APOCALYPSE SOON

> "But of that day or hour no one knows, not even the angels in heaven, nor the Son, but the Father *alone.* Take heed, keep on the alert; for you do not know when the *appointed* time will come." (Mark 13:32-33)

Before you read the title and dismiss me as a nut who retreats to a mountaintop at midnight to await the Second Coming of Christ, read the quote just below the title again. "No one knows" exactly when Christ will come again, and I certainly do not claim such knowledge. I am just trying to read the signs of the times. [1]

People have predicted the end of the world for thousands of years, [2] and it hasn't happened yet. But things may be different today. The prophets of doom this time are not religious fanatics, but scientists. They warn us that our world-wide addiction to fossil fuels—oil, coal, and natural gas—is heating up our air and our oceans, generating problems that will one day prove difficult, or even catastrophic, for the human race if we don't change our ways.

And so far, we aren't changing our ways. Indeed, our use of fossil fuels is increasing. According to statistics from the U.S. Energy Information Administration (USEIA), worldwide petroleum consumption increased 7.3 % from 2009 to 2013; worldwide natural gas consumption increased 11.5 % from 2008 to 2013; and worldwide coal consumption increased 11.6 % from 2008 to 2012. [3] Similarly, the BP Statistical Review of World Energy [4] reflects that, from 2004 to 2014, world oil consumption increased 10.8%, world natural gas consumption increased 25.6%, and world coal consumption increased 33.3%. [5]

The USEIA projects that consumption of petroleum and other liquid fuels will increase by 36.9% between 2010 and 2040, and could increase by as much as

41.4%. [6] If we continue down this path, the future predicted by the climate scientists bears some striking similarities to what Jesus told us would precede the end times. But we will get to that. First, we need a basic understanding of what the scientists are telling us.

Basic Climate Change Facts. Carbon is one of the building blocks of life; all living organisms contain carbon. When plants and animals die, that carbon is trapped and buried with them. Oil, coal, and natural gas were at one time dead plants and animals, until time, heat, and pressure transformed them. Thus, each of these fossil fuels contains carbon. When they are burned as fuel, the carbon combines with the oxygen in the air to form carbon dioxide, or CO_2. (Carbon dioxide consists of one carbon atom, "C," joined to two oxygen atoms, "O_2"—thus, CO_2.) Combustion of fossil fuels releases billions of tons of CO_2 into the atmosphere every year.

So what's so bad about CO_2? In small quantities it is actually a very beneficial molecule—vital, in fact, for all plant life on Earth. Plants use CO_2, water, a few nutrients, and the Sun's energy to grow through a process called photosynthesis, releasing oxygen in the process—which is very convenient for us, since that is what we breathe.

Also, without CO_2 and other "greenhouse gases," such as methane, the Earth would be a much colder place. The greenhouse gases absorb some of the heat energy from the Sun before it escapes into space, just as a greenhouse traps heat inside. Because of greenhouse gases like CO_2 the average temperature on Earth is about 58° Fahrenheit; [7] without them, the average temperature would be a very chilly two to four degrees *below zero*. That's about 35 degrees *below* the freezing point of water. That is much colder than the last ice age (which ended 10,000 years ago), when ice covered much of the northern United States and northern Europe;

then the average temperature on Earth was only about 10 degrees cooler than it is today. Without CO_2 and other greenhouse gases, Earth would be an ice planet.

But too much of a good thing nearly always causes problems, and CO_2 is no exception. Just ask the planet Venus, whose atmosphere of at least 95% carbon dioxide generates an average temperature well over 800°. Venus is closer to the Sun than we are, but that alone does not explain why Venus is hot enough to melt lead. The planet Mercury is only about half as far from the Sun as Venus, yet has a much lower average temperature. [8] The difference is CO_2. Mercury has very little atmosphere, so a lot of the heat it receives from the Sun escapes into space. Venus' atmosphere traps almost all of that heat.

Before the Industrial Revolution began in the eighteenth century, Earth's atmosphere had about 280 parts per million (ppm) of CO_2. In other words, if you had sampled a million molecules from the atmosphere then, about 280 of them would have been carbon dioxide molecules. But that number has been steadily climbing since humans began pumping CO_2 into the air. As of June 2014, CO_2 exceeded 397 ppm, and continues to increase by about 2 ppm annually. That extra CO_2 has driven up the average temperature on Earth almost two degrees since 1880, when such records began to be kept.

Scientists believe this situation will continue to get worse—probably a lot worse. The Intergovernmental Panel on Climate Change is a group of more than 2,000 scientists worldwide. Their 2014 report projects that average global temperatures [9] will increase between 0.5° and 1.25° over the next two decades, compared with the period of 1986-2005, and could be as much as 7-8° warmer than that 20-year period by the end of this century. [10]

It's Only Getting Worse. We are adding CO_2 and other greenhouse gases to the atmosphere faster all the time. One reason is that developing countries such as China, Brazil, and India are devouring fossil fuels to power their growing

economies, even as developed areas like the United States, Europe, and Australia continue to guzzle these fuels as they have for decades. Another reason is population growth. In the early 1960s three billion people shared this planet. Now the world population has grown close to seven billion, and is expected to reach nine billion by 2050. As we add more people, total energy use increases, even if per capita energy usage doesn't change (although per capita energy use has also increased).

The pressure of population growth and the demands of modern society have led to the destruction of large swaths of vegetation in favor of agriculture and development. For example, we have destroyed more than half of Earth's tropical rain forests. Such destruction is a double blow: it hurls CO_2 into the atmosphere by releasing the carbon stored in the vegetation, while also killing plants that absorb huge quantities of CO_2 from the atmosphere.

Fire also releases CO_2, because the carbon in plants and trees binds with oxygen in the air when they burn, generating CO_2. Whether man or nature starts the fire, hotter temperatures will create conditions in which fire thrives and spreads, by drying out vegetation and decreasing precipitation in some locations.

And it gets worse, because as the Earth warms a lot of carbon that is currently confined in "carbon sinks" will eventually get released into the atmosphere. For example, billions of tons of CO_2 and methane are locked away in the permanently frozen ground (permafrost) of Siberia, Alaska, the Arctic, and many high-elevation areas. This permafrost holds the remains of dead plants which never fully decomposed due to the frigid temperatures. But as temperatures rise, some of this permafrost is thawing. And as it does, those dead plants will finish decomposing, releasing previously suspended CO_2 and methane into the atmosphere. With warmer global temperatures, this will become more common,

especially since temperatures in the polar regions are rising faster than global temperatures generally.

Speaking of carbon sinks, a tremendous volume of CO_2 is dissolved in the vastness of the oceans. But warm water cannot hold as much CO_2 as cold water. So as the oceans warm—which is already happening, by the way—they will either release some of that CO_2 into the atmosphere or simply absorb less of the CO_2 we are emitting. Either way, the amount of CO_2 in the air will increase more rapidly.

Then there is the albedo effect. The albedo of a surface measures how much sunlight it reflects. White surfaces, such as snow and ice, reflect a lot. Darker surfaces reflect less—often a lot less. Snow and ice, for example, reflect 80 to 90 percent of the sun's energy back into space, whereas ocean water reflects less than 10 percent. As temperatures rise, the ice in the Arctic Ocean is melting. The summer Arctic ice has been retreating at a rate of about eight percent per decade since 1979, and may entirely disappear by 2060. Replacing snow and ice with water means much more of the sun's energy will be absorbed, which adds to global warming. Similarly, since ice and snow reflect more sunlight than almost anything else on dry land, retreating ice and snow will also increase the albedo of land surfaces.

Warming temperatures could also mean less phytoplankton. Phytoplankton is a microscopic sea plant that helps keep CO_2 under control, and is vital for life on Earth. Through photosynthesis, phytoplankton removes CO_2 from the air and fixes the carbon into organic form—as much as a hundred million tons of carbon a day—releasing oxygen in the process. About one-half of the oxygen on Earth comes from phytoplankton. But studies have shown that the growth of phytoplankton is inhibited by global warming in several ways: (1) warm water doesn't circulate vital nutrients as well as colder water, so the phytoplankton has less to feed on; (2) some of the carbon in the ocean turns into carbonic acid,

making the water more acidic, and this damages some types of phytoplankton; and (3) in the Arctic, phytoplankton grows at the edge of sea ice, so less ice probably means less phytoplankton.

And It Could Get Much Worse. Scientists also warn of catastrophic scenarios that are unlikely to occur in your lifetime or mine, but which will be disastrous if or when they do. The release of "clathrates" is one such nightmare possibility.

Clathrates are methane molecules. Huge quantities of clathrates are trapped in ice crystals on and under the deep ocean floor. Estimates range as high as 55 quadrillion cubic yards of the stuff. (That's 55 with 15 zeros after it!) This methane is kept under control by pressure and low temperatures at the bottom of the ocean. But if the deep ocean were to warm sufficiently, some scientists believe this methane could one day be freed from its underwater prison. Since methane is twenty times as efficient as CO_2 in trapping the sun's heat, global warming could escalate exponentially if these clathrates escape.

Another frightening possibility is the collapse of South America's Amazon rain forest, which could one day be doomed by the combination of increasing CO_2 and higher temperatures. The Amazon basin receives about 75 to 100 inches of rainfall each year. This large quantity of rain results in part from a process called transpiration, which occurs when water evaporates from a plant as it opens its stomata to take in CO_2. The quantity of plant life in the Amazon basin is so great that a lot of the moisture in the air results from transpiration. Without this process, the air would be drier, and less rain would fall. But in a cascade of unfortunate events, increasing CO_2 levels shorten the length of time plants must open their stomata, which reduces evaporation due to transpiration, and this in turn decreases rainfall.

In addition, climate computer models predict that higher global temperatures will promote more frequent El Niño-like conditions, decreasing rainfall across the Amazon basin. By 2100, this combination of higher temperatures, higher CO_2 levels, and decreasing rainfall could devastate the rain forest, leaving behind only grasses, shrubs, and even desert vegetation in some places. And then comes the most painful news of all—the plush rain forest vegetation that used to be a carbon repository gives up its carbon after it dies, adding huge quantities of CO_2 to the atmosphere and exacerbating the problem of global warming.

What the Future Could Look Like. So what does all this added CO_2 mean to you, your children, and your children's children? Well, for starters it means some locations will be warmer and wetter, while others will be hotter and dryer. So heat waves and droughts will occur more often—and be harsher—in areas which are prone to them. And since warmer air can hold more moisture, storms and hurricanes will be more severe; these storms will send rain, snow, and ice in heavier quantities in some locations, and greatly increase the risk of flooding in coastal and low-lying areas.

More flooding will likely increase the spread of various diseases. For example, cholera is caused by bacteria that thrive in fecal-contaminated water—a common problem when flooding occurs. Flooding can also promote the spread of the plague, by driving flea-infested rats into close proximity with humans. Mosquitoes breed in stagnant water, so flooded areas will be more prone to the diseases mosquitoes carry, such as malaria, yellow fever, dengue fever, West Nile virus, and encephalitis. Warmer temperatures will also increase the mosquitoes' range, which is often limited by colder temperatures. So as temperatures rise, mosquitoes will carry these diseases to higher elevations and locations closer to the polar regions—places that were once too cold. Since low temperatures also act as a barrier to the ticks that carry Lyme Disease, global warming will promote the

spread of that illness, too. People that live in hotter, dryer climates could suffer as well, because meningitis thrives in warm, dry conditions.

Climate change will also impact people's health in other ways. A 2016 report by the U.S. government predicts that higher average temperatures will degrade air quality by increasing fine particles (from increased frequency and intensity of wildfires), ozone, and airborne allergens, causing problems for people with respiratory conditions, asthma, and allergies. [11] The same report predicts an increased risk for waterborne illnesses, from such causes as the growth and spread of harmful algae and bacteria due to higher water temperatures, and contamination of freshwater and some seafood from excessive rain runoff and storm surges. [12] Mental health will also be adversely impacted, because the dangers and destruction that accompany weather-related disasters often cause anxiety, depression, and post-traumatic stress, especially among children, the elderly, and other highly vulnerable groups. [13]

Many species, plant and animal, will face extinction because of their inability to adapt to the changing climatic conditions. Coral reefs are suffering—and many have been destroyed—because they are highly sensitive to the warmer, more acidic oceans that global warming produces. Trees are being lost, and many more will be lost, because their natural enemies—diseases, insects, and fire—flourish in warmer weather.

Ice at the poles and in glaciers is melting due to warmer temperatures, and this will certainly get worse. Melting ice will cause ocean levels to slowly rise. However, ocean levels are rising even without the ice melt, simply due to the fact that water expands as it warms. In the short term, these rising sea levels will make storm surges more dangerous; in the long term, higher water levels could be disastrous for many islands and coastal areas.

Warmer temperatures and more CO_2 may be beneficial for farmers in some colder climates, such as Canada and Russia. This is primarily due to the longer growing season, but also because plants grow marginally better, up to a point, as CO_2 levels increase. Unfortunately, these gains will be more than offset by crop damage elsewhere caused by flooding, heat waves, drought, fire, and plant diseases.

Climate change can also affect food distribution—higher temperatures promote spoilage, and weather disasters can disrupt transportation infrastructure and delivery systems. So food shortages may be inevitable. And as if that isn't bad enough, higher levels of CO_2 decrease the nutritional value of such food staples as rice and wheat by lowering the amount of protein and essential minerals in these foods. [14]

Water shortages will be more frequent and more acute, especially in traditionally dry climates, because of a combination of more frequent drought conditions, saltwater contamination from rising sea levels, increased pollution from flooding, and the loss of glaciers which often provide summer freshwater.

Finally, many experts are warning that problems caused by global warming—such as food shortages, water shortages, and refugees displaced by storms and flooding—will greatly increase the dangers of conflict around the globe. And one of the nations at risk for more severe droughts is China, home to more than a billion people and powerful armed forces.

Signs of the Times. We are already seeing some of these signs now. The world is getting hotter. The Goddard Institute for Space Studies (GISS), part of the United States' National Aeronautics and Space Administration (NASA), publishes statistics on world temperatures. And GISS statistics tell us that the hottest year worldwide since 1880 [15] occurred in 2015, when the mean average global temperature was 1.9° warmer than the mean average in 1880. GISS statistics also

show that the 16 hottest years on record have all occurred during the past 18 years (1998-2015). [16] The European summer of 2003 was so hot that tens of thousands of people died from the heat. A heat wave in southeast Australia in 2009 killed 300 people, and heat-related bushfires killed another 173. Scientists tell us that in another 60 years such heat waves may be common.

As you would expect, a hotter world melts ice. Antarctica's Larsen-B ice shelf provides a stark illustration. The Larsen-B ice shelf was a huge mass of ice along Antarctica's coast, about the size of the country of Luxembourg. [17] Yet the ice was so weakened by melting that in February, 2002 it collapsed into the ocean in only a few weeks.

Melting ice is also causing glaciers worldwide to shrink. Some have already disappeared, such as Bolivia's Chacaltaya glacier. In the not-too-distant future, Montana's Glacier National Park will appear to be misnamed because the glaciers will all be gone.

Wildfires and droughts are on the rise in many areas. The 2014 IPCC Report notes that wildfires have increased in frequency in the western United States, Canada, Portugal, Greece, the Amazon region of South America, and Africa's Mt. Kilimanjaro. [18] In 2005, the worst drought in 40 years struck the Amazon. In 2012, hot and dry conditions in Colorado caused the worst wildfire season in a decade, while the central and eastern portions of the country suffered through record summer heat. In January 2014, the governor of the State of California declared a state of emergency due to that state's unprecedented drought conditions.

The first decade of the new century (2001-2010) saw more Category 5 hurricanes (the most severe type of hurricane) in the Atlantic Ocean than in any decade in recorded history. History had also never recorded a hurricane in the South Atlantic—until March 2004, when a hurricane struck Brazil. In 2005, the North Atlantic saw three Category 5 hurricanes—Katrina, Rita, and Wilma—for

the first time in a single season, along with two Category 4 storms. Indeed, Category 4 and 5 storms have nearly doubled in recent years. [19]

Mosquitoes now trouble cities like Nairobi, Kenya, and Harare, Zimbabwe, which used to be inhospitable for them due to cold temperatures at the higher altitudes. Mountain pine beetles in British Columbia and spruce bark beetles in Norway are killing millions of trees because cold weather no longer controls the beetle population.

And if all of this results from an increase of less than two degrees, what will happen by 2100, when CO_2 levels could be well above 500 ppm and global average temperatures could be several degrees higher than today? No one knows with certainty what havoc these higher temperatures will inflict on us and our fellow travelers on Planet Earth. [20] But without doubt the problems we are currently experiencing will grow worse—probably a great deal worse.

New Testament Prophecy. So what does all of this have to do with Jesus and the New Testament? Did He foresee any of this? I believe so. In the synoptic Gospels (Matthew, Mark, and Luke), the authors recount a conversation Jesus had with some of His disciples about what would happen before His ultimate return "on the clouds of the sky with power and great glory." (Matthew 24:30) [21] Jesus talks about a time of suffering worse than any the world has ever known [22]—tribulation so great that "unless those days had been cut short, no life would have been saved." (Matthew 24:22) [23] But Jesus also talks about what comes *before* this—what He calls "birth pangs." (Matthew 24:8) [24] In Matthew and Mark, these birth pangs include three elements: wars, famines, and earthquakes. [25] Luke adds a fourth—diseases. [26]

With the exception of earthquakes, these "birth pangs" are exactly what climate scientists predict will be in our future if we do not control greenhouse gases. Warmer global temperatures are already increasing the number and severity

of droughts, heat waves, deluges, and major storms, as well as flooding and insect activity. Global warming will cause these problems to grow worse, one day leading to food and water shortages, as well as increasingly widespread epidemics. In such a world, conflict and wars would be almost inevitable. Thus, three of the four birth pangs—famine, disease, and wars—are predictable outgrowths of what climate scientists are telling us today.

But what about earthquakes? There are two possible explanations. The literal New Testament Greek, *seismos*, means a "commotion." [27] This word usually refers to an earthquake. However, in the context of Biblical prophecy the term can also refer to a political commotion or insurrection. Thus, we have the image of not only wars *between* nations, but of violent upheavals *within* nations, as people struggle to survive amidst growing hardship.

However, if the term "earthquake" is taken in its literal sense, consider this: the number of man-made earthquakes is on the rise. From 1970 to 2000, the U.S. Geological Survey recorded an average of 20 earthquakes of magnitude 3.0 or greater in the United States each year. But in the four years from 2010 to 2013 (inclusive), 450 such earthquakes occurred—an average of more than 100 per year. *Time* magazine recently reported that Oklahoma experienced 907 magnitude 3.0 earthquakes in 2015 compared to just one in 2007, and that the state now has more such earthquakes than California. [28]

One likely cause of this dramatic increase is the injection of waste water deep underground. The water lubricates places where stress has built up in underground rock formations, causing movement—that is, earthquakes. Injection of waste water underground is frequently incidental to the process of hydraulic fracturing, or "fracking," which is an increasingly common method of extracting fossil fuels from deep underground. To be fair, these man-made earthquakes are a very tiny fraction of the tens of thousands of magnitude 3.0 or greater earthquakes

that occur annually worldwide. So, for now at least, man's influence on earthquakes appears to be trivial. But 200 years ago man's impact on the climate was trivial.

The Great Tribulation? Let's also revisit another part of Jesus' prophecy, the part that comes after the "birth pangs." He predicted a time of suffering worse than any mankind has ever known. [29] Climate scientists are echoing this prophecy with warnings that out-of-control global warming could eventually trigger catastrophes on a scale we've never seen before. And we are not merely talking about killer heat waves, mega-droughts, or Category 5 hurricanes.

What would happen if 9% of the world's ice melted? That's the amount of ice in Greenland. If all of that ice became water, ocean levels would rise as much as 23 feet, swamping low-lying islands and many coastal cities such as Miami and New Orleans. Now imagine flooding that was ten times worse. Antarctica holds about 90% of the world's ice, so the resulting ice-melt would raise sea levels 170 to 200 feet! If this were to happen, New York City and almost all of Florida would be under water. Such melting would take a long time to complete, measured in centuries rather than decades. But if we continue warming the planet, that outcome will eventually become inevitable.

As Greenland's ice melts, it could trigger another kind of catastrophe in Europe. If you look at a globe, you will notice that Great Britain is about as far north as Canada. Yet the British enjoy a much warmer climate thanks to the Gulf Stream, the fastest ocean current in the world. The Gulf Stream transports warm water from near the equator up to the North Atlantic, where it thaws England and some other parts of Europe. This heat conveyer belt keeps moving due to the relative salinity of ocean water, because water that is saltier is also heavier. As the warm Gulf Stream travels north, a lot of heat and water ascend into the atmosphere through evaporation. The remaining water becomes much saltier, and therefore

heavier, so it sinks to the ocean floor in the North Atlantic in vast quantities before beginning its journey back to the south. This sub-surface waterfall in turn pulls more water northward.

But this tremendous flow of water can be interrupted if a sufficiently large body of freshwater intervenes. The freshwater dilutes the salinity of the Gulf Stream's current, preventing it from sinking. The waterfall stops, and so does the northern flow of water. This results in Europe becoming much colder, because the heat stays down south. Does this seem far-fetched? It isn't. It has actually happened. About 13,000 or 14,000 years ago, after several thousand years of retreating and melting ice, a huge ice dam in North America burst. Freshwater behind the dam rushed down the St. Lawrence River into the North Atlantic and disrupted the Gulf Stream. Europe was plunged back into an ice age (called the "younger Dryas") for 1,000 years. Average summer temperatures in parts of northern and western Europe dropped by as much as 16°.

Climate scientists tell us that a similar disruption of the Gulf Stream is unlikely during this century. But the salinity of the water in the North Atlantic has been slowly decreasing, the result of melting ice and increased precipitation in that area, so the possibility does exist.

Conclusion. When I was a young and ignorant baby Christian—and still under the influence of Hal Lindsey's best-seller, *The Late Great Planet Earth*—I believed Christ's Second Coming would probably occur during my lifetime. I now doubt that. In fact, I don't even think the "birth pangs" will come in my lifetime unless global warming speeds up considerably. But as the effects of climate change grow worse, the birth pangs will become more and more evident, if we do not blind ourselves to them. We will see more severe heat waves and more serious droughts, leading to *famines* more tragic than any we've witnessed before. Hurricanes and storms will cause more suffering, more flooding, and more *disease*. The growing

misery will trigger *unrest* within countries, and *wars* between nations, as people fight over scarce resources needed for survival.

Reading the signs of the times, I fear we will blindly go on burning fossil fuels and making the problem worse, until disaster becomes inevitable. We will eventually approach the point of our own extinction, "but for the sake of the elect those days will be cut short." (Matthew 24:22) And then Christ will come again, from the sky, [30] like a flash of lightning. [31] Just don't ask me exactly when that will occur. I don't make predictions like that, and I don't like mountaintops at midnight.

Sources:

1. *Hot, Flat, and Crowded: Why We Need a Green Revolution—and How it Can Renew America (Release 2.0)*, by Thomas L. Friedman (Picador / Farrar, Straus and Giroux, New York, 2008, 2009).
2. *Field Notes from a Catastrophe*, by Elizabeth Kolbert (Bloombury Publishing, New York and London, 2006).
3. *The Weather Makers: How Man is Changing the Climate and What it Means for Life on Earth*, by Tim Flannery (Atlantic Monthly Press, New York, 2005).
4. *Science as a Contact Sport: Inside the Battle to Save Earth's Climate*, by Stephen H. Schneider (National Geographic, Washington, D.C. 2009).
5. *Global Warming for Dummies*, by Elizabeth May and Zoë Caron (John Wiley & Sons Canada, Ltd., 6045 Freemont Blvd., Mississauga, Ontario L5R 4J3, 2009).
6. *Earth Under Fire: How Global Warming is Changing the World*, by Gary Braasch (University of California Press, Berkeley and Los Angeles, 2007).
7. *Global Warming & Climate Change Demystified*, by Jerry Silver (McGraw Hill Companies, Inc., New York, *et. al.* 2008).
8. *The Complete Idiot's Guide to Global Warming (Second Edition)*, by Michael Tennesen (Alpha, a member of Penguin Group (USA) Inc., New York, 2008).
9. National Weather Service's Fahrenheit to Celsius Converter, found at http://www.wbuf.noaa.gov/tempfc.htm.
10. *Epidemic! The World of Infectious Disease*, ed. by Dr. Rob DeSalle (The New Press, New York, published in conjunction with The American Museum of Natural History, 1999).
11. "Global Land-Ocean Temperature Index," through February 2016, published by the National Aeronautics and Space Administration's Goddard Institute for Space Studies, and found at (last viewed 4/5/2016): http://data.giss.nasa.gov/gistemp/tabledata_v3/GLB.Ts+dSST.txt
12. *Ice Ages, Past and Future*, by Jon Erickson (TAB Books, Blue Ridge Summit, Pennsylvania, 1990).
13. "King Coal's Comeback," by Bryan Walsh, *Time*, June 11, 2012, pages "Business 1-4."
14. "A Brief History of the Apocalypse," at http://www.abhota.info/index.htm
15. The following sources in Bible Explorer 4.0 software (WORDsearch 2006): (1) Strong's Talking Greek & Hebrew Dictionary; (2) Adam Clarke's Commentary; (3) Barnes' Notes on the New Testament; (4) A Commentary on the Holy Bible.
16. "The Golden Age: Could Europe and China's fracking forays remake global energy?," by Bryan Walsh, in *Time*, May 21, 2012, pages 47-48.
17. "Little link between drilling, quakes," by Seth Borenstein, The Associated Press, as printed in the *Fort Worth Star-Telegram*, June 16, 2012, p. 4A.
18. "If the polar ice caps melted, how much would the oceans rise?," part of the web site, "HowStuffWorks.com," found at http://science.howstuffworks.com/environmental/earth/geophysics/question473.htm.

19. "If Polar Ice Vanished," by Peter Tyson, NOVA, PBS.org, found at http://www.pbs.org/wgbh/nova/earth/mapping-sea-level-rise.html.
20. "FAQ: Antarctica," USAToday.com, found at http://www.usatoday.com/weather/resources/askjack/aicefaq.htm.
21. *The Late Great Planet Earth*, by Hal Lindsey with C.C. Carlson (Bantam Books, Toronto-New York-London. 1973, published by arrangement with Zondervan Publishing House, 1970).
22. *Huff Post Denver* articles, "Colorado Wildfires 2012: Stunning NASA Map Shows Severe Heat Wave Fueling Wildfires," (posted 6/30/2012), found at http://www.huffingtonpost.com/2012/06/30/waldo-canyon-fire-2012-st_n_1639836.html, and "Colorado Wildfires 2012: Worst Wildfire Season In A Decade; Fires Close In On Tourist Destinations," by Thomas Peipert, Associated Press (posted 6/25/2012), found at http://www.huffingtonpost.com/2012/06/25/colorado-wildfires-2012-v_n_1623695.html?utm_hp_ref=denver.
23. "Hurricanes: The Greatest Storms on Earth," found at the NASA Earth Observatory web site, http://earthobservatory.nasa.gov/Features/Hurricanes/hurricanes_3.php.
24. "The Physical Carbon Pump," part of the University of California at San Diego's *Climate Change: Earth's Climate System*, found at http://earthguide.ucsd.edu/virtualmuseum/climatechange1/06_1.shtml.
25. Adam Clarke's Commentary, in Bible Explorer 4.0 software.
26. Barnes' Notes on the New Testament, in Bible Explorer 4.0 software.
27. "The Golden Age: Could Europe and China's fracking forays remake global energy?," by Bryan Walsh, in *Time*, May 21, 2012, pages 47-48.
28. California Drought, found at: http://ca.gov/drought/.
29. International Energy Statistics, compiled by the U.S. Energy Information Administration, and found at: http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=1&pid=1&aid=2&cid=regions,&syid=2008&eyid=2012&unit=TST
30. Trends in Atmospheric Carbon Dioxide, National Oceanic & Atmospheric Administration's Earth System Research Laboratory, Global Monitoring Division, found at: http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html.
31. Global Analysis – Annual 2013, National Oceanic & Atmospheric Administration's National Climatic Data Center, found at: http://www.ncdc.noaa.gov/sotc/global/2013/13.
32. Kirtman, B., S.B. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang, 2013: Near-term Climate Change: Projections and Predictability. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

33. Cubasch, U., D. Wuebbles, D. Chen, M.C. Facchini, D. Frame, N. Mahowald, and J.-G. Winther, 2013: Introduction. In:Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
34. Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner, 2013: Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
35. **IPCC**, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp.
36. IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 688.
37. Kirtman, B., S.B. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schar, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang, 2013: Near-term Climate Change: Projections and Predictability. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
38. Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner, 2013: Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K.

Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

39. "Man-Made Earthquakes Update," on the U.S. Geological Survey web site (posted January 17, 2014), found at: http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/.
40. "Earthquake Facts and Statistics," on the U.S. Geological Survey web site, found at: http://earthquake.usgs.gov/earthquakes/eqarchives/year/eqstats.php.
41. "Commonly Asked Questions and Facts," on the Rainforest Foundation U.S. web site, found at: http://www.rainforestfoundation.org/commonly-asked-questions-and-facts.
42. "Amazonia – Annual Precipitation (mm)" chart, on the "Skeptical Science" web site, found at: http://www.skepticalscience.com/IPCC-false-predictions-Amazon-rainforests.htm.
43. "Luxembourg," on the Wikipedia web site, found at: http://en.wikipedia.org/wiki/Luxembourg.
44. U.S. Energy Information Administration's "International Energy Outlook 2014, available on the U.S. EIA's web site, at: http://www.eia.gov/forecasts/ieo/pdf/0484%282014%29.pdf.
45. BP Statistical Review of World Energy, June 2015 (64th edition), available at: http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-full-report.pdf (last viewed 3-2-2016).
46. "The Faults of Oklahoma," by Josh Sanburn, *Time*, Volume 187, No. 10, March 21, 2016.
47. USGCRP, 2016: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX.

[1] See Matthew 16:3.

[2] See, for example, the entertaining web site, "A Brief History of the Apocalypse," at http://www.abhota.info/index.htm (last viewed 5/5/2016).

[3] The exact statistics are as follows: coal consumption increased from 7.34 billion short tons in 2008 to 8.19 billion short tons in 2012; petroleum consumption increased from 85.0 million barrels per day in 2009 to 91.2 million barrels per day in 2013; and natural gas consumption increased from 108.9 trillion cubic feet in 2008 to 121.4 trillion cubic feet in 2013. All statistics were taken from the U.S. Energy Information Administration web site, at www.eia.gov. For example, statistics for world petroleum consumption are at: http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5&pid=5&aid=2 (last viewed 3-2-2016). Statistics for 2013 were not yet available for coal consumption at the time of this writing.

[4] BP Statistical Review of World Energy, June 2015 (64th edition), available at: http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2015/bp-statistical-review-of-world-energy-2015-full-report.pdf (last viewed 3-2-2016).

[5] According to BP's statistics, per the Statistical Review cited in footnote 4, oil consumption increased from 83.1 million barrels per day in 2004 to 92.1 million barrels per day in 2014; natural gas consumption increased from 2.70 trillion cubic meters in 2004 to 3.39 trillion cubic meters in 2014; and coal consumption increased from 2.91 billion "tonnes oil equivalent" in 2004 to 3.88 billion "tonnes oil equivalent" in 2014.

[6] This is according to the U.S. EIA International Energy Outlook 2014. The USEIA reference scenario projects an increase in consumption of petroleum and other liquid fuels (such as kerogen, biofuels, and liquids produced from coal and natural gas) from 87.2 million barrels per day in 2010 to 119.4 million barrels per day in 2040. Other scenarios project consumption as high as 123.3 million barrels per day by 2040.

[7] For convenience, all temperatures are in degrees Fahrenheit. To convert Fahrenheit to Celsius, subtract 32° and then multiply by 5/9, or go to the National Weather Service's Fahrenheit to Celsius Converter, found at http://www.wbuf.noaa.gov/tempfc.htm.

[8] Mercury is about 36 million miles from the Sun and has an average temperature of about 380°. Venus is about 67 million miles from the Sun.

[9] i.e., global mean surface air temperatures

[10] See, for example, the following citations in the 2014 IPCC report:

(1) IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp. – at pp. 13, 57-58, 62, 138, 178-179, 189.

(2) Kirtman, B., S.B. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schar, R. Sutton,

G.J. van Oldenborgh, G. Vecchi and H.J. Wang, 2013: Near-term Climate Change: Projections and Predictability. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. – at pp. 955, 1012.

(3) Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner, 2013: Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA – at pp. 1031, 1055-1056.

[11] USGCRP, 2016: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX, at p. 9.

[12] *Ibid.*, at p. 15.

[13] *Ibid.*, at pp. 18-19

[14] *Ibid.*, at pp. 16-17.

[15] This is based on average mean global temperatures, with a "year" measured from January through December.

[16] See the "Global Land-Ocean Temperature Index," through February 2016, published by the National Aeronautics and Space Administration's Goddard Institute for Space Studies, and found at: http://data.giss.nasa.gov/gistemp/tabledata_v3/GLB.Ts+dSST.txt.

[17] Luxembourg has 2,586 square kilometers, or 998 square miles.

[18] See IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (cited previously in fn. 10) – at pp. 30-32, 44-46, 1005-1006.

[19] In fairness, some scientists argue that this apparent increase in severe hurricanes may be the result, in whole or in part, of better methods of detection and tracking, such as satellite technology. See "Hurricanes: The Greatest Storms on Earth," NASA Earth Observatory web site, found at: http://earthobservatory.nasa.gov/Features/Hurricanes/hurricanes_3.php.

[20] The uncertainty arises from the many variables that must be taken into account in trying to predict future occurrences. Two of the most important variables are:

1. Clouds. Higher temperatures and warmer ocean water will increase evaporation, which should result in more clouds. But clouds have two opposite effects. Because they consist of water vapor—a potent greenhouse gas—high, thin clouds trap the sun's energy, warming the

planet. On the other hand, low thick clouds cool the planet because of their albedo effect—that is, they reflect more of the sun's energy than they trap. At this time, no one knows which will be the more impactful of the two.

2. Greenhouse gas levels. Uncertainty remains concerning how fast greenhouse gas levels will rise, due to such factors as the increasing use of fossil fuels by developing countries, energy conservation efforts, and the rate of growth of alternative energy sources, such as solar and wind power.

[21] See also Mark 13:26 and Luke 21:27.

[22] Matthew 24:9-21; see also Mark 13:95-6, 13:9-19, and 13:21-22

[23] See also Mark 13:20.

[24] See also Mark 13:8.

[25] Matthew 24:6-7 and Mark 13:7-8

[26] Luke 21:10-11

[27] Strong's Talking Greek & Hebrew Dictionary, in Bible Explorer 4.0.

[28] "The Faults of Oklahoma," by Josh Sanburn, *Time*, Volume 187, No. 10, March 21, 2016, p. 36.

[29] Matthew 24:9-22; Mark 13:95-6, 13:9-22

[30] Matthew 24:30

[31] Matthew 24:27

