

Storms of My Grandchildren by James Hansen, December 2009.

In *Storms of My Grandchildren*, James Hansen, 68 years old and one of the world's leading climate-scientists, gives us the results of his lifelong work to understand the climate changes that are now occurring, and offers advice on how to minimize them. As a scientific description of climate science and climate change, this book is one of the best, written in an accessible tone with excellent metaphors and simple explanations that non-technical readers can easily understand. But Hansen also provides the depth and detail that make the book interesting to readers with more background and previous reading in climate science. What also makes this book both enjoyable and unusual is that it reads almost like a suspense story, we are pulled along through the more detailed explanations by Hansen's teacher-like encouragements ("Bear with me a few paragraphs more, or if you don't have the patience, skip to the next section") and by his candid accounts of a decades long effort to make politicians aware of the seriousness of the climate problems facing humanity. Along the way, Hansen takes up in the book, as he has done in real life, the major arguments of the climate contrarians (sceptics), and puts them to rest with indisputable facts and clear logic. At the same time, he is ever the honest scientist and teacher, taking pains to show where the data is poor (for example, concerning aerosols, needed to accurately calculate the net heat balance of the earth) and where the models lack realism (for example, in describing the melting of ice-sheets). On the whole Hansen argues mostly from historic data, referring back to earlier geologic periods in the earth's history when the climate changed, and uses models only to study hypothetical events or special questions.

This empirical approach is highly convincing. Thus are we led to understand that the current climate, with a warming of a 0,7 degree C, is near the highest of *this* interglacial period (the last 12000 years) and probably about like previous interglacial warm periods. Those warmings, however, were caused by gradual, small changes in the tilt in the earth's axis and in its orbit, and thus were temporary, while our current warming, caused by mankind's release of CO₂ into the atmosphere, is still on the rise and will not stop until centuries or millennia after we stop putting CO₂ into the air. We find that the 2 degrees so much talked-about by politicians is *not* a safe limit, but what Hansen calls "a disaster scenario", since the last time the earth was that hot, around 3 million years ago in the Middle Pliocene period, sea level was 25 meters higher than today and earth was "a different planet".

What is a safe limit, then? Hansen today argues for 350 ppm CO₂ (note: less than the current concentration of 387 ppm) corresponding to about a 1 degree maximum warming (0,7 already, the rest will come gradually in decades ahead). The reason: the earth systems are non-linear and almost certainly have tipping points, beyond which change speeds up, reinforcing itself, and taking the climate to another state. The key factors affecting these tipping points are: 1) ice sheet melting 2) methane hydrates on the ocean floor (and in the frozen tundra). These are wild cards, since the current warming apparently is occurring ten or a hundred times faster than earlier warmings in earth's history. Research on these factors is scanty and current models do not include them. Their major effects, however, are well known: *a speeding up of the warming* (the uncertainties concern the temperatures at which they begin, how fast they proceed and the time needed to reach a final state). Pointing to Arctic summer ice melting, mountain glacial melting, coral reefs dying and measured warming on land, Hansen says: "Relevant scientists—those who know what they are talking about—realize that the climate system is on the verge of tipping points." Therefore are we strongly advised to limit ourselves to 1-degree, only slightly above where we are now.

Interwoven in the scientific explanation of climate change, Hansen tells the story of his only moderately-successful attempts to make the public aware of global warming and get climate change put on the political agenda. Hansen's experience indicates, sadly, that national governments, in the U.S. and elsewhere, are largely uninterested in real, effective action. He attributes this to money: special interest groups (coal, oil, ...) use lobbyists to convince politicians that climate change is

uncertain, natural and not dangerous. And as with the tobacco industry earlier, vested interests seek to keep the issue seen in the media and the public eye as an open issue to be debated, not an imminent danger to be acted upon. Time and again, Hansen urges young people to take charge of their own futures by voting new politicians into the arena and putting new, transparent, politics to work, going back to the original ideal of the American revolution: one man, one vote (in which special interests could not rule). Young people yes, but this is something at which we can all work, regardless of age.

What shall we work for, in the political agenda? First, to phase out coal until the emissions can be successfully captured and safely stored—that means *a moratorium on new coal plants* today since there are currently no capture and storage facilities in operation—it is only an idea. Second, put a price on *carbon*, through *taxes at the source* (the mine, oil well, port of import, etc.). This will work to the disadvantage of fossil fuels so that they gradually will be phased out. Such taxes can be implemented nationally, then successively adjusted to be fair (in the sense of international business competition) through bilateral and international agreements. Hansen believes the Kyoto idea of cap and trade is hot air—political greenwash intended to give the impression of doing something, while not changing anything at all (emissions have in fact continued to rise since Kyoto was agreed upon 1992). Third, *a crash program on fourth generation (breeder reactor) nuclear power* that runs on uranium waste from old reactors plus from decommissioned nuclear weapons, and generates almost no long-lived waste. The purpose would be to develop a cost-competitive, standard reactor that could be readily and quickly deployed around the developing world (particularly in China and India) *instead of building more coal-fired plants*. Coal is currently the cheapest power source, and the one that developing nations are using to build their economies on. Hansen's plug for breeder reactors may be hard to understand or swallow for many environmentalists, accustomed to thinking of nuclear power as the costliest, most dangerous mistake of the past century. But perhaps we should read up more on this issue, and even supposing an unfavourable review, accept nuclear research and development as one of many lines to pursue, in order to not prematurely close the door on anything which *might* help us out of the the big bind we are in.

Regardless of how one feels on the nuclear issue, Hansen's integrity and genuine concern for his grandchildren and ours shine throughout this important book and make it probably the best available work for understanding both the climate science and the politics behind the current state of inaction at national and international levels. (A less technical description of the science, but not the politics, can be found in Mark Lynas' excellent *Six Degrees*). It is well worth reading, even if you choose other political priorities on the details of how to phase out fossil fuels on a planetary scale. Hansen's main political message is that if we are to avoid dangerous climate change, *most of the oil, gas and coal must remain in the ground*. Since we cannot expect the owners of fossil fuels to stop selling them, we must tax and legislate them out of existence, and provide workable alternatives for all of us to live on in the near and foreseeable future. Otherwise, our children and grandchildren will see increasingly violent storms, exacerbated by rising sea level that will make life more costly, more difficult and more unpredictable than it already is on this crowded blue planet, third from the sun.

N.B.: Dr. James Hansen is a brave man who has fought censure and intimidation through much of his career, and kept speaking out in the service of what he believed in. Now, with this book, he writes for his and our grandchildren. Much of what he writes is available free online at his website: www.columbia.edu/~jeh1. For a short description of his criticism of "politics as usual", see the November 2009 article: [Is there any real chance of averting the climate crisis?](#) listed on that website.

Archie Duncanson, Stockholm, February 2010