

# Climate Change: Summary of Current Science

By Jeff Harding.

Cap and Trade, Global Warming, and Climate Change all have significant implications for we humans. The following analysis was done by Cato scholar, Andrei Illarionov, formerly Vladimir Putin's chief economic advisor. As an economist he studied the available literature and synthesized the current state of the scientific evidence on climate change and global warming. It is significant in that the "solutions" coming out of Copenhagen are really political in nature and not necessarily based on the best science or the best economics.

For the record, I believe in climate change and global warming, as the science suggests. The issue is the extent and impact of human behavior ("anthropogenic factors"). I think the scientific evidence presented by Illarionov and Cato, as well as the Competitive Enterprise Institute is pretty good.

I will also refer you to RealClimate.org which is run by four climatologists, and who have excellent resource materials. I will not comment on their objectivity or accuracy because I am not a climatologist. So, you can compare some of their data to those that Illarionov and Cato present. I checked a few and there is some agreement on the data, but perhaps not the overall view of things.

I will say that much of what is written about global warming and climate change is bunk. I think that it is the latest movement around which people who hate capitalism and free markets gravitate toward. And I am skeptical about the political solutions offered, especially those coming out of Copenhagen. My guess about Copenhagen: nothing major will happen.

## A Few Notes on Climate Change

By Andrei Illarionov

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As the Copenhagen Climate Conference is taking place, it is appropriate to clarify once again what is more or less accurately known about the climate of our planet and about climate change.

Obviously, a brief post can not substitute for detailed studies of professionals in a variety of scientific disciplines – climatology, atmospheric physics, chemistry, geology, astronomy, and economics. However, a short post can summarize basic theses on the main trends in climate evolution, on its forecasts, and on its actual and projected effects.

1. *The Earth's climate is constantly changing.* The climate was changing in the past, is changing now and, obviously, will be changing in the future – as long as our planet exists.
2. *Climatic changes are largely cyclical in nature.* There are various time horizons of climatic cycles – from the annual cycle known to everyone to cycles of 65-70 years, of 1,300 years, or of 100,000 years (the so called Milankovitch cycles).
3. *There is no fundamental disagreement among scientists, public figures and governments about the fact that the climate is changing. There is a broad consensus that climate changes occur constantly.* The myth, created by climate alarmists, that their opponents deny climate change is sheer propaganda.
4. *Current debate among climatologists, economists and public figures is not about the fact of climate change, but about other issues.* In particular, disagreements exist on:
  - Comparative levels of modern day temperatures (relative to the historically observed),
  - The direction of climate change depending on the length of record,
  - The extent of climate change,
  - The rate of climate change,
  - Causes of climate change,
  - Forecasts of climate change,
  - Consequences of climate change,

– The optimal strategy for human beings to respond to climate change.

5. *Unbiased answers to many of these issues are critically dependent on a chosen time horizon – whether it is 10 years, or 30 years, or 70 years, or 1000 years, or 10,000 years, or hundreds of thousands or millions of years.* Depending on the time horizon, the answers to many of these questions may be different, even opposite.

6. *The current level of global temperature in historical perspective is not unique.* The average temperature of the Earth is now estimated at about 14.5 degrees Celsius. In our planet's history there have been few periods when the Earth's temperature was lower than the current – in the early Permian period, in the Oligocene, and during periodic glaciations in the Pleistocene. For most of the time during the last half billion years, the air temperature at the Earth's surface greatly exceeded the current one, and for about half of this period it was approximately 25°C, or 10°C higher than the current temperature. Regular glaciations of cold periods during the Pleistocene era lasted for approximately 90,000 years, with a low temperature of approximately 5°C below that of the present, alternated by warm interglacial periods (for 4,000-6,000 years) with temperatures of 1-3°C higher than at present. Approximately 11,000 years ago the last significant increase in temperature began (of approximately 5°C), during which time a huge glacier, that covered a considerable part of Eurasia and America, had melted. Climate warming has played a key role in humanity's acquisition of the secrets of agriculture and in its transition to civilization. Over the past 11,000 years there were at least five distinct warm periods, the so-called "climatic optima" when the temperature of the planet was at 1-3°C higher than at present.

7. *The focus of climate change depends critically on the choice of time horizon.* In the past 11 years (1998-2009 years) global temperature was flat. Before that, in the preceding 20 years (1979-1998 years) it increased by about 0.3°C. Before that, during the preceding 36 years (1940-1976 years) the temperature fell by about 0.1°C. Before that, for the preceding two centuries (1740 – 1940 years), the overall trend in global temperature was mainly neutral – with periodic warming, followed by cooling, and then again warming. Over the past three centuries (from the turn of 18th century), the temperature in the northern hemisphere has increased by approximately 1.3°C, from the trough of the so-called "Little Ice Age" (LIA) during the years 1500-1740 years, followed by the contemporary climatic optimum (CCO), which started around 1980. During the three centuries preceding the LIA, the temperature in the northern hemisphere was falling compared to the level it was during the medieval climatic optimum (MCO) in the 8th – 13th centuries. Depending on the chosen time frame the long-term temperature trend has a different trajectory. For periods of the last 2,000 years, the last 4,000 years, and the last 8,000 years, the trend was negative. For periods of the past 1,300 years, the last 5,000 years, and the last 9,000 years it was positive.

8. *The rate of contemporary climate change is much more modest in comparison with the rate of climatic changes observed earlier in the history of the planet.* The Intergovernmental Panel on Climate Change (IPCC) describes the increase in the global temperature by 0.76°C over the last century (1906-2005 years) as extraordinary. There is reason to suspect this temperature value is somewhat overstated. However, the main point is that previous rises in temperature were greater than those in the modern era. Comparable data demonstrate that the increase in temperature, for example, in Central England in the 18th century (by 0.97°C) was more significant than in the 20th (by 0.90°C). The climatic changes in Central Greenland over the past 50,000 years show that there were at least a dozen periods during which the regional temperature increased by 10-13°C. Given the correlation between changes in temperature at high latitudes and globally, those shifts in temperature regime in Greenland meant a rise in global temperature by 4-6°C. Such a rate was approximately 5-7 times faster than the actual (and, perhaps, slightly exaggerated) temperature increase in the 20th century.

9. *The rate of current climate change (the speed of modern warming) by historical standards is not unique.* According to IPCC data, the rate of temperature increase over the past 50 years was 0.13°C per decade. According to comparable data, obtained through instrumental measurements, a higher rate of temperature increase was observed at least three times: in the late 17th century – early 18th century; in the second half of the 18th century; and in the late 19th century – early 20th century. The centennial rate of warming in the 20th century is slower than the warming in the 18th century that was instrumentally recorded and slower than

slower than the warming in the 19th century that was instrumentally recorded and slower than the warming in at least 13 cases over the past 50,000 years that were measured by palaeoclimatic methods.

10. *Among the causes of climate change in the pre-industrial era there were hardly any anthropogenic factors* – due to modest population size and mankind's limited economic activities. But the range of climatic fluctuations and their rate and peak values in the pre-industrial era exceeded the parameters of climate change recorded in the industrial period.

11. *During the industrial age (since the beginning of the 19th century) climate change is believed to be under the impact of both groups of factors – of natural and of anthropogenic character.* Since the rate of climate change in the industrial age is so far noticeably smaller than at some time in the pre-industrial age, there is no basis for the assertion that anthropogenic factors had already become as significant as natural factors, even less for the assertion that they overwhelm natural factors.

12. *Factors of anthropogenic climate change are rather diverse and can not be confined to carbon dioxide only.* Mankind impacts local, regional and global climate by constructing buildings and structures, heating houses, industrial and public premises, by logging and planting forests, plowing arable land, damming rivers, draining and irrigating lands, leveling and paving territories, conducting industry, issuing aerosols, etc.

13. *There is no consensus in the scientific community on the role of carbon dioxide in climate change.* Some scientists believe that it is crucial, others believe that it is secondary to other factors. There are also serious disagreements on the nature and direction of possible causality between concentration of carbon dioxide in the atmosphere and temperature: some researchers believe the former causes temperature to rise, others argue the opposite – that fluctuations in temperature cause changes in carbon dioxide concentration.

14. *Unlike carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>) is harmless to humans; in contrast to aerosol, a harmful and dangerous substance, carbon dioxide does not pollute the environment.* It has neither a color, nor a taste, nor a smell. Therefore, popularly used photos and videos showing factory chimney stacks emitting smoke and cars emitting exhaust to illustrate carbon dioxide are just misleading – CO<sub>2</sub> is invisible; what is visible in those images are pollutants. It should also be noted that the increased concentration of carbon dioxide in the air has a positive impact on the productivity of plants, including agricultural crops.

15. *The relationship of the concentration of carbon dioxide to climate change remains a subject of intense scientific debate.* True, the concentration of carbon dioxide in the atmosphere over the past two centuries increased from 280 parts per million of air particles in the early 19th century to 388 particles in 2009. It is also true that the global temperature in that period rose by about 0.8°C. But whether these two factors are connected is unclear. The dynamics of CO<sub>2</sub> concentration did not correlate well with the expected changes in temperature. The significant and rapid increases in global temperature during the interglacial periods of the Pleistocene, during the Medieval Climatic Optima, in the 18th century, were not preceded by an increase in carbon dioxide concentration. In the industrial age, an increase in carbon dioxide concentration in the atmosphere was not always accompanied by a rise in global temperature. In 1944-1976 CO<sub>2</sub> concentration increased by 24 units – from 308 to 332 particles, but the global temperature fell 0.1°C. In 1998-2009 CO<sub>2</sub> concentration increased by 21 units – from 367 to 388 particles, but the global temperature trend remained flat. In the first half of the 1940's the decline in the concentration of carbon dioxide by 3 units (as a result of the massive destruction caused by World War II) did not prevent the global temperature to rise by 0.1°C.

16. *So far global climate models demonstrate their limited effectiveness.* The complex nature of the climate system is not reflected adequately enough in the global climate models whose use has recently spread around the world. The projections developed on their basis in the late 1990s through the early 2000s predicted the global temperature to rise by 1.4-5.8°C till the end of the 21st century with a 0.2-0.4°C increase already in the first decade. In reality during 1998-2009 the temperature was flat at best.

17. *Forecasts of global climate change made at the beginning of this decade by Russian scientists (from the Arctic and Antarctic Research Institute, the Voejkov Main Geophysical Observatory) predicted a fall in the global temperature by 0.6°C by 2025-2030 in comparison with a temperature peak reached at the end of the 20<sup>th</sup> century. So far the actual temperature for the last decade has not risen.*

18. *Implications of climate change for human beings differ greatly depending on their direction, size and rate. An increase in temperature leads as a rule to a softer and moister climate, while a decline in temperature leads to a harder and drier climate. It was a climatic optimum in the Holocene period with temperatures 1-3°C higher than today that greatly contributed to the birth of civilization. Conditions for people's life and economic activities in warmer climates are usually more favorable than in colder environments. In warmer climates there is usually more precipitation than in drier areas, the cost of heating and volume of food required to sustain human life is lower, while vegetation and navigation periods are longer, and crops' yields are higher.*

19. *Methods "to combat global warming" by reducing carbon dioxide emissions suggested by climate alarmists are not only scientifically unfounded in the absence of extraordinary or unusual changes in climate during the modern era. Such measures, if adopted, are especially dangerous for mid- and lower income countries. Those measures would effectively cut those countries off the path to prosperity and hinder their ability to close the gap with more developed nations.*

20. The impact of all anthropogenic factors (not only CO<sub>2</sub>) on climate is unclear when compared with factors of nature. *Therefore, the most effective strategy for humanity in responding to different types of climate change is adaptation.* That approach is exactly the way that humans have reacted to the larger-scale climatic changes in the past, even though they were less prepared then for such changes. Now mankind has greater resources to adapt to lesser climate fluctuations and it is better equipped for them scientifically, technically and psychologically. The adaptation of humanity to climate changes is incomparably less costly than other options being proposed and imposed by climate alarmists. Human society has already adapted to climate change and will continue to do so as long as economy and society are vibrant and free.

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