

CLIMATE SCEPTICISM IN A NUTSHELL

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Professor Sir Nicholas Stern is Adviser to the UK Government on the economics of climate change and development and Head of the Government Economic Service. He leads the Stern Review on the Economics of Climate Change, reporting to the United Kingdom's Chancellor of the Exchequer and to the Prime Minister. The report will be published in Autumn 2006. In *World Economics*, Vol 7, no.2, April-June 2006, Sir Nicholas Stern published an article, which sets out some of the issues under consideration. It was based on his lecture, 'What is the Economics of Climate Change?', given at OXONIA, The Oxford Institute for Economic Policy, as part of their Distinguished Lecture Series, on 31 January 2006.

Stern's article has been fiercely criticised by Ian Byatt *et al*¹ in the same issue of *World Economics*. The authors believed, among other things, that the first fruits of the Stern Review constitute a false start: they do not provide a sound basis for the further work of the review team. According to Byatt *et al*, the treatment of the issues has to be more inclusive, more informed and less dominated and constrained by questionably or mistaken assumptions. They point out that Stern and his team paint a somber and even dramatic picture of future climate change, from which far-reaching inferences are drawn for economic policy. But in their opinion the judgments of the Stern team are too confident and unqualified. As regards the scientific aspects, it gives insufficient weight to the pervasive uncertainties which still surround projections of climate change.

In his response to this critique, again in the same issue of *World Economics*, Sir Nicholas Stern observed that Byatt and his co-authors largely focus on the science of climate change and some well-known criticisms of IPCC (Intergovernmental Panel on Climate Change) projections. But he believes that they are wrong. According to Sir Nicholas:

'The overwhelming body of evidence leaves no doubt that the threat of climate change is real and serious. Counter-arguments or hypotheses have been undermined and discredited as new evidence has come in.'

So, apparently, Sir Nicholas holds the view that climate scepticism is losing ground. I beg to differ. It would imply that it has been comprehensively and convincingly refuted by the adherent of the AGW (Anthropogenic Global Warming) hypothesis. As far as I know, this has not been the case. Part of the reason may be that AGW adherents are not familiar with the basic tenets of climate scepticism. In order to fill this gap, the following short and - admittedly oversimplified - overview, which is meant to be accessible to a non-expert readership, may help them to concentrate the mind.

¹ Ian Byatt, Ian Castles, David Henderson, Nigel Lawson, Ross McKittrick, Julian Morris, Alan Peacock, Colin Robinson and Robert Skidelsky.

It is generally believed that CO₂ concentration in the atmosphere has increased from 285 to 365 ppmv (parts per million by volume) over the last century. According to the adherents of the man-made global warming hypothesis, the increase of this greenhouse gas should be partly attributed to man-made CO₂ emissions, causing a rise in temperature over the past 150 years of 0.6 °C. Over the last few decades the human contribution should even have been substantial, although the IPCC does not present precise figures. This view is contested by the climate sceptics.

It is often claimed - in official publications and the media - that climate sceptics constitute only a tiny minority among the scientific community. This is not correct. Worldwide tens of thousands bona fide scientist of various disciplines, including 72 Nobel laureates, have publicly expressed doubts about the AGW hypothesis and its underlying science (see annex). In a report published in May 2004, made on the request of the Russian government, also the Russian Academy of Sciences has expressed its support for the sceptical view.

Climate sceptics have in common that they are critical of the AGW hypothesis and the ensuing climate policies, such as the Kyoto protocol. But there are also differences of view among them, while the focus of their criticism may vary. They do not have a consensus culture.

Climate sceptics do not deny climate change. In the history of the Earth, climate change is the norm. But that has nothing to do with a significant human impact on climate. We do not know what constitutes an 'average', 'stable' or 'optimum' climate. What is 'normal'? The current climate? Or that of 100, 1000, 10,000 or 100,000 years ago? Is climate policy in order to keep the climate stable not an example of human hubris?

Both intuitively and scientifically, climate sceptics have difficulty in imagining that climate, which is a very complex system, and which is subject to a great variety of powerful natural forces, can be controlled and stabilized by the tuning of one or a couple relatively minor factors, such as the emission of man-made greenhouse gases. Many sceptics, such as Leroux, believe that the man-made contribution to the total greenhouse effect (natural - including water vapour - plus man-made) amounts to a mere 0.3%. The natural exchange of greenhouse gases between oceans, land and the biosphere is considerable. The human contribution is relatively minor. Moreover, seen from a geological perspective the current CO₂ concentration in the atmosphere is not particularly high.

The climate sceptics emphasize that AGW is not more than a scientific hypothesis. Hypotheses should be tested by observations. According to the hypothesis, warming in the higher layers of the air (troposphere) and the poles should be more pronounced than at the surface of the Earth. However, measurements do not confirm this to be the case. According to the scientific method, hypotheses which do not match observations have to be rejected, and have to be substituted by alternative hypotheses. AGW adherents do not seem to follow that rule.

Sceptics also emphasize that climate is a complex, non/linear, stochastic system. These features imply that no predictions can be made.

What about the very basis of the global warming scare: the measurements which are used to establish the worldwide average temperature? As Pawley notes, the devices

used to measure these temperatures have a measurement uncertainty of plus or minus 0.5 °C - a one degree spread. This inaccuracy, the limited number of measuring points and calibration problems can add up to a plus or minus one degree (or more) uncertainty, or a two degree spread in uncertainty. It is not very likely that the devices of 100 years ago were more accurate than those of today. So how can one be sure that there is global (as opposed to local) warming?

But even if the accuracy of thermometers would be adequate, there is another snag. As Essex and McKittrick have noted, temperatures are a way to describe the condition of a system, not its properties. H₂O, the most important greenhouse gas, exists in various forms in the atmosphere: ice, water and gas. It constantly transforms itself from one form into the other on a large scale, with increasing or decreasing temperatures as a result. When it passes, for instance, from its solid to its liquid phase (which may happen because of ice melting caused by changing ocean currents), the melting process requires heat, which is withdrawn from its surroundings. Thermometers in the neighbourhood will signal cooling and the world average will go down. But this cooling has nothing to do with whatever global phenomenon and there is no net loss or gain of the energy content of the system.

Some sceptics, such as Friis-Christensen, Svensmark, Baliunas, De Jager and Van Geel, underline the dominant impact of the sun on temperatures and climate in general. Recently the astronomer Khabibullo Abdusamatov of the Pulkovo Astronomic Observatory in St. Petersburg declared that the Earth will experience a 'mini Ice Age' in the middle of this century, caused by low solar activity. Temperatures will begin falling six or seven years from now, when global warming caused by increased solar activity in the 20th century reaches its peak. The coldest period will occur 15 to 20 years after a major solar output decline between 2035 and 2045. This view is shared by the Belgian astronomer, Dirk Callebaut, who expects a 'grand minimum' in the middle of this century, just like the Maunder Minimum (1650-1700), a period during which the Thames, the Seine and the Dutch canals were frozen in winter. In the same vein, NASA's solar physicist David Hathaway has recently reported that the Sun's Great Conveyor Belt has slowed to a record low crawl. This has important repercussions for future solar activity. The Great Conveyor Belt is a massive circulating current of fire (hot plasma) within the Sun. Researchers believe the turning of the belt controls the sunspot cycle. According to theory and observation, the speed of the belt foretells the intensity of sunspot activity ~20 years in the future. A slow belt means lower solar activity; a fast belt means stronger activity. Hathaway believes that Solar Cycle 25, peaking around the year 2022, could be one of the weakest in centuries.

Others, like Veizer and Shaviv, emphasize the role of cosmic rays, which vary in time and are, moreover, being modulated by fluctuating sun activity. These rays hit gas molecules in the atmosphere and form the nucleus of what becomes a water vapour droplet. These in turn form clouds, reflecting some of the sun's energy back to space and cooling the Earth. They all believe that the impact of man-made greenhouse gasses is at most a minor factor, if not completely insignificant.

Another group, including Lindzen, Singer, Hoyt and Michaels, focuses its criticism on the deficiencies of climate models to predict future climate. Actually the IPCC,

which represents the AGW view, emphasizes that the models produce projections and not predictions. There is a world of difference between the two. But, more often than not, the distinction gets lost in the public climate debate.

The models solve the equations of fluid dynamics and are capable of describing the fluid motions of the atmosphere and the oceans. But they do a very poor job of describing the clouds, the dust, the chemistry and the biology of fields, farms and forests, as well as topography. In other words, they are not able to 'capture' the real world that we live in. The authors in question emphasize that no single model has ever been validated. They have not been able to simulate past climate. *A fortiori*, they are incapable of producing reliable projections of future climate. Insofar as AGW adherents maintain that they have been able to achieve a nice 'fix', the sceptics argue that this has only been possible by tricks, such as flux adjustment, which they generally qualify as fudging.

AGW adherents argue that it is possible to distinguish the anthropogenic forcing ('human fingerprint') from natural forcings, for instance the sun, eruptions of volcanoes and natural ('internal') climate fluctuations, such as el Niño. On the basis of the best estimates of natural forcings, they calculate the hypothetical rise in temperature and compare it with measured temperatures. The difference between the two is the human finger print. They conclude that from the middle of the century, and particularly over the last few decades, the human contribution to global warming has become a dominant forcing. The sceptics reject this kind of reasoning. They believe that the estimates of the natural forcings are not accurate enough to warrant such conclusions. Moreover, they underline that there are plenty of other important forcings, such as aerosols and the formation of clouds, which have been disregarded in these kind of calculations. That is why they do not trust the outcomes.

AGW adherents recognize that warming will be reduced by extra cloud formation. They also admit that models should be improved to take account of this effect. According to some sceptics this is a euphemistic way to acknowledge that climate models can not handle this important, yes perhaps even predominant effect. The reason is clear. Cloud formation varies enormously, both in time and place. It will probably never be possible to model these fluctuations. Consequently, models will remain useless to predict the climate. More generally, climate sceptics underline logical inconsistencies between the uncertainties which are acknowledged by the IPCC on the one hand and its assertive pronouncements about future climate catastrophes on the other. And if one does not fully understand the climate system, how then could one know what measures should be taken to 'control' it?

AGW adherents acknowledge that their models are still far from perfect. But they argue that these are constantly being improved. Some sceptics retort that in the past economists had similar confidence in their models. But somewhere in the seventies they came to the conclusion that there are limits to their usefulness.

Another group, including McIntyre, McKittrick and Soon, are focusing their critique on historical temperature reconstructions (the hockey stick-shaped temperature curve over the last thousand years, based on research by Mann *et al*), which occupies a central place in the reports by the IPCC. This curve conveys the message that recent temperature rise is without precedent in the past millennium and

that it is man-made. In doing so, the hockey stick has played a decisive role in rallying political support for Kyoto. The sceptics reject these claims. They believe that temperatures in the Middle Ages (the Mediaeval Warmth Period) were higher than today. The Idso's are currently collecting a spate of recent peer-reviewed studies from various parts of the world, which indeed seem to support the view of the sceptics. <http://www.co2science.org/scripts/CO2ScienceB2C/data/mwp/mwpp.jsp>

Mann's 'hockey stick', which has been qualified by the German climatologist Von Storch (not a climate sceptic) as 'Quatsch', has recently been subject of an investigation by a special panel of the American National Academy of Sciences. The panel concluded:

'The Research Council committee found the Mann team's conclusion that warming in the last few decades of the 20th century was unprecedented over the last thousand years to be plausible, but it had less confidence that the warming was unprecedented prior to 1600; fewer proxies - in fewer locations - provide temperatures for periods before then. Because of larger uncertainties in temperature reconstructions for decades and individual years, and because not all proxies record temperatures for such short timescales, even less confidence can be placed in the Mann team's conclusions about the 1990s, and 1998 in particular.'

Authors such as Singer and Douglas, highlight the puzzling deviation of surface temperatures and those in the lower troposphere. While all models project a higher rise of temperatures in the lower troposphere than those near the surface, observations of the real world show just the opposite, which raises doubts about the underlying science. In the light of the discrepancy of temperature measurements at the surface and the satellite measurements, the adherents of AGW recognize that models need to be improved, especially as regards the description of conditions at higher altitudes. But the sceptics believe that the mismatch is so serious that it fundamentally discredits the reliability of the models. Sceptics also argue that the IPCC underestimates the urban heat island effect. City temperatures are considerably higher than those in the countryside. Tall wind-blocking buildings and bunches of heat-absorbing concrete and bitumen cause temperatures to rise. Over time cities have expanded. Consequently, this effect has inflated surface based temperature measurements in and around cities. The sceptics argue that the adjustments which have been made to correct for this effect have been insufficient.

A distinction should be made between the primary heating effect of CO₂ and its ultimate heating effect, including positive (temperature raising) and negative (temperature lowering) feedbacks, because of amplifying/offsetting mechanisms in the atmosphere. These include changes in cloud formation and changes in albedo (reflection of the earth surface, e.g., because of melting of ice or changes in snow cover). While the AGW adherents argue that a doubling of the CO₂ concentration in the atmosphere will result in a temperature rise of something of the order of 3 °C, various climate sceptics believe that it is much lower: 0.3 - 1.5 °C, which is less than to get excited about. Generally, AGW adherents believe in relatively strong positive feedbacks, amplifying the primary heating effect of CO₂, while climate sceptics believe these effects to be somewhere in the range from mildly positive to negative. Authors, such

as Lindzen, Rörsch and Thoenes, surmise that the atmosphere possesses a negative (temperature lowering) feedback mechanism in the form of a 'cloud iris effect' or 'water thermostat', which offsets the warming effect of a higher concentration of greenhouse gases.

But some sceptics even question the direction of the causal relationship between CO₂ and temperatures. Especially geologists, such as Priem, argue that temperature rises precede the increase in CO₂ concentration in the atmosphere on geological time scales. Rörsch believes that this is also true for shorter time scales. On the basis of observations of year-to-year fluctuations of worldwide temperatures and CO₂ concentrations in the atmosphere, he concludes that the concentration of CO₂ in a particular year has no effect on the average global temperature. Conversely, the average annual global temperature in a particular year largely determines the uptake of CO₂ by the atmosphere, in the sense that higher temperatures lead to an increased uptake of CO₂ in the atmosphere and vice versa. In other words, observations show that after a relatively warm year, the CO₂ concentration in the atmosphere continues to increase, while temperatures go down. So, in their view, the causal relationship between CO₂ and temperature might well be just the opposite of that of the AGW hypothesis.

Insofar global warming is real, sceptics argue that - up to a point: + 2 °C is often mentioned - its effects will be beneficial to mankind, because of increases in agricultural yields, as a result of higher temperatures, enlargement of agricultural areas, especially in the Northern hemisphere, and the aerial fertilizing effect of higher concentrations of CO₂, which promote plant growth. More generally, sceptics argue that human beings have managed to adapt to an incredible variety of regional climates to develop successful societies.

As far as sea level rise is concerned sceptics regard the range which has been published in the latest IPCC reports (9 - 88 cm in this century) as grossly exaggerated. Over the past centuries, sea level has risen by 15 - 20 cm per century. So far, no acceleration has taken place, which might have been expected as a consequence of the human contribution to the greenhouse effect.

As regards the economic dimension of the climate issue sceptics have criticized the IPCC because it alarmingly raised its projected temperature upswing. The penultimate IPCC report still presented a range of 1.0 - 3.5 °C; the last report a range of 1.4 - 5.8 °C. Courtney argues that this rise has nothing to do with increased climate/ temperature sensitivity for CO₂, but should exclusively be attributed to the use of a different set of economic scenarios ('story lines' in the vocabulary of the IPCC), which show an unlikely high economic growth rate with corresponding high greenhouse gas emissions. Castles' and Henderson's critique is even more fundamental. They believe that the IPCC's economic scenarios contain serious analytical errors, e.g., by comparing differences in real GDP on the basis of exchange rates in stead of purchasing power parities. Moreover, they point out that in some scenarios, the main reason for building in convergence in GDP per head is a presumption that international inequalities are evidence of remediable injustice and that policies will be directed towards remedying it. This view of events and relationships is open to obvious objections; and it is a dubious procedure, in what is presented as a neutral scientific

inquiry, to project a specific sequence of future outcomes, not on the basis of argument and evidence, but on the grounds that the world would be a better place if it occurred.

Boehmer-Christiansen, Seitz and Leroux criticize the IPCC because of 'spindoctoring', disguising uncertainties and exaggerating risks, while they also disapprove the dominant role of meteorologists/climatologists in the process, at the expense of representatives of other scientific disciplines, such as astronomy, physics, paleoclimatology, paleobiology and geology, who are often critical to the AGW hypothesis.

Climate sceptics often detect biases in scientific papers and/or statements by mainstream AGW adherents, which they attribute to their dependence government subsidies. Many governments have committed themselves to Kyoto. More often than not, it is much easier to acquire subsidies for research which may confirm the AGW hypothesis than for investigations which are at odds with the man-made global warming paradigm. Sceptics see this as an attack on the impartiality and integrity of science.

Authors as Lomborg and Labohm underline the unfavourable relationship between costs and benefits of Kyoto, and, *a fortiori*, that of follow-up proposals to even further reduce the emission of man-made greenhouse gases (post-Kyoto). In addition, Labohm underscores the adverse effects of Kyoto on national sovereignty as well as on our market system. For Europe the implementation of Kyoto implies a transfer of authority to 'Brussels' and the introduction of elements of central planning into the European economy.

As regards the political aspects, climate sceptics argue that the official information about the climate issue has been less than complete, yes even (deliberately) imbalanced and/or slanted, in the sense that climate threats have been hyped, while the public had been deluded into believing that the propose measures, especially Kyoto, would be effective to counter the putative threat. Governments have withheld information about the costs and benefits of Kyoto (and post-Kyoto). The sceptics are of the opinion that this is inadmissible from the point of view of democratic accountability and transparency. So far, the net cooling effect of Kyoto, as amended at the climate conference in Marrakech (0.02 °C in 2050), has never been published in official documents, while the costs of the proposed measures, something to the tune of hundreds of billions of dollars per year for the participating countries, have either not been calculated or grossly underrated.

At the climate conference in Montreal (December 2005) it has become clear that majority of the countries in the world rejects the cap-and-trade approach to global warming (emission ceilings in conjunction with tradable emission right). Against this background, sceptics are opposed to an 'Alleingang' of Europe, because such a policy course, including a system of tradable emission rights, is ineffective, and will jeopardize the economic development of Europe and its worldwide competitiveness. It will also adversely effect Europe's investment climate, both for internal and external investors. Europe will become less attractive for foreign direct investments, while European investors will move production facilities abroad, with depressing effects on Europe's wealth and employment.

The sceptics believe that a system of tradable emission rights meets with many fundamental and practical objections. These are vastly underestimated. As regards the fundamental objections, it is argued that such a system constitutes an infringement of our free market system. It will entail a new layer of regulation, on top of the existing layers, which will impose an extra burden on business and industry. Such measures would, of course, be warranted if they could prevent a climate catastrophe. But the climate sceptics challenge the view that the on-going changes in climate are a portent for disaster.

Climate sceptics are generally not against energy savings and the improvement of energy efficiency. Nor are they opposed to measures which, for other reasons than the reduction of greenhouse gas emissions, may have a positive impact on the environment.

In the light of major uncertainties concerning the underlying science, and considering countless more urgent societal priorities, climate sceptics regard Kyoto to be unjustifiable, also because of the dismal cost-benefit relationship of the policies in question.

Assuming that CO₂ does only play a minor role in the heat balance of the Earth, Kyoto and post-Kyoto are ineffectual and a squandering of resources. (This goes further than Lomborg's view that Kyoto is not cost effective. In his book, 'The Skeptical Environmentalist', he takes the AGW hypothesis for granted. Many other sceptics do not.)

The adherents of the AGW hypothesis and Kyoto often argue that the science is settled and that all scientists agree. This overview shows that this is simply not true.

Discussion is the lifeblood of scientific progress. In all scientific fields there are permanent debates going on, which their practitioners are eager to join. However, in climatology communication between different schools of thought seems to be labouring under all kinds of impediments. Often passions run high, accompanied by mutual recriminations. There are many documented incidents of derision, ostracism and even intimidation of climate sceptics by representatives of the mainstream. So-called 'information' campaigns to promote political support for Kyoto, show traits which are similar to the ones which were, and still are, so popular under authoritarian regimes. The selection of speakers, papers and the format of the conferences is such that, more often than not, critical views are being kept at bay. Adherents of AGW often argue that climate sceptics should first publish in peer-reviewed journals before their criticism could be taken seriously. Climate sceptics retort that the peer-review process (of journals such as *Science* and *Nature*) is dominated by AGW proponents and that sceptics have to meet stricter demands in order to get published than the mainstream authors. Many climate sceptics have experienced the submission of their articles being turned down on flimsy grounds. Moreover, they argue, the peer-review process as such proves to be flawed, witness for instance Mann's hockey stick. The sceptics have nevertheless published hundreds of articles in peer-reviewed journals, but these articles are generally ignored in the periodical stocktaking by the IPCC of the state of climate science.

Many climate sceptics are reluctant to openly air their criticism of the AGW hypothesis, because this may damage their career prospects at national meteorological

offices or environmental research institutions. Yet, over the last few years the number of self-declared climate sceptics has been growing, which, fortunately, might have contributed to the somewhat more relaxed and business-like exchange of views between the two camps today.

What is so exceptional about climatology that scientific debate proves to be so fraught with difficulties? First of all, mainstream climatology has been politicised, in the sense that it has been prematurely forced into the straitjacket of the AGW paradigm, which is indispensable to legitimise all sorts of painful and intrusive policy measures, including Kyoto. A lot of political capital has been invested in this international undertaking over the past fifteen years. The thought that these investments might prove to be futile, because of the fact that their scientific basis is fundamentally flawed and their cost-benefit relationship abysmal, is a political and scientific nightmare, which the proponents of the current climate policies are anxious to suppress. Secondly, man-made global warming is the mother of all environmental scares. It is part of a new quasi-religion, which seems to be impervious to rational arguments. As the former British Chancellor of the Exchequer, Lord Nigel Lawson, recently observed in an article in the 'New Spectator':

'It has to be said that this [the sceptical viewpoint] is not an easy message to get across, not least because climate change is so often discussed in terms of belief rather than reason. It is, I suspect, no accident that it is in Europe that climate change absolutism has found the most fertile soil. For it is Europe that has become the most secular society in the world, where the traditional religions have the weakest popular hold. Yet people still feel the need for the comfort and higher values that religion can provide; and it is the quasi-religion of green alarmism and what has been termed 'global salvationism' of which the climate change issue is the most striking example, but by no means the only one which has filled the vacuum, with reasoned questioning of its mantras regarded as a form of blasphemy. But that can be no basis for rational policy-making.'

Hans Labohm is an independent economist and publicist. Together with Dick Thoenes and Simon Rozendaal he is co-author of 'Man-Made Global Warming: Unravelling a Dogma'. Recently he became an expert reviewer for the United Nations Intergovernmental Panel on Climate Change (IPCC).

ANNEX:

Well-known climate sceptics from different scientific disciplines and various parts of the world include: Khabibullo Abdusamatov; Jarl Ahlbeck; Sallie Baliunas; Tim Ball; Robert Balling; Jack Barrett; Dave Barss; David Bellamy; Sonja Boehmer-Christiansen; Frits Böttcher; Paal Brekke; Adriaan Broere; Ian Byatt; Ian Castles; John Christy; Ian Clarke; Paul Copper; Richard Courtney; Michael Crichton; Petr Chylek; (late) John Daly; Peter Dietze; David Douglass; Hugh Ellsaesser; John Emsley; Hans Erren; Robert Essenhigh; Chris Essex; Bob Foster; Chris de Freitas; Eigil Friis-Christensen; Bas van Geel; Lee Gerhard; Vincent Gray; William Gray; Kenneth Green; Timo Hämeranta; Tom Harris; Howard Hayden; David Henderson; Louis

Hissink; Christopher Horner; Douglas Hoyt; Heinz Hug; Sherwood, Keith and Craig Idso; Andrei Illarionov; Yuri Izrael; Albert Jacobs; Kees de Jager; Zbigniew Jaworowski; Hans Jelbring; Madhav Khandekar; Kirill Kondratyev; Chris Landsea; Douglas Leahey; Allan MacRae; Mikhel Mathieson; Stephen McIntyre; Ross McKittrick; Patrick Michaels; Fred Michel; Asmunn Moene; Julian Morris; Thomas Moore; Tad Murty; William Kininmonth; Kirill Kondratyev; Salomon Kroonenberg; Hans Labohm; Knud Lassen; Nigel Lawson; David Legates; Marcel Leroux; Richard Lindzen; Gerrit van der Lingen; Bjørn Lomborg; David Nowell; James O'Brien; Tim Patterson; Bob Pawley; Alan Peacock; Benny Peiser; Roger Pielke; Ian Plimer; Harry Priem; Paul Reiter; Colin Robinson; Art Robinson; Arthur Rörsch; Simon Rozendaal; Rob Scagel; Gary Sharp; Nir Shaviv; Paavo Siitam; Frederick Seitz; John Shotsky; Fred Singer; Robert Skidelsky; Carlo Stagnaro; Phillip Stott; Willie Soon; Roy Spencer; Henrik Svensmark; George Taylor; Henk Tennekes; Dick Thoenes; Jan Veizer; John Weissberger and David Wojick. Many of their contributions to the climate debate can be found in peer-reviewed journals and/or on internet.