

# The Annotated “Take AIM at Climate Change”

## Verse 2

**Singer:** “Man, why should I care what’s going on there?  
What does ice<sup>1</sup> and wildlife<sup>2</sup> mean to my life?”

**MC:** See, that’s the catch, it’s not all that obvious  
But changes in the North and South are gonna affect all of us.<sup>3</sup>

That’s why we got polar adventurers<sup>4</sup>  
Measure the thickness of the ice<sup>5</sup>, and checkin’ the Earth’s temperature.<sup>6</sup>

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<sup>1</sup> While most of us only think about ice when we want something cold to drink, nature’s ice comes in many forms that are beautiful, functional and an essential part of Earth’s climate system. Ice that forms as the ocean surface freezes in winter is called *sea ice* and is usually not more than 12 feet thick. Sea ice can have a lifetime of a few years and moves in response to winds and currents. In contrast, *glaciers* (<http://nsidc.org/glaciers/quickfacts.html>) range from 100 meters to over 4,000 meters thick (that’s more than 13,000 feet, close to 3 miles.) Glacier ice usually flows a few meters per year (and up to 14 km/yr.) and the front advances or retreats in response to changes in precipitation and temperature. The lifetime of a mountain glacier is on the order of hundreds to thousands of years, whereas the larger Antarctic and Greenland ice sheets have been around for millions of years. (<http://www.nsidc.org/data/atlas/index.html>)

<sup>2</sup> Arctic wildlife (<http://www.saskschools.ca/~gregory/arctic/Awildlife.html>)  
Antarctic wildlife (<http://www.antarcticconnection.com/antarctic/wildlife/index.shtml>)

<sup>3</sup> To paraphrase the Las Vegas tourist slogan, “what happens at the Poles doesn’t stay at the Poles.” One important reason is that ocean currents transport heat around the globe and in doing so help regulate Earth’s climate. Cold surface ocean currents, called “eastern boundary currents”, carry cold waters from the polar regions toward the Equator while western boundary currents, like the Gulf Stream, transport warm water from the equatorial regions toward the Poles. This causes northern Europe to be much warmer than communities at the same latitude in Canada. ([http://www.windows.ucar.edu/tour/link=/earth/Water/ocean\\_heat\\_storage\\_transfer.html&edu=mid](http://www.windows.ucar.edu/tour/link=/earth/Water/ocean_heat_storage_transfer.html&edu=mid))

Atmospheric circulation also transports heat and moisture around the globe. Cold, dry air from the polar regions moves toward the Equator until it becomes warm and moist enough to rise away from the Earth. This happens at about 60° latitude. As that air rises, the water vapor begins to condense to form precipitation. There are three of these vertical circulation cells in the atmosphere: the Polar, mid-latitude and Hadley cells. Air and water movement caused by density variations is an important factor in both atmospheric and ocean circulation. ([http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/circulation/global\\_scale\\_circulation.html](http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/circulation/global_scale_circulation.html))

<sup>4</sup> During the 4<sup>th</sup> International Polar Year, which ran from March 2007 through March 2009, over 50,000 scientists from more than 60 countries have been studying different parts of the Arctic and Antarctic system. This includes research on topics ranging from continental-scale ice sheets to microscopic algae in the ocean and includes earth scientists, biologists, chemists, physicists, atmospheric scientists and many more. For more on America’s contribution and links to other nation’s research and education projects, please visit <http://www.ipy.org/>

“Word life”<sup>7</sup>, that ice is the Earth’s refrigerator<sup>8</sup>  
But when it starts to melt it will be felt at the Equator<sup>9</sup>

Peop’, when glaciers melt, the oceans start swellin’<sup>10</sup>

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<sup>5</sup> Sea ice thickness is a function of atmospheric and ocean temperatures, as well as its age. Multi-year sea ice is thicker than first year sea ice. Warming ocean and atmospheric temperatures have dramatically decreased the extent of Arctic sea ice, but has also caused the ice to thin. Thinner sea ice is more susceptible to break up by the wind and warming temperatures. Between 2006 and 2008 sea ice along the coast of Greenland thinned the most. ([http://nsidc.org/sotc/sea\\_ice.html](http://nsidc.org/sotc/sea_ice.html)) You can see Corps of Engineers researcher Jackie Richter-Menge checking sea ice in the POLAR-PALOOZA podcast at: <http://passporttoknowledge.com/polar-palooza/pp06aplis02.php>

<sup>6</sup> NYU oceanographer and mathematician David Holland thinks that it’s the temperature of sea water that is making glaciers in both the Arctic and Antarctic move faster. He also knows that actual data is often missing, and so he has set out with colleagues to measure air and ocean temperatures both in Greenland and Antarctica. You can see his research expeditions on the Pine Island Glacier (Antarctica) and Jakobshavn (Greenland) at <http://passporttoknowledge.com/polar-palooza/pp06pig01.php> and [http://www.pbs.org/newshour/bb/environment/july-dec07/greenland\\_08-01.html](http://www.pbs.org/newshour/bb/environment/july-dec07/greenland_08-01.html)

<sup>7</sup> In case you don’t know the phrase “Word life…” here’s a definition from the “Urban Dictionary”: “Word Life”: Originally originating as Latino slang in the ’80s to mean “I swear to you on my life what I tell you is true”, it eventually was picked up by rappers in the early ’90s to mean “I promise”. Eventually all rappers were using it, but it wasn’t the ‘in’ slang until E-40 used it every other word (in his everyday speech). Eventually it was heard in the movie “Big Money Hustlas” starring ICP and Twiztid where Big Stank (Jamie Madrox) and Lil’ Poot (Monoxide) would spit it as their catch phrase. After seeing this movie, John Cena decided to use it as his own catch phrase.

<sup>8</sup> Ice keeps the Earth cool because it has a high “albedo.” Albedo is another word for reflectivity. Light colored objects, like ice, reflect most of the sunlight that reaches them and we say they have a high albedo. In this way, ice prevents the Sun’s radiation from being absorbed and transformed into heat, thereby keeping Earth cool. However, over the past several decades, summer sea ice cover has been declining over the Arctic. (<http://svs.gsfc.nasa.gov/vis/a000000/a003500/a003556/>) In 1970, the summer sea ice covered an area of 10 million km<sup>2</sup>, and by 2000 it covered about 8 million km<sup>2</sup>. In 2007 sea ice cover shattered all previous records and reached a low of 5.5 million km<sup>2</sup>. This reduction in sea ice extent means that more of the Sun’s radiation can be absorbed by the ocean, further warming the planet and melting more sea ice. (You may have read that in summer 2008, the extent – or area covered – of Arctic sea ice increased. Some skeptical bloggers interpreted this to mean “global warming” was no longer an issue: we wish they were correct, but NOAA and NASA researchers believe the 2008 ice was mainly thin, first year ice, and that the 2008 volume (i.e. extent times thickness) was at an all-time low. However, Earth’s climate is very complex. The total amount of Arctic sea ice will very likely continue to fluctuate year by year. The only way to understand what’s happening is by continuous careful measurements gathering objective data.

<sup>9</sup> People around the Earth, including those living at the Equator, will be impacted in a whole variety of ways in a warming world. The Intergovernmental Panel on Climate Change (IPCC) (<http://www.ipcc.ch/>) wrote a report which summarizes the impacts around the world (<http://www.ipcc.ch/ipccreports/ar4-wg2.htm>) For instance: “Agricultural production, including access to food, in many African countries and regions is projected to be severely compromised by climate variability and change... In some countries, yields from rain-fed agriculture could be reduced by up to 50% by 2020.” In Asia decreased availability of freshwater “could adversely affect more than a billion people by 2050”.

And then they flood the coasts where the people be dwellin'<sup>11</sup>  
Could say "Peace" to Florida, New York, and California<sup>12</sup>,  
All drowning in the ocean<sup>13</sup> - don't say we didn't warn ya!

For real, all it takes is a couple degrees<sup>14</sup>

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<sup>10</sup> Melting glaciers and ice sheets cause sea level to rise, flooding low-lying coastal areas like New Orleans and Venice. Sea ice is different because it is already floating, so melting sea ice cannot cause sea level rise. Since 1993, melting glaciers have contributed just over 1mm/year to sea level rise; most of this has come from the melting of mountain glaciers. If all the ice in the much larger Greenland and Antarctic ice sheets melted, sea level would rise more than 70 meters (~230 ft). Predictions of actual sea level rise for the next century are very difficult to determine but most estimates range from 20-60cm. ([http://nsidc.org/sotc/sea\\_level.html](http://nsidc.org/sotc/sea_level.html)) Breaking news (March 2009) – at a conference in Copenhagen preparing for upcoming climate negotiations, researchers presented evidence that the IPCC estimates (quoted above) were an under-estimate. New data from both Greenland and Antarctica suggest sea level rise may be one meter by the end of the 21<sup>st</sup> Century. (<http://www.guardian.co.uk/environment/2009/mar/11/sea-level-rises-climate-change-copenhagen>)

<sup>11</sup> Over 630 million people live within 10 m elevation of current sea level. (<http://eau.sagepub.com/cgi/content/abstract/19/1/17>) That means about 10% of the world's population is at risk of experiencing a whole range of coastal hazards including flooding and erosion, loss of fresh water supplies for drinking and irrigation, reduction of agricultural lands, and population pressure as displaced residents relocate. At particular risk are small, low-lying island nations, such as the Maldives and Kiribati. These countries already have plans in place should they need to permanently evacuate their population to another country. (<http://www.islandsfirst.org/index.html>)

<sup>12</sup> Many U.S. coastal regions, including many of our largest cities, are vulnerable to sea level rise. For instance, if sea level rises just one meter the Louisiana Gulf coast will witness inland migration of the coastline by tens of kilometers in most areas. The Mississippi delta would be the hardest hit and the coastline could retreat as much as 100 kilometers inland. This region is extremely important for shipping, coastal fisheries and has a unique cultural heritage. Click here <http://www.globalwarmingart.com/sealevel> to explore the sea level threats to California, New York and anywhere around the globe.

<sup>13</sup> It is important not to be alarmist. Climate scientists do not expect catastrophic coastal flooding caused by several meters of sea level rise to happen by the end of the 21<sup>st</sup> Century. But several are worried that without taking steps to curb greenhouse gas emissions we may set Earth on a path where such massive disruptions are inevitable. They argue it's up to this and coming generations to make choices about how much Earth will change in coming centuries.

<sup>14</sup> While the planet's climate has been relatively stable during the past 10,000 years – a period when human civilization first flourished (meaning the development of agriculture, city life, and written history) – Earth has experienced natural climate fluctuations during that time, such as the Little Ice Age, when a temperature drop of about 1°C had major consequences. The cooler temperatures and increased variability in climate was felt most strongly in Europe in the 17<sup>th</sup> to 19<sup>th</sup> centuries. Crop production declined as the growing season became shorter. The increased precipitation is linked to the spread of the bubonic plague, which is estimated to have led to the death of a third of the European population. Collapse of the Norse settlements in Greenland may also be partially attributed to increased sea ice extent and these seemingly small temperature changes. Remember that *climate* is very different from *weather*. Weather is our daily experience of climate. The term climate refers to the average temperature and precipitation over decades. Typically when scientists talk about predictions of a 2°C temperature

Before floods, droughts<sup>15</sup>, and hurricanes<sup>16</sup> are not anomalies<sup>17</sup>  
And all these catastrophes become our new realities  
Comin' down on the world just like the Sword of Damocles<sup>18</sup>.

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increase, that refers to the global average temperature. It does not mean that every place on the planet will warm exactly 2°C, some places will warm more, and some places less. Studies of Earth's past climate provide a context in which we can understand how much 1° C matters. For instance, the average temperature difference between the last ice age (about 20,000 years ago, when ice almost a mile thick covered much of North America) and today is in the range of 5-9°C. The Earth has warmed 0.7° in the past 100 years and projections for the next 100 years show an additional warming of 1.5-3.5°C. A couple of degrees can make a huge difference!

<sup>15</sup> The IPCC reports that warming in the past century has already altered Earth's hydrologic system. Snowmelt is happening earlier and lakes and reservoirs are heating up. These are commonly used as sources for our drinking water and so we find that water shortages and decreases in water quality are becoming more frequent. The IPCC also concludes that precipitation is very likely to *increase* at high latitudes and *decrease* at lower latitudes, providing benefits to some and problems to others, including possible conflicts over diminished supplies. Lastly, most projections show an increase in the number of extreme precipitation events enhancing the likelihood of flooding. In places, total precipitation may not change, but the altered timing and intensity of the precipitation may disrupt the patterns to which humans, plants and animals are accustomed.

<sup>16</sup> Hurricanes are powered by the heat stored in the ocean, so warmer waters may increase the intensity of hurricanes in the future. Many scientists are studying this topic and although it is not clear if the overall *number* of hurricanes will increase, most agree that the intensity of hurricanes *will* increase. Although global warming cannot incontrovertibly be said to “cause” any one particular hurricane, it can increase the likelihood that a tropical storm will pass over waters that are warmer than average. In late August 2005, Hurricane Katrina passed over the Gulf of Mexico where the surface water temperature was 2°F above normal. This heat provided additional fuel to strengthen Hurricane Katrina into a category 5 storm. The destruction in New Orleans was made worse by the fact that large areas of the city lie below sea level, making them extremely susceptible to flooding.

<sup>17</sup> As noted in several places, Earth's climate is extremely complex and it's hard to predict with absolute certainty what the new “realities” will be. (“Anomaly”, a·nom·a·ly, n, “something that deviates from the norm or from expectations” Encarta® World English Dictionary © 1999 Microsoft Corporation. All rights reserved.) Here's how climate scientist Stephen Schneider tries to explain the odds: “...when communicating with laypersons, I try to use accessible language and metaphors ... For me, metaphors that convey both urgency and uncertainty are best – particularly for controversial cases like climate change. For example, I often say climate is like a die: it has some hot faces, some wet faces, some dry faces, etc. I think our (in)action on global warming is *loading the climatic die* (emphasis added) for more heat and intense drought and flood faces. Similarly, I might ask an audience: ‘If you put a pan full of water in the sun and another in the shade, which will evaporate first?’ Since everybody knows the answer, such a metaphor for intensifying the hydrological cycle that will occur with global warming adds to clear communication...” (<http://stephenschneider.stanford.edu/Mediarology/MediarologyFrameset.html>)

<sup>18</sup> According to Wikipedia, the “Sword of Damocles” is frequently used (for example, by the Roman orator, Cicero) to epitomize “...the imminent and ever-present peril faced by those in positions of power” and “More generally ...to denote the sense of foreboding engendered by the precarious situation, especially one in which the onset of tragedy is restrained only by a delicate trigger or chance.”

<http://en.wikipedia.org/wiki/Damocles>

**CHORUS:**

Take aim at climate change... (Let's take aim)

Take aim at climate change... (something...)

Take aim at climate change... (Gotta all work together)

Take aim at climate change...