CLIMATE SCIENCE FORUM

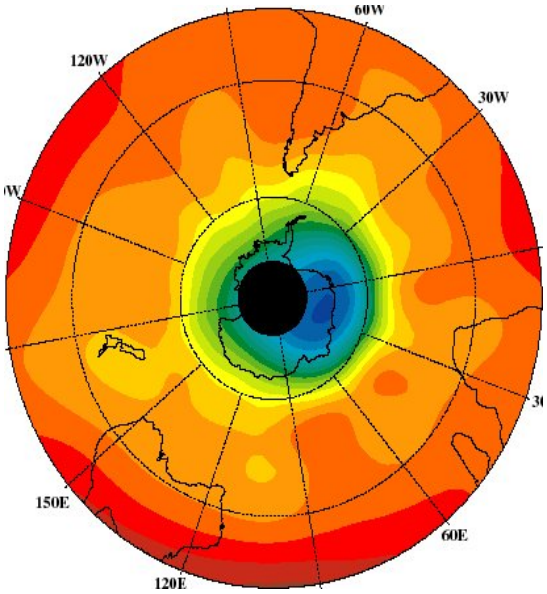
Winter 2011–12: #14

Pdf Newsletter (Ready-to-Print)

First Time Ozone Hole Formed in the Arctic

In 2011, for the first time, ozone was destroyed over the Arctic regions to an extent comparable to yearly losses in Antarctica. Although Arctic temperatures are milder than the severe cold of the Antarctic stratosphere, a comparable percentage of ozone was destroyed in both polar regions this year. Writing in *Nature*[1], Gloria L. Manney and 28 co-authors claim that a true "ozone hole" formed over the Northern Hemisphere this year.

In the 1980s, scientists were stunned to discover that a "hole" formed in the ozone layer of the stratosphere every spring over Antarctica. They were quickly convinced that the newfound ozone



Picture Depicts the Ozone Hole over Antarctica: From 1979 to 1997, total ozone declined 40% or more in blue toned zone.

disappearance was real. Chlorine compounds were destroying the natural ozone, and the only known source of chlorine was a class of man-made chemicals called *chlorofluorocarbons* (CFCs), which were manufactured as refrigerants and as propellants in aerosol spray cans. *(To page 4)*

News in this Issue

Extreme Weather now More Frequent

Trend will continue, IPCC finds

Extreme heat, intense rainfall and drought have clearly become more frequent in the last 60 years in many regions, the United Nations climate-change body reported in a summary[1] just released. The Intergovernmental Panel on Climate Change (IPCC) looked at how often extreme weather and climate events now occur, and whether economic losses related to disasters are now more frequent than before. They also projected trends through the 21st century, based on expected increases in greenhouse gases.

Economic losses from weather and climate disasters have grown in the developed nations of the world, whether the losses were insured or not (see Figure, next page, top). Losses vary tremendously from year to year, as the figure shows well, and vary greatly from one region to another. But in less developed nations, the rate of human fatalities from weather disasters is much higher (95% of such deaths are in developing nations). And economic losses in the poorer countries are taking a larger percentage of their Gross Domestic Product (GDP).

(Continued on page 2)

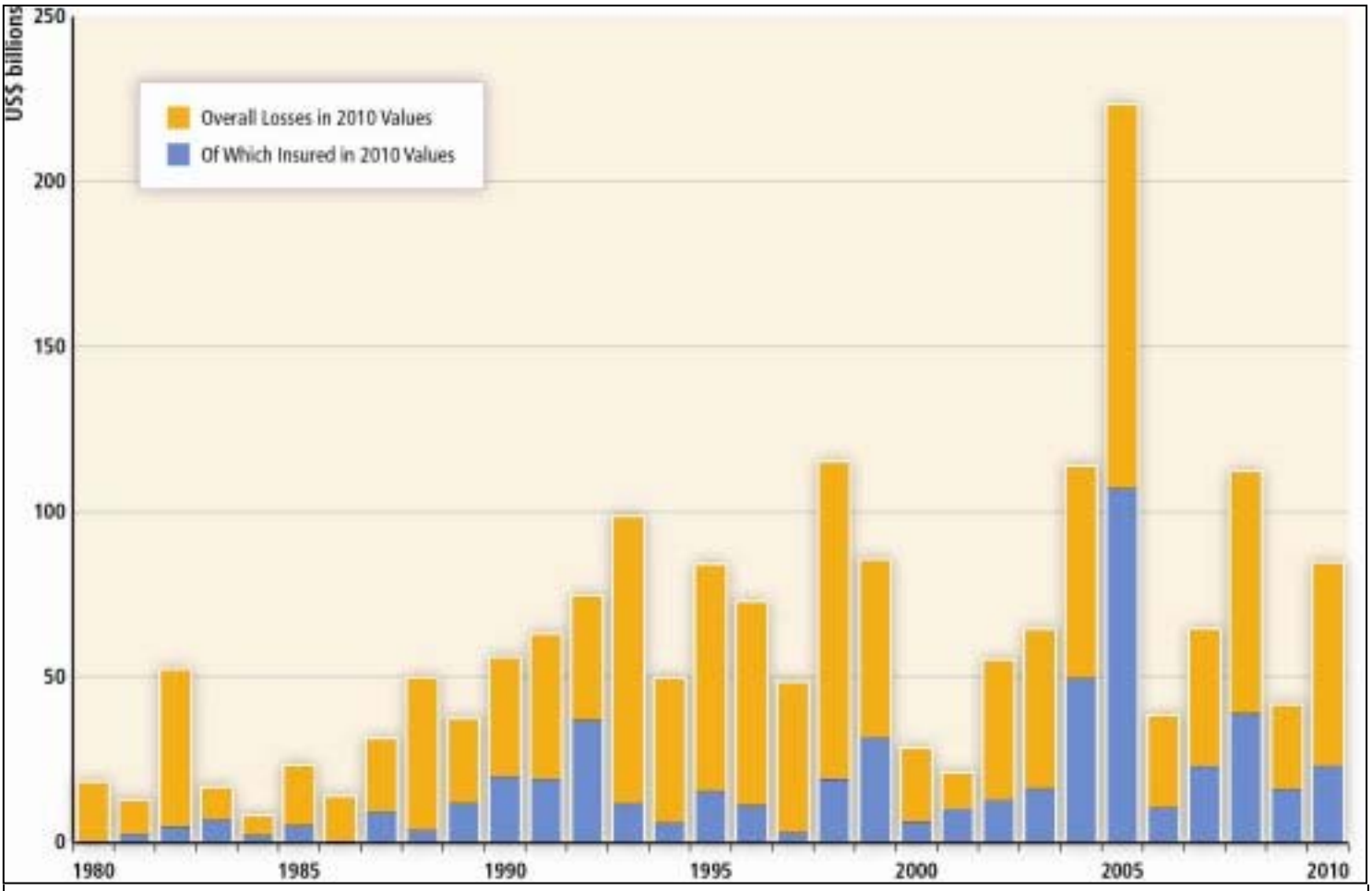


Figure: Dollar cost of weather- and climate-related disaster losses over the last 30 years, in billion US$. Insured values in blue, non-insured values in yellow, converted to values in 2010. Source: Generic presentation, Special Report on Extremes, IPCC. [http://www.ipcc-wg2.gov/SREX/images/uploads/IPCC_SREX_slide_deck.pdf]

(Extreme Weather: Continues from page 1)

The major cause of increasing economic losses from weather disasters is the increasing exposure of people and their assets to weather risks—not so much the global changes in weather or climate, although that too is important. "*Exposure*" is the presence of people, infrastructure, assets, etc. in places that could be adversely affected. More people now live on the Atlantic coastline of the US where they are exposed to landfalling hurricanes, for example; and more homes have been built on the coastline, along rivers and in flood plains than before. In addition to their greater exposure, certain groups of people have also become more vulnerable to the risks from weather-related disasters.

Heat and drought

Most land areas are seeing more warm days and warm nights than in the past; this is more than 90% probable for any location. The length and number of heat waves or warm spells have increased for many locations, but not all. The authors have medium confidence that some regions, notably southern Europe and West Africa, are experiencing longer and more intense droughts than before.

It is "virtually certain" that record-warm daily high temperatures will become more frequent through the 21st century; record-cold daily low temperatures will become less frequent. By "virtually certain," the IPCC means "from 99% to 100% probable." It is also very likely that heat waves will be longer, more frequent, and more intense.

To make this trend clear, a hot day that is now expected once in 20 years, will likely recur once every two years by the year 2100. In the northern Arctic, such a day would recur once every 5 years.

There is evidence that drought will intensify around the Mediterranean Sea, in central Europe, the middle of North America, Mexico, Central America, and southern Africa and northeast Brazil, as this century goes on. Confidence in this prediction is also "medium." The trend is a good example of what

(Continues on page 3)

(Extreme Weather, Continues from page 2)
climate scientists now expect: that wet regions will get wetter, and dry regions dryer, as the hydrological cycle of Earth speeds up.

Rainfall and floods

Up to the present, the number of "heavy precipitation" events per year has increased significantly in many regions, while a few regions see fewer heavy rain events. More regions are seeing an increase than a decrease.

Precipitation now considered "heavy" in any given region will likely recur more frequently over the 21st century, in many places. The proportion of rainfall from heavy storms will likely increase, too, in the tropics, the polar regions, and in northern temperate latitudes in the winter (but not the summer).

In some regions where precipitation is expected to decrease, heavy rainfalls are still expected to increase. There is medium confidence in this prediction.

These forecasts imply that flooding should become more problematic, but confidence in the trend of river-related flooding is low. The evidence for it is limited, and the causes of floods are very complex.

But along sea coasts the predictions are quite clear. Coastal high water levels are very likely, as sea level continues to rise everywhere, and wind speeds and waves increase over the temperate zone oceans (*Climate Science Forum*, summer 2011)[2].

Hurricanes and typhoons have been headline news in the last ten years. It may surprise many that this report did not find any trend in tropical cyclone activity over the last 40 years or more. They were compelled to this conclusion after noting that modern observing systems (especially satellites) detect tropical cyclones in remote oceans much better than pre-1960 technology did. Their prediction for the 21st century is nuanced: that the global frequency of tropical cyclones will either remain the same or will decrease, while the top wind speed of such cyclones will likely increase. ("Likely" means from 66% to 100% probable.)

There is medium confidence that the number of cyclones (low-pressure systems) in the temperate and polar latitudes will decrease. This implies that storms will be less frequent, although in storms that do occur, heavy rain will be more frequent.

(To column at right) →

Reducing the Risks

Many risk-reduction measures make sense under a wide range of future climates. These are called "low-regrets" measures, and include systems to warn people of disasters; to provide better water supplies and drainage; to enforce better building codes; to manage land and ecosystems sustainably.

Reconstruction after a disaster provides an opportunity to "do it better" for the next disaster. But short-term fixes that protect people from immediate risk (such as a levee) may increase future risks (if more people move into a flood plain and develop the low-lying land, for example). Measures that dissuade people from building on low-lying, flood-prone land would make economic sense in the long term.

Managing risks works best when tailored to local circumstances. Communities can reduce their risk and adapt to climate change if they combine local knowledge with scientific expertise that is tailored to their community.

Citations

1. Intergovernmental Panel on Climate Change (IPCC), 2011: ***Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, special report*, Summary for Policymakers, 18 Nov. 2011, 29 p., Geneva.**

2. "Winds Grew in Power over much of the Oceans" - *Climate Science Forum*, summer 2011, p. 1.

CLIMATE SCIENCE FORUM

http://climate-science.org

Editor-in-Chief: Michael A. Fortune, Ph.D.

Email: editor @ climate-science. org

Published at Portland, Oregon, USA

Tel: (503) 922-0003

(First Ozone Hole in Arctic — Continued from page 1)

In the Antarctic stratosphere, temperatures routinely plummet to an extremely frigid –80°C by the end of winter. When that happens, water vapor and nitric acid condense into polar stratospheric clouds from 15 to 30 km above the ground. The cloud particles offer surfaces on which chemical reactions, involving chlorine, can be catalyzed. These reactions decompose ozone in the atmosphere.

Scientists were not sure that an ozone hole would form in the Arctic, since the Arctic stratosphere rarely gets cold enough for these clouds to form, although they did observe that some ozone was lost every year. Manney's team reports that the whirl of air around the Arctic known as the "polar vortex" was unusually cold and isolated from surrounding regions for four months ending in March 2011. That isolation was enough to destroy most of the ozone there by March—unprecedented in the Northern hemisphere.

While the greenhouse effect warms the lower atmosphere, it actually cools the stratosphere. That is because greenhouse gases intercept some of the heat radiation that Earth emits to outer space. That energy warms the lower layers, but what the low layers gain, the upper layers lose. So the stratosphere has been steadily cooling for several decades precisely because the greenhouse effect has become stronger.

Thus, with ever more global warming at the surface, a very cold stratosphere like the one in 2011 may occur more often, which would favor future Arctic ozone holes. With some concern, the authors add that such a hole "could exacerbate biological risks from increased exposure" to ultraviolet radiation, especially when the polar vortex shifts over populated middle latitudes, as it did last April.

Citation:

1. "Unprecedented Arctic ozone loss in 2011" by Gloria L. Manney and 28 others (2011). *Nature*, vol. 478, 469–475, 27 Oct. 2011, doi:10.1038/nature10556.

11-Year Solar Cycle Indeed Influences Cold Winters

Climatologists have long argued whether the sun's activity, which waxes and wanes through an 11-year cycle, might influence seasons on Earth to be warmer or colder than usual; or whether variations in solar energy might add to long-term global warming. In the last 25 years, some observed that winter-season westerly winds in middle latitudes weakened during the quiet phase of the sun's 11-year cycle, when the sun is less active. Such proposals encountered two problems. First, there is no known mechanism up to now by which the solar wind or solar particles in "outer space" can affect weather patterns. Second, as a result of that, climate models have not been able to consistently simulate any influence of solar variations on the weather.

With a published letter in *Nature Geoscience*[1], Sarah Ineson and 6 colleagues at the Hadley Centre in the UK found a plausible way that the solar cycle may affect pressure and temperature patterns, and simulated an influence on winter climate that resembles that of the North Atlantic Oscillation (NAO), a natural cycle that greatly affects the winters in North America and Europe..

Satellite observations now show that solar ultraviolet (UV) radiation became less intense in the quiet phase of the last solar cycle, and that the intensity dropped more than had been thought possible, from the active to the quiet phase. In the last, unusually long solar minimum (2004 to 2007), the flux of UV radiation in the middle of the UV spectrum fell, by four to six times more than had been assumed before. Ultraviolet rays strongly heat the stratosphere, as ozone absorbs the rays and heats up. How might the heating at very high levels influence winds at much lower levels?

The Hadley scientists put the new UV observations into their climate model, to look for an effect of this reduction in UV intensity between the peak and the trough of the 11-year cycle. The effect resembled the pressure and temperature patterns of the North Atlantic Oscillation (NAO), in its negative state. When the NAO is negative, cold winters are the rule in the United States and northern Europe, and mild winters in Canada and southern Europe.

The last three winters, from 2008 to 2011, were abnormally cold in the Eastern and Midwestern United States. The authors imply that the recent quiet period of the solar cycle, an unusually long and inactive period, were partially responsible for the string of three cold winters in the US. According to them, this periodic relationship offers a new tool for prediction of seasonal climate over periods of ten years or more.

Citation:

1. "Solar forcing of winter climate variability in the Northern Hemisphere" by Sarah Ineson and 6 co-authors, *Nature Geoscience*, vol. 4, 753-757, Nov. 2011, doi: 10.1038/NGEO1282.

Return Home