	A wide range of classroom focused materials with ppts to deliver main concepts - activity based	multiple sources - but data based	Introduce polar content into STEM concepts	Teacher workshop materials with lesson plans on wide range of topics
Understanding Albedo	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_ClimateChange_UnderstandingAlbedo.pdf	Arct, Antarc	student generated								albedo	HS	Univ of Alaska Fairbanks									Physical model	integrates to standards	Inquiry based	Set up and test model on Albedo feedback	Inquiry based learning of concept

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UNEP/GRID- - - Arendal's Polar Programme	http://www.grida.no/polar/	Arct, Antarc	IPY	X	X	X	X	X	X		General	IPY, multiple science partners			X	X			movies, blogs etc	n/a	multiple sources, research based	Portal for international issues and science research	current issues, current research
Uses of Permafrost* (*available only to Arctic students)	http://arcticclimatemodeling.org/lessons/acmp/acmp_912_Permafrost_UsesOfPermafrost.pdf	Arct	Elder from Arctic community	X							HS	Univ of Alaska Fairbanks						Visit from Elder & Field Trip	integrates to standards	Arctic Elders	Observe & Draw Permafrost Features	Learn from community elders & from visual observation in the field	
USGS IPY Climate Research	http://international.usgs.gov/ipy/resources/climate_change.shtml	Arct (Alaska)	graph, summary of science articles	X			X				General	USGS			X			maps	no	USGS	Changes in permafrost temperature and thickness as indicators of climate change.	Use permafrost as an indicator of climate change	
Using NASA NEO and ImageJ to Explore the Role of Snow Cover in Shaping Climate	http://serc.carleton.edu/eet/albedo/index.html	Arct	satellite data								9-16 grades	Albedo & Snow cover	SERC			X			standards based	Satellite imagery	correlate land surface temperature, snow cover, and reflected short wave radiation data	Use NASA Earth Observation (NEO) satellite images for understanding interrelatedness of data	

POLAR EDUCATION RESOURCES

Activity or Resource Title	url	Region	Data Type	Data Topics							Audience	Author/ Institution	Activity Type						Developed Curriculum	Data Source	GOAL	Focus	
				Permafrost	Sea Ice	Ppl	Glacier	SLR	Marine Ecosystem	Other			S	B	W	V	P	O					
Venture Arctic	http://www.pocketwatchgames.com/venture-arctic	Arct	?						X	Terrestrial Ecosystem	HS to General	Pocketwatch Games	X							no	unknown	understand and protect the roles of animals in the ecosystem	Stewardship of the ecosystem
Whither Arctic Sea Ice	http://serc.carleton.edu/eet/seaice/index.html	Arct, Antarc	satellite data		X				X		9-16 grades	SERC & CIRES			X	X				Satellite imagery	measure seasonal variation in sea ice & long term trends, handle data	Using 30 yrs. of sea ice data students examine, compare and make decisions	
Woods Hole Polar Discovery site	http://polar.discovery.whoi.edu	Arct	website with graphic animations, interviews, sound tapes,		X	X			X	Arctic & Antarctic circulation graphics	General	WHOI			X				NO	Satellite imagery, WHOI	Covers range of topics to showcase their polar research including climate change and glaciers	Showcasing their IPY research and work shows 'science in action' lots of video interviews in the archive	
Yearly Changes in Sea Ice @ Poles	http://www.windows2universe.org/earth/polar/sea_ice/sea_ice_north_animation.html	Arct, Antarc	data visualization		X						HS, undergrad	Windows to the Universe	X		X	X			no	NSIDC	Visualize annual sea ice changes Arctic, Antarc., season and monthly comparisons, includes future projection	Annual fluctuation of sea ice in both poles, projection to 2049	