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# THE DAY AFTER TOMORROW SCENARIO: WHAT IF GLOBAL WARMING CAUSES RAPID CLIMATE CHANGE?

by Michael K. Lee\*

In a 2004 Hollywood movie entitled “The Day After Tomorrow,” a climatologist tries to save his son who is stuck in frozen New York because the world was suddenly plunged into a new Ice Age. The movie was an exaggeration to be sure; designed to entertain moviegoers. Nonetheless, a growing consensus of both scientists and policymakers are taking rapid climate change seriously. What if global warming causes rapid climate change and what are the policy implications if that did happen?

Scientific evidence confirms that over the past millions of years the global climate has been on a pendulum from warm or interglacial periods to cold glacial conditions. The grand climate shifts occur during spans of tens of thousands of years, caused by a combination of changes in the tilt of the Earth’s rotational axis (every 41,000 years), changes in the orientation of the Earth’s elliptical orbit, called the “precession of the equinoxes” (every 23,000 years), and changes in the shape (more or less round) of the elliptical orbit (every 100,000 years).<sup>1</sup> Consequently, the traditional scientific view of climate change is that it is slow and gradual over a span of tens of thousand or at least thousands of years.

However, through ice cores from Greenland and Antarctica, evidence has been mounting since the 1970s that, in between the grand shifts in climate, there are serious oscillations in climate — occurring within the span of decades rather than thousands of years.<sup>2</sup> This phenomenon, called “rapid climate change,” is followed by long interludes at equilibrium in significantly warmer or colder states. The best known example is the Young Dryas cooling of 12,000 years ago, a transitional climate event that is thought to have begun and ended within a decade and, for the one thousand year duration thereafter, the North Atlantic region was five degrees Celsius cooler.<sup>3</sup> A shorter cool period occurred more recently in the Little Ice Age which occurred from 1300 AD to about 1800 AD.<sup>4</sup> Historical events, such as the Vikings leaving Greenland, have been attributed to the Little Ice Age.<sup>5</sup> Scientific evidence, through lake sediment as well as ice core studies, suggests that rapid climate change occurs with relative frequency: “during the

past 110,000 years, there have been at least [twenty] such abrupt climate changes.”<sup>6</sup>

Scientists are unclear what causes rapid climate change but one highly viable mechanism is an ocean dynamic called the “Great Ocean Conveyor Belt.”<sup>7</sup> The Great Ocean Conveyor Belt is a circulation system that transports heat throughout the world’s oceans. Much of the ocean circulation is dependent upon the salinity of the oceans. As warmer weather melts the ice around Greenland and the Arctic, the melted fresh water makes major North Atlantic Ocean regions less salty, and the cold, less salty water then sinks. Fresh water is less dense and does not sink as readily, which would slow down the Ocean Conveyor. The significance of this slowdown is that presently, “[t]he conveyor circulation increases the northward transport of warmer waters in the Gulf Stream at mid-latitudes by about 50 [percent]

over what wind-driven transport alone would do.”<sup>8</sup> Should serious disruption in the Great Ocean Conveyor occur, model calculations indicate the potential for cooling of three to five degrees Celsius in the ocean and atmosphere — causing weather repercussions of the same magnitude as the Little Ice Age.<sup>9</sup>

Various government, inter-governmental entities, and non-government organizations have researched the possible public policy implications in the event such rapid climate change occurs. According to one study done in the United States,<sup>10</sup>

rapid climate change may potentially cause: (1) an annual average drop in temperature by up to five degrees Fahrenheit over North America and Asia, and a drop of six degrees Fahrenheit in northern Europe, making northern Europe’s climate more like Siberia’s; (2) an annual temperature increase by up to four degrees Fahrenheit in areas throughout South America, Australia, and Southern Africa; (3) the persistence of drought-like conditions for a majority of the decade in important agricultural regions and in areas providing water resources for population

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*Developing nations will be most affected by the struggle for food, energy, and water as they lack the resources and capacity to quickly adapt to the climate change.*

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centers in eastern North America and Europe; (4) shortages of food because of decreases in overall global agricultural production; (5) commercial fisherman that fish in a specific region will have difficulty in adapting to the massive fish migrations; (6) decreased quality and availability of fresh water in important regions because of shifting precipitation patterns, which will likely cause more frequent droughts and floods; (7) restricted access to energy supplies because of extensive sea ice and storms; and (8) mass migrations, including those stemming from northern Europe.<sup>11</sup>

Developing nations will be most affected by the struggle for food, energy, and water as they lack the resources and capacity to quickly adapt to the climate change.<sup>12</sup> In particular, for the over 400 million people living in drier, subtropical, often over-populated and economically poor

regions, climate change and its effects are likely to pose severe risk to political, economic, and social stability.<sup>13</sup> Some nations, especially those with poor relations with their neighbors, are also likely to be involved in struggles over food, clean water, and energy.<sup>14</sup> Meanwhile, nations with relatively intact resources,

such as the United States, “may build virtual fortresses around their countries, preserving resources for themselves.”<sup>15</sup>

As the science on rapid climate change improves, nations should prepare for its contingency and inevitable effects. Suggestions on preparations include determining which countries will be the most vulnerable to changing climatic conditions, identifying strategies to enhance water management capabilities, and rehearsing various adaptive responses.<sup>16</sup>



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*A growing consensus of both scientists and policymakers are taking rapid climate change seriously.*

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## Endnotes:

<sup>1</sup> Ocean and Climate Change Institute, Are We on the Brink of a ‘New Little Ice Age?’ (Feb. 10, 2003), available at <http://www.whoi.edu/institutes/occi/viewArticle.do?id=10046> (last visited Feb. 11, 2007). See also Jonathan Adams, Mark Maslin & Ellen Thomas, *Sudden Climate Transitions During the Quaternary*, 23 *PROGRESS IN PHYSICAL GEOGRAPHY* 1 (1999).

<sup>2</sup> Adams, *supra* note 1, at 3-4.

<sup>3</sup> Adams, *supra* note 1, at 4.

<sup>4</sup> Ocean and Climate Change Institute, Common Misconceptions about Abrupt Climate Change, at <http://www.whoi.edu/institutes/occi/viewArticle.do?id=10149> (last visited Feb. 11, 2007).

<sup>5</sup> Ocean and Climate Change Institute, *id.*

<sup>6</sup> Weather Underground, The Science of Abrupt Climate Change, available at [www.wunderland.com/education/abruptclimate.asp](http://www.wunderland.com/education/abruptclimate.asp) (last visited 01/15/2007). See generally, COMMITTEE ON ABRUPT CLIMATE CHANGE, ABRUPT CLIMATE CHANGE: INEVITABLE SURPRISES (National Academy Press 2002).

<sup>7</sup> Weather Underground, *supra* note 6.

<sup>8</sup> Ocean and Climate Institute, *supra* note 1.

<sup>9</sup> Ocean and Climate Institute, *supra* note 1.

<sup>10</sup> Peter Schwartz & Doug Randall, *An Abrupt Climate Change Scenario and Its Implications for the United States National Security* (October 2003), available at [http://www.climate.org/PDF/clim\\_change\\_scenario.pdf](http://www.climate.org/PDF/clim_change_scenario.pdf) (last visited Feb. 11, 2007).

<sup>11</sup> Schwartz & Randall, *id.*

<sup>12</sup> Schwartz & Randall, *id.* at 5.

<sup>13</sup> Schwartz & Randall, *id.*

<sup>14</sup> Schwartz & Randall, *supra* note 10, at 2.

<sup>15</sup> Schwartz & Randall, *supra* note 10.

<sup>16</sup> Schwartz & Randall, *supra* note 10, at 2-3.