

Natural Hazards and Global Climate Change: What Does the Future Hold for us?

Menas Kafatos, PhD

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mkafatos@gmail.com

With the recent release of the Intergovernmental Panel on Climate Change (IPCC) report, put together by an international panel of experts under the auspices of the United Nations, governments and the public throughout the world are becoming acutely aware of the dangers to human societies of global warming, precipitated by the uncontrollable and continuing in an ever increasing manner release of greenhouse gases such as carbon dioxide and methane. Model predictions carried out into the future, indicate possible increases of global atmospheric temperatures by as much as 5 degrees Celsius over the next hundred years, which would have disastrous global consequences for droughts, agricultural productivity and sea level rise. The models are not accurate enough to give us the exact scenario of what may happen but they all point to increases of global atmospheric temperatures.

Governments in the world are increasingly under pressure from not just the scientific community but also the public to do something about curtailing the release of greenhouse gases from fossil fuels, which, most scientists believe, is the direct reason for the increase of global temperatures. It is here where global politics, development of new economic powers and associated industrial productivity, sustaining and expanding a modern way of life, and other factors, enter the picture and complicate any possible solutions: The Kyoto Protocol needs to be renewed but it is still not clear how, who will sign it and what it will mean; the stubborn refusal of U.S. governments, to acknowledge the need to curtail greenhouse releases and limit fossil fuel burning and the associated message that this is sending throughout the world; the emergence of India and particularly China as world economic powers, with their associated increasing need of energy production and thirst to find new energy sources; the lack of massive usage of alternative sources of energy production, which to compete with fossil fuels will require years of development and economic viability; and the dream of billions of people in the world to enjoy the same modern way of life that we in developed nations take for granted, all play an effect here. Besides what the implications for the future environment, and human societies which cannot survive in a massively degraded environment these things hold, they may lead us to continued societal strife and, who knows?, even global war. It is hard to make the case that somehow governments will abandon their usual ways and not use power to prevail over others when future resources become scarce and agricultural production and feeding of their own people are threatened.

In addition to global warming there are other major concerns. Natural hazards (e.g., Hurricane Katrina) have increased and become more severe, and these natural hazards often become catastrophes. Another major concern is the collapse of ecosystems in many parts of the world. An event can happen in an ecosystem. Sometimes the effects of that event are not immediately obvious but they still affect other ecosystems. Once these kinds of events occur, their effects spread uncontrollably. These hazards are caused by human activities or are influenced by human activities. They are a challenge because they are occurring now and not tens of years into the future. Let's examine them in detail.

Natural hazards include: Wildfires, sand and dust storms, tropical cyclones (known as hurricanes and typhoons), severe weather, floods as well as droughts, and also earthquakes. With the exception of earthquakes, it is possible that increases in occurrence and severity of all or most of the above are somehow associated with human activities. This is because the increase in these hazards can be directly tied to global climate change. The IPCC report outlines several connections between global climate change and these hazards, however, we still do not

understand all the complex interactions of the Earth's ecosystems. Nevertheless, the severity and increase of natural hazards are like an alarm. This alarm is telling us to pay attention because if we do not, there will be disastrous consequences.

Recent droughts and heat waves as well as willful human activities in Europe have led to massive fires in several countries, such as Portugal, Spain, France, Italy and Greece. Many deaths in heat-stricken countries like France during past summer seasons are also on the increase. Wildfires often rage in many States in America, threatening houses and communities in general, from Georgia, to Florida, to New Mexico and California, just to mention a few. Tropical forests are being burned by people for the sake of agricultural development. They burn trees to make grass fields to feed cows and other livestock. These animals are then slaughtered to feed humans. This system is highly inefficient and environmentally degrading. Trees are also burned down to make way for new human communities. Forest fires in one country affect not just that country but also many neighboring countries. Neighboring countries can be affected through the spread of smoke aerosols. Examples of this include the Indonesian fires which affected major nearby cities like Kuala Lumpur. The burning started by humans, affects Nature because weakened forests are more likely to subsequently burn by natural causes. For example, humans burning forests in Africa promotes natural desertification, which decreases available forests even more.

Desertification in Africa has worsened droughts. It has also caused the collapse of local agricultural production and resulted in unabated famines, which have killed millions of people. In addition to droughts, there is another apocalyptic dread, war. Droughts and war have caused unbelievable human suffering. This may become a common occurrence in other parts of the world as global warming may turn many agricultural areas dry. The drier such areas become, the more water resources will be depleted in attempts to save them. Desertification often causes fires but also causes increases in sand and dust storms. Desertification and droughts in Australia are now threatening the water supplies of most Australian cities, particularly Perth. These trends that we are seeing now will become much worse with future climate change. There is data that shows an increased level of droughts, warming of many areas of the Earth, and related risks to the Earth's forests. It is possible that the increasing scarcity of water will pitch countries against countries, even leading to major wars, for control of this most important commodity, particularly in arid and semi-arid regions.

The increase of severe weather often leads to floods, and even though they are the opposite of droughts, these also seem to be on the rise. Often some areas are afflicted by droughts while other areas by floods. The extremes will become more severe: Flooded areas will get more floods and dry areas will become drier. Recent floods in Central Europe might be caused by the cutting of forests and also by global warming. Severe weather causes floods in India, Pakistan, Bangladesh, the Philippines, South American countries, and China. These floods affect economies and lead to massive deaths. Countries like Korea are increasingly experiencing the wrath of floods. Severe rains make large rivers overflow, and they also cause sudden flash flooding in major urban centers, trapping or drowning many people. Even traditionally dry areas such as Athens, Greece, are increasingly experiencing flash floods. This kind of severe weather has a particularly devastating effect in major cities, like the recent example of Mumbai, India, striking without notice and killing many people. Is climate change responsible for the increase of severe weather? Prediction models seem to indicate that this is indeed the case. But it is important to note that just because these are future models does not mean it is a future problem. These things are happening right now in front of our eyes.

Desertification in Asia and strong winds have led to an increase of the so-called "yellow sand" phenomenon. This phenomenon affects several East Asian countries, particularly China, Korea, and Japan. During the spring months, many cities in East Asia become are affected by yellow sand, leading to economic losses and increases in respiratory ailments. Desert dust from Africa crosses the Mediterranean and this causes bad weather and affects agriculture and living conditions in many European and Middle Eastern countries, in addition to North-

ern Africa itself. Forecasting dust storms is difficult because of the relationship with a complex interaction of winds. It is also difficult to predict dust storms because there are local conditions such as the nature of soil and the changing weather patterns. Once a dust storm develops, satellites from space track it. Using the satellites, weather and dust propagation models can be used to provide important information to authorities downstream of the storm.

Deserts (from where sand and dust storms originate) existed before this global climate change phenomenon. However, global warming will increase the strain on the Earth's ecosystems. Global warming is likely to turn many areas that are presently green into arid areas or even deserts. It is unlikely that deserts will become smaller because of human activities. That means that natural hazards like sand and dust storms will continue to increase in the future. These kinds of storms ignore known political boundaries and borders. Dust storms from Asia and Africa often travel thousands of kilometers, crossing the great oceans, affecting distant regions, far away from their places of origin.

The connection between tropical cyclones and global climate change is still under debate. However, many scientists believe climate change is partially responsible for the increase in cyclones. The recent increase of tropical Atlantic storms or hurricanes seems to be tied to an increase in the sea surface temperature. For example, it has been convincingly shown that abnormally high temperatures occurred in the Gulf of Mexico in summer 2005, higher than the average temperatures, and that these high temperatures led to the formation of the devastating hurricanes Katrina, Wilma, and Rita. This natural destruction was accompanied by human neglect. We ignored the signs of what might happen in terms of flooding, namely in the case of the city of New Orleans, hit by Katrina. The summer of 2006 did not prove as disastrous for the U.S. coastline because fewer storms developed. Perhaps this is because of the development of more dust storms off the coast of Africa near Sahara, and these dust storms might have curtailed the growth of hurricanes in the U.S. This is a topic that scientists are currently investigating. However, the Pacific Rim countries did feel the effect of more typhoons. It seems that regarding tropical cyclones, when the Atlantic is quiet, the Pacific often is not. And vice versa.

Will super typhoons as Korea experienced become more numerous in the future? Will more category 3 to 5 hurricanes like Katrina strike the United States in the coming years? Again, the evidence seems to be pointing to warmer oceans which will in general mean more severe storms. Global models even predict that areas that were quiet up to now may be subject to tropical storms in the future. A particularly important prediction of models run by a Japanese team show that in the future, the Persian Gulf region may experience storms. This might threaten the world's supply of oil. Specific storm occurrences cannot be predicted, however, we now have a general idea how busy a given season may be based on data. This data includes statistics and monitoring of parameters such as the sea surface temperature using satellites. Satellites can also track the development of tropical cyclones after they have formed. Satellite observations and detailed modeling are becoming new tools to better understand these phenomena.

Warmer oceans are already occurring, perhaps outpacing the expected atmospheric warming. It is predicted that by 2050, there will be no polar ice during the summer season. Besides the obvious effect to polar ecosystems, such as the possible extinction of polar bears, it may have disastrous consequences for the climates of Europe and North America as global warming might disrupt the flow of the Gulf Stream. Sea rise will continue as result of the warmer oceans. Although not classified as a natural hazard, sea rise will have disastrous consequences for many low-level coastal areas and islands of the world, where millions of people live. Under extreme scenarios, many major coastal cities may find themselves under sea water.

Besides sea level rise and warming of the oceans, human activities are responsible for the pollution of huge parts of the oceans. Such pollution in extreme cases kills fish and disrupts marine ecosystems. An ironic result is that humans cannot harvest affected fish and other marine life. Pollution of seas causes coral bleaching and the

disappearance of vast areas of coral reefs. We still do not know the implications for marine ecosystems, which are in delicate balance with the environment. Each species serves an important role for the benefit of the whole. In addition, the extreme overfishing of many seas has led to the prediction that there will be no more available fish reserves left in the open seas by 2050.

Extinction of species and collapse of ecosystems may be the way of the future and are currently on the increase. These are not directly tied to global warming but their cause is the same as for global warming: uncontrolled human activities and disregard for the Earth which sustains us all. In areas such as the Amazon, where a large percentage of the world's species reside, the collapse of tropical ecosystems may have unpredictable effects for the Earth, beyond just the local habitats. Preserving species is usually associated with small groups of activists and green political parties. But we have to realize that we humans depend on a healthy environment and that the Earth's biosphere is an immense system of checks and balances. It is not just wealth and good living conditions that are important to human societies. If the underlying environment is in ill health, human societies will be in serious peril. This issue is not just for a limited group of activists, it concerns all of humanity. No individual species can survive separated from the rest of the biosphere, not even humans. Disregarding the health of other species comprising the biosphere may ultimately be the most foolish act that humans can perform, making Nature turn in a way against us.

Another possible consequence of global warming is the migration of tropical diseases from the equator to more northern and southern regions. This is already occurring and if accelerated in the future, it may threaten temperate species and humans that have no immunity to tropical diseases. For example, malaria may migrate northward from poorer tropical regions to affluent countries. Plants in northern and southern temperate regions may become targets of virulent tropical diseases.

Along with the effects of natural hazards, the Earth's environment is experiencing increased pollution. As with natural hazards, this anthropogenic pollution is not contained within boundaries. Aerosols from dirty coal burning plants, smoke aerosols from agricultural practices or burning of forests, city pollution and dust storm aerosols, are all on the increase. Their combination can prove harmful and even deadly to many humans. Megacities of the world such as Beijing and Cairo, and regions such as the Indo-Gangetic plains of India housing more than 600 million people, are subject to the deadly combination of all natural and human-created aerosols. No major city is free of all aerosols. Scientists are now studying the propagation of such pollutants and their effect on and feedback mechanisms from regional and global climates.

Scientists are increasingly using the many available satellites to study hazards and the developing climate changes. Models are a necessary complement to observations. Support for these scientific efforts is crucial now and for the future. However, no matter what scientists do, the above problems cannot be addressed by science alone. Since these problems are global, it is essential that the world's societies are involved. Global solutions and international agreements involving all societies are of paramount importance.

The scenarios painted here are not alarmist or beyond realism. What was portrayed in Al Gore's movie "Inconvenient Truth" might actually be mild compared to future reality. What we are saying here is not meant to lead to despair and inaction but to point out what may happen so we become prepared to face the challenges, many of which are around the corner or occurring right now. Whether or not we will be able to sustain our current way of life and have our brothers and sisters in other developing countries enjoy the same is still an open question. This is because energy production (which threatens the environment and ultimately all of humanity) is necessary to enjoy a modern lifestyle. However, one thing is clear: If we do nothing and continue things as they are, a catastrophe of possible monumental proportions awaits us and particularly our children and the children of our children. For us to continue business as usual is like insisting to watch TV in a room, while the rest of our house is on fire. Besides the direct threat of global warming and its associated hazards, other threats may turn nations

against each other. These threats include dwindling agricultural production, massive famines, vanishing water supplies, and economic collapse. Global warming is arguably the greatest threat to humanity, and this may lead societies to the use of war, which may take global proportions and may accelerate the demise of global civilization.

So what can we, as ordinary citizens of the world, do? Besides the obvious task of asking our governments to pay attention to the increasing threat, we can maintain our own awareness of our place in the world and how we are part of the Earth that nourishes us and supports us. If we maintain the simple awareness “I remember the Earth, my home”, maybe this will lead us to treat the Earth and the environment the way we treat our own home; to treat the Earth with respect and love and assuring we maintain it. The Earth is our ultimate home, for all of us, irrespective of who we are or where we live. If we remember this simple message, we may be able to do what is right for us and for our fellow humans, for our fellow species, inhabiting this tiny blue dot in the universe. We may be able to pass on to our children and the children of our children a habitable planet, rather than a collapsed nightmare environment. This is not a prescription for specific political action or movement. It is a request for personal awareness and a commitment to ourselves. Whether you decide to take specific actions to limit pollution or protect the surrounding environment, it is up to you. However, if this message “I remember the Earth, my home” rings truth to you, pass it on to others. As global warming increases, simple awareness by more and more people may be what is needed.

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Menas Kafatos is University Professor and Director of the internationally known Center for Earth Observing and Space Research at George Mason University. He directs research for many hazards and leads international projects in these areas as well as aerosol and pollution propagation.