

The Day After Tomorrow worksheet



1. What continent are the main characters taking ice samples from in the beginning?
2. What happened to the ice shelf?
3. What was the vice president of the U.S. worried about at the global warming conference in?
4. What type of precipitation was falling at the New Delhi, India global warming conference?
5. What tools are used to monitor the ocean temperature by the ocean researchers?
6. What types of precipitation fell in Tokyo?
7. What types of clouds does Sam's plane fly into?
8. What types of weather did they get in Los Angeles, California?
9. When one scientist says only the sun can affect the global temperature, Jack says what current could be responsible?
+
+
10. What states will be most affected by the weather changes in the movie, the North or the South?
11. What city is Sam in while waiting to return home to Washington D.C.?
12. Sam has good instincts because when the power starts to go out at the house he tells the other to do what?
+
+
13. List two reasons why Sam and his friends go to the library:
+
+
14. Why should Sam stay in New York?
15. What is ironic (involving a surprising or apparently contradictory fact) about the people crossing the Rio Grande River at the border of Texas, USA and Mexico?
+
16. What do they need to get from the ship?
17. What does the space shuttle see at the end of the movie?
18. Do you think "The Day After Tomorrow" is true, or is there something in the movie that you think could not happen in real life? You can refer to the information below

By Jeffrey Masters, Ph.D. — Director of Meteorology, Weather Underground, Inc.

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Modern computer models of the Earth's weather show that the only types of storms planet Earth can manage are the current ordinary hurricanes, blizzards, and thunderstorms. The formation and evolution of the superstorm as described in *The Day After Tomorrow* and *The Coming Global Superstorm* is a meteorological impossibility. Let's summarize just a few of the scientific impossibilities in the movie:

o Clusters of thunderstorms cannot merge together to form a continent-scale blizzard with a calm eye over land. Huge storms with calm eyes can only happen over the oceans. These storms are called hurricanes, and require that the core of the storm be over warm ocean waters in order to utilize the powerful latent heat energy that water vapor gives up when it condenses into rain. And the laws of physics do not allow these type of storms to create blizzard conditions, only heavy rain.

o A 300-foot high storm surge whipped up by the intense winds of the superstorm smashes through Manhattan. There's a little problem here--the winds needed to create a storm surge of this magnitude are probably at least twice the speed of sound (1200 mph), yet there is little apparent wind on the ocean's surface as the wave smashes ashore.

o The superstorm is shown in many scenes rotating clockwise, and in other scenes counter-clockwise. Oops, all large-scale storm systems in the Northern Hemisphere must rotate counter-clockwise, thanks to one of the laws of physics on a rotating planet called the Coriolis force. So, enjoy the special effects. Discuss how you wished they'd spent more money showing more special effects instead of showing so much drippy melodrama. Ponder the precautionary nature of the tale as you drive home in your fossil-fuel guzzling vehicle, and take the opportunity to learn more about the science of abrupt climate change--but don't take the movie seriously. It's science Fiction

The disaster film epic, *The Day After Tomorrow*TM, depicts a world where global warming triggers an abrupt climate change, creating a global superstorm that unleashes unimaginable worldwide weather disasters. In the span of just a few days, tornados devastate Los Angeles, huge hail pounds Tokyo, and colossal tsunamis and blizzards whip New York. Could it really happen? Could global warming really cause such incredible disasters?

Like much science fiction, *The Day After Tomorrow*TM is based on some solid scientific fact. Recent scientific discoveries show that the present day climate is unusually stable, and that "normal" climate for Earth is the climate of frequent extreme jumps--like a light switch flicking on and off. Thus, the popular conception that global warming will lead to a slow and steady increase in temperature that humans can readily adapt to may be incorrect. Global warming could push the climate system past a threshold where a sudden, irreversible climate shift would occur. This would most likely happen if the increased precipitation and glacial melt water from global warming could flood the North Atlantic with enough fresh water to slow down or even halt the mighty Gulf Stream ocean current. Without the Gulf Stream pumping warm, tropical water to the North Atlantic, average temperatures would cool in Europe and North America by 5°F or more in just a few years--not enough to trigger a full-fledged ice age, but enough cooling to bring snows in June and killing frosts in July and August to New England and northern Europe, such as occurred in the famed "year without a summer" in 1816. In addition, shifts in the jet stream pattern would bring about severe droughts and damaging floods in regions unaccustomed to such events, greatly straining global food and water supplies. Climate experts consider a sudden global warming-induced climate shift unlikely in the next 100 years, but do acknowledge their computer models are too crude to know just what the probabilities are.

But no, a sudden global warming-induced climate shift could not cause the kind of instant wild weather mayhem depicted in the movie. In this respect, *The Day After Tomorrow* is science Fiction with a capital "F". The laws of meteorology get seriously abused here. Consider the book the movie is based on, *The Coming Global Superstorm*, by Whitley Streiber and Art Bell. Whitley Streiber is a UFO expert and author of the best-selling 1985 book *Communion*, a non-fiction account of his abduction by extra-terrestrials. Art Bell hosts a nationally syndicated all-night radio show, *Coast to Coast AM*, which specializes in UFOs and the supernatural. They argue that a sudden climate shift would create such strong atmospheric instability that an incredible "superstorm" must result. Powerful clusters of thunderstorms in the Arctic would penetrate deep into the stratosphere, bringing -150°F upper atmospheric air to the surface, flash freezing any living thing caught outside. The clusters of thunderstorms would merge into a continent-sized "superstorm" that would suck energy from the oceans heated by global warming, generating winds of 100-200 mph, blizzard conditions with hundreds of feet of snow, temperature falls in Canada of 100 degrees in an hour, and incredible thunderstorms with huge hail and tornados.

The primary scientific evidence Streiber and Bell offer to support their intuition involves the discovery of woolly mammoths with partially digested plant remains in their stomachs: "The sudden freezing that killed these animals required much more than a bad storm. It required a storm that was capable of delivering unprecedented levels of extreme cold to the surface and doing it so suddenly that the animals which were caught placidly grazing, did not even have time to look up.... To all appearances they were simply frozen solid where they stood without enough warning to do more than raise their

heads." It takes a pretty talented scientist to infer the existence of "superstorms" from the appearance of how a frozen animal held its head, especially when ice core, sediment core, and tree ring studies all show no evidence of historical superstorms. But Bell and Streiber are not scientists, and certainly didn't run any computer models of the atmosphere to verify their theories. Modern computer models of the Earth's weather show that the only types of storms planet Earth can manage are the current ordinary hurricanes, blizzards, and thunderstorms. The formation and evolution of the superstorm as described in *The Day After Tomorrow* and *The Coming Global Superstorm* is a meteorological impossibility. Let's summarize just a few of the scientific impossibilities in the movie:

- o The superstorm sucks vast quantities of frigid upper atmospheric air down to the surface, flash freezing any living thing caught outside. However, any graduate of a high school physics course could tell you that the air would warm on its descent in response to the requirements of the Ideal Gas Law, and would never be able to flash freeze anything. One scientist in the movie does remember his high school physics and asks, "But wouldn't the air warm as it descends?" But the senior scientist replies, "No, it's moving too fast!" Sorry, guy, but the Ideal Gas Law applies no matter how fast the air is moving. If you were on my thesis committee, I'd kick you off.
- o Clusters of thunderstorms cannot merge together to form a continent-scale blizzard with a calm eye over land. Huge storms with calm eyes can only happen over the oceans. These storms are called hurricanes, and require that the core of the storm be over warm ocean waters in order to utilize the powerful latent heat energy that water vapor gives up when it condenses into rain. And the laws of physics do not allow these type of storms to create blizzard conditions, only heavy rain.
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