

Global Climate Changes – Antidogmatron

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Abstract

Many recent researches point to the opposing opinions about climate changes, i.e. what causes them, by what dynamics they are being developed as well as how climate will change in future. It can be said that the followers of global warming dominate to a great extent with their statements and results of researches as in public life so in the science publications. In this paper we have tried to point to the numerous argumentative results which are continually marginalized. What is really new is that the attempts of determining the solar activity connection with other climate elements are more numerous and according to our conviction, the main point of the research is being more and more moved out of the atmosphere borders. Contrary to the widely spread belief of the catastrophic climate projections in the future, some researchers' results from Serbia also mostly fit into such view of the mentioned problem. Our searching through the literature has convinced us that there are also regions in other parts of the planet where e.g. the trend of temperature growth is lightly expressed so as those where negative values appear.

Key words: Global climate changes, solar activity, opposing opinions

Introduction

Global warming represents one of the phenomena which to a great extent, has an influence on the most of the human activities. It can be said that the followers of global warming dominate to a great extent with their statements and results of researches as in public life so in the science publications. The aim of this paper is to present the arguments of the scientists who have conditionally saying, opposing viewpoint. We are assured that the general support of such views is incomparably smaller so that more space will be given here to their results.

“The biggest problem we have with the climate debate is that the big mathematical models can't predict what'll really happen since the models contain simplifications that are probably wrong in important ways. We end up having to guess what will happen. Nature continually makes the climate change even without humans getting involved. So even once a change has happened it is still impossible to figure out how much of the change was caused by humans” (<http://www.futurepundit.com/>). Many papers can be written on this theme, but for this occasion we will give a brief review of the results published in the last ten years.

Survey of Recent Researches

Taking over the role of an institution for arousing the human conscience the Intergovernmental Panel for Climate Change (IPCC), according to the estimation from 1995, claimed that the temperature on Earth increased between 0.3 and 0.6°C during the 20th century. The increase of $0.6 \pm 0.2^\circ\text{C}$ is according to the new estimation (2001). That increase is 0.7°C according to the World Meteorological Organization (WMO, 1999). On the basis of IPCC models (over 2250 scientists participated in their making) the increase of 1.4 - 5.8°C is expected up to 2100. Considering that CO₂ concentration reached the level of 0,037 % at the end of the last century, the terms as “global warming” and “greenhouse effect” have become a part of a standard science vocabulary (Ducic, Radovanovic, 2005). “The biggest catalyst for climate change today are greenhouse gases” (<http://www.giss.nasa.gov/research/news/20011206/>) Shindell D. T.

Significant stimulus to the followers of the global warming due to excessive air pollution was the paper Mann et al (1998) published. They came to the results which pointed that the 20th century, that is period from 1990, and especially 1998 was the warmest one in the previous 600 years (it looks like a hockey stick in the graph, by which this term has been included into the science literature, figure 1). Citing Mann and Jones (2003), Mc Guire (2004) has concluded that period after 1980 was the warmest one in the last 2000 years. He also cites: “another nail in the coffin of the global warming skeptics was provided by a research team led by Qiang Fu ...” Schär and his co-authors (2004), similar like Beniston (2004) and Beniston and Diaz (2004) propose that the only explanation for the heat wave in Europe i.e. in Switzerland 2003 is that increasing greenhouse gases concentrations in the atmosphere are increasing climate variability as well as simply raising global temperatures. When it is an eventual solar impact on the weather and climate about, the viewpoints similar to what Barrow (1995) stated, could often be seen: “Solar variability over the next 50 years will not induce a prolonged forcing significant in comparison with the effects of the increasing concentrations of CO₂ and other greenhouse gases”.

Contrary to the prevailing opinion, more and more papers have appeared in which the question of global warming is generally considered as over-dimensioned. Dmitriev (1997), Michaels (1998), Arking et al, (2001), Agerup (2004), as well as many others gave very severe critiques on the account of used methodology and results that it was come to in the scenarios of IPCC. The mentioned authors have emphasized that the phenomenon of global climate changes certainly exist, but those changes are in the first place the consequence of the natural processes, and the human impact on them is considerably smaller. Changes on the regional level are also the focus of the researches, i.e. that there are regions on Earth which, conditionally said, show trend of stagnation, as well as those where the trend of air temperature decrease have been noticed. On the basis of the air temperature trend analysis for 20 stations in

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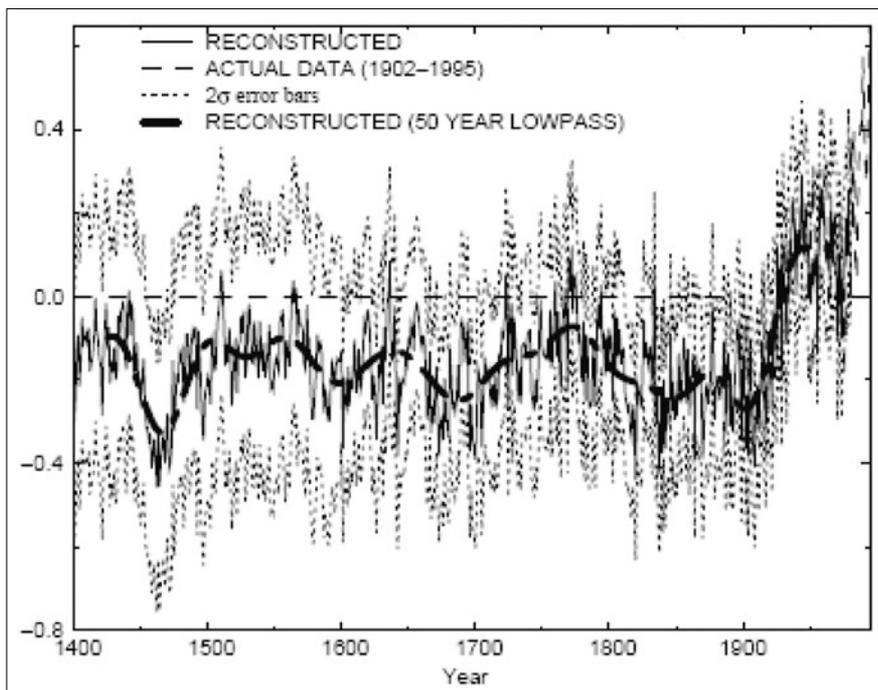


Figure 1: The long-term trends in the reconstructed annual mean Northern Hemisphere series (Mann et al., 1998)

Serbia, for period 1951-2000, Radovanović and Ducić (2004) came to a conclusion that “The maximum values of linear trend are calculated for Belgrade, Palić, Negotin, Zaječar and Loznica (0.13 - 0.14). ...Nevertheless, it could be said judging from accessible data that south of Kraljevo a negative trend in southeast direction has been stated”. The authors have presented the results of the research for Hungary and Bulgaria in the same paper on the basis of which a more significant temperature growth in the 20th century in these two neighboring countries could not be noticed. For the same time period Przybylak /2002/ calculated that the linear trend of air temperature (°C/10 years) in the area of the Arctic had the following values: Atlantic region 0.00, Siberian region 0.04, Pacific region 0.33, Canadian region 0.17, Baffin Bay region -0.19, Artic 1 (data from 37 Arctic stations) 0.08, Artic 2 (for 60-90°N latitude band) 0.16 and NH (land + ocean - areally averaged temperature for Northern Hemisphere) 0.09. Objectively these results can serve as a frame index only due to different length of the series in air temperature observing in comparison with the values which IPCC presents.

McIntyre and McKittrick (2003, 2005) obtained part of the program that Mann (1998) used, and they found serious problems. Not only does the program not do conventional PCA, but it handles data normalization in a way that can only be described as mistaken. The results that Soon et al., (2001) have come to, can be summed up into the following conclusions:

1. The increased surface temperature of about 0.5°C to 0.6°C over the last one hundred years is a natural phenomenon

- because 80 % of the rise in levels of atmospheric CO₂ during the twentieth century occurred after the initial major rise in temperature.

2. Surface temperatures (based on land and sea measurements) peaked by around 1940, then cooled until the 1970s; since then, there has been a surface warming.
3. The primary impact of the greenhouse effect of added CO₂ is in the lower atmosphere (rather than at the surface), but accurate measurements of that layer of air by U.S. National Oceanic and Atmospheric Administration (NOAA) satellites over the last 22 years have not shown any hint of global warming.

Shnidell et al. (1999) have also come to interesting results: “Solar cycle variability may therefore play a significant role in regional surface temperatures, even though its influence on the global mean surface temperature is small (0.07 K for December-February). The radiative forcing of the solar cycle, resulting from both irradiance changes and the impact of greenhouse trapping by the additional ozone, is also small (0.2 W m⁻² for December-February)”.

The essence of this brief survey of different views in the field of the climate changes is related to the fact that we cannot claim for sure what kind of weather circumstances we are expecting in the following month, not to mention longer periods of time. “It is hard to predict accurately where and how much rain will fall next week. It is harder still to forecast next year’s rainfall patterns” (http://earthobservatory.nasa.gov/Study/NAmerDrought/NAmer_drought.html).

As the analysis of the recent results concerned Gray (2000) has stated the opposing view point: Three of the four methods of measuring global temperature show no signs of global warming:

- Proxy measurements (tree rings, sediments etc) for the past 1000 years,
- Weather balloons (radiosondes) for the past 44 years,
- Satellites (MSU Units) for the past 21 years. The fourth method, surface measurement at weather stations, gives an averaged mean global rise of a mere 0.6°C over 140 years, but is intermittent and irregular. Individual records are highly variable, regional, and sometimes, particularly in remote areas, show no change, or even a fall in temperature. It is concluded that temperature measurements carried out away from human influence show no evidence of global warming. Contrary to catastrophic predictions of IPCC for the 21st century, Landscheidt (2000) expects a mild temperature decrease in period to 2010.

The beginning and end of the text written by Monibot et al., (2005) perhaps illustrates best the tense confrontation of the opinions “The science of climate change is under attack ...Isn’t it time you started fighting for your science”? The complete problem has deeply been infiltrated on the level of political confrontations. Famously, Inhofe declared on the Senate floor: “With all of the hysteria, all of the fear, all of the phony science, could it be that man-made global warming is THE greatest hoax ever perpetrated on the American people? It sure sounds like it” (<http://www.newwest.net/index.php/city/comment/9136/C396/L396>).

■ Mysterious Sun

In the last few years many papers have appeared studying the solar impact on the certain meteorological, i.e. climate elements from various aspects. “There has been more controversy about other parameters such as the open solar flux from the Sun, the geomagnetic *aa* index and the galactic cosmic ray (GCR) flux, which varies inversely with solar activity” (Kristjansson et al., 2004).

Lockwood et al., (1999) researched the supposition that during the 20th century it came to a considerable GCR flux increase, concluding that between 1964 - 1996 the increase of the total magnetic flux ejected from the Sun was 41% (± 13%) (figure 2).

Shaviv (2005) concluded that “...increased solar luminosity and reduced CRF over the previous century should have contributed a warming of 0.47±0.19°K, while the rest should be mainly attributed to anthropogenic causes. Without any effect of cosmic rays, the increase in solar luminosity would correspond to an increased tem-

perature of $0.16 \pm 0.04^\circ\text{K}$ ". It was calculated that the rest which was attributed to the anthropogenic causes was $0.13 \pm 0.33^\circ\text{K}$.

Except already mentioned Kristjansson et al. (2004), Svensmark and Friis-Christensen (1997), Marsh and Svensmark (2000), Udelhofen and Cess (2001), Kristjansson et al. (2002), Usoskin et al. (2004), Palle (2005), Zherebtsov et al. (2005) and many others have written about the connection of the cosmic radiation (including the solar, too) and global, i.e. regional cloudiness. Perhaps these words illustrate best the knowledge they have come to: "Although a detailed physical model quantifying this connection is still missing, correlation studies support its validity" (Usoskin et al., 2004). However, Sun and Bradly (2004) have the opposite opinion: "This reply thus further confirms our earlier conclusion that there is a lack of evidence to support the GCR-cloud hypothesis".

It is certainly indisputable that there have been many papers from the earlier periods but we would like to remark that we also had experts who suggested similar attitudes. "We must say immediately that a considerable number of climatologists suspect in the immediate helio-climate connections mainly because the intensity of the solar radiation in different periods of the solar activity is insignificantly changed, for 1% only ...Nevertheless, the weather conditions and climate on Earth do not have the cycles lasting eleven years, which are characterized for the solar activity....Thus we have bowed to the group of the climatologists who also search for the causes of the climate variability on Earth in the solar activity ...Namely, the weather conditions and climate are explained almost exclusively by the phenomena and processes in the atmosphere and on the surface of our planet. Even the weather "caprices" of 1980 were explained more by the St. Helen's volcano eruptions that happened on May 18, 1980 than by extremely strong and rough processes on the Sun during 1979/80 ...The satellite recordings show that after every flare on the Sun it comes to the increased cloudiness almost the next day" ...(Rakicević, 1987).

If there are already strong indications (in most of the presented papers) related to the solar and/or cosmic radiation connection with the phenomenon of cloudiness, we can ask ourselves clearly does it mean that the precipitations are also predisposed by the influences from the outside? The justification of such "heretical" question lies in the fact, which could not be denied, that the precipitations can emerge only from clouds. In that sense the paper written by Bhattacharyya, Narasimha (2005) was shocking. "Using wavelet techniques it is also found that the power in the 8-16 y band during the period of higher solar activity is higher in

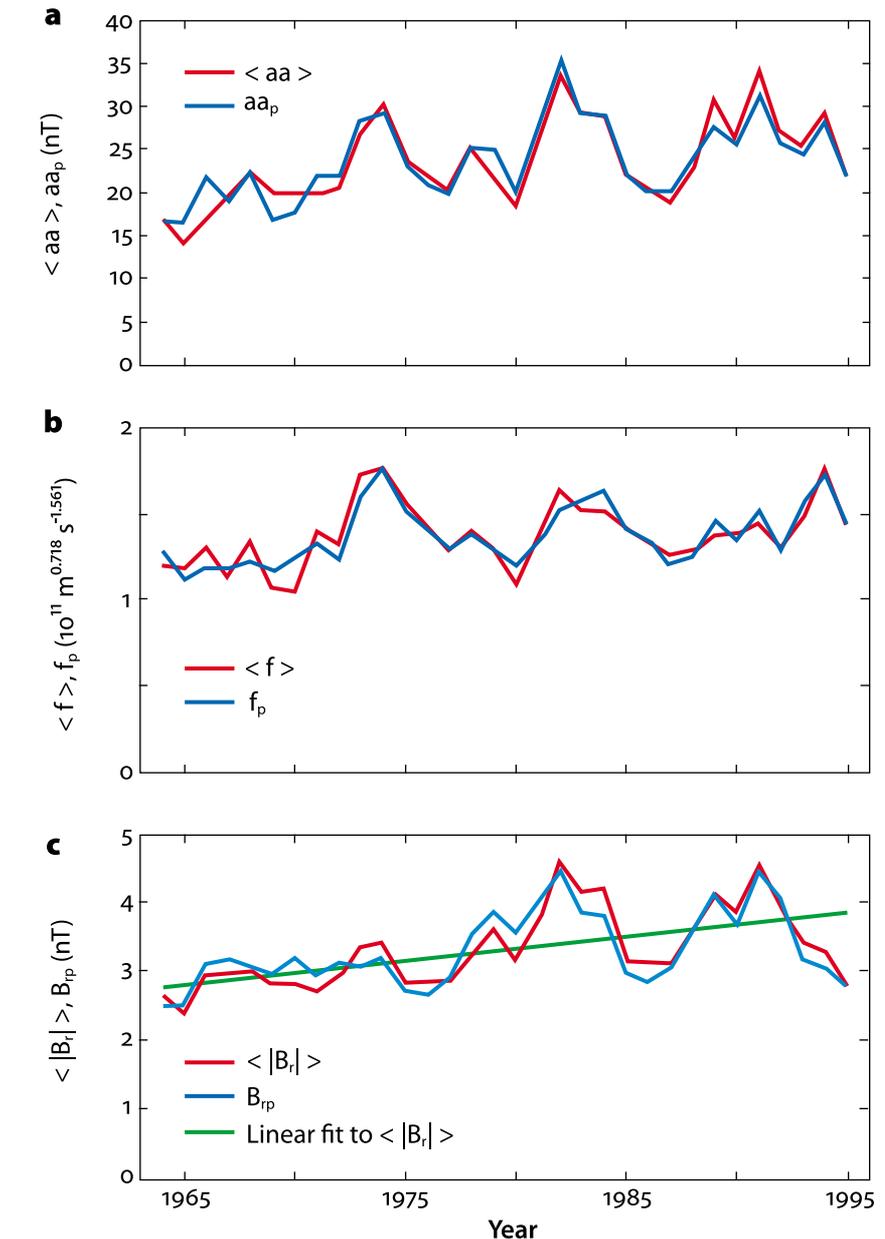


Figure 2: Time series of observed annual means and corresponding best-fit predicted values for 1964–96. **a**, Observed (aa) and predicted. **b**, The annual means (f). **c**, The annual means of the amplitude of the radial IMF component ($|B_r|$) and the predicted value B_{rp} (Lockwood et al., 1999)

6 of the 7 rainfall time series, at confidence levels exceeding 99.99 %. These results support existence of connections between Indian rainfall and solar activity".

Mukherjee (2006) also showed the existence of certain predispositions between the processes on the Sun and not just those climate elements it has been talked about. "It may be noted that the sudden snowfall on the northern hemisphere continents on the 25th of December, 2004 has sufficient bearing on Star-Sun-Earth's atmosphere interaction". Contrary to the "conservative" ideas and beyond the fact that there are many unclearness there, we can get an impression that scientists are more and more turned towards the Sun. Habbal, Woo (2004) have considered that: "The combination of solar wind dynamic pressure and magnetic reconnection leads to the for-

mation of the tear-drop shaped magnetosphere, and the entry of solar energetic particles into the Earth's ionosphere". According to Stevancević's (2004, 2006) hypothesis the electromagnetic waves that come to us from the Sun by the hydrodynamic pressure (after the penetration through the magnetosphere) are spreading over the air masses causing directly the development of the weather conditions. If there is a saturation of the air with moisture in the place of contact, depending also on the characteristics of the solar wind (SW), not only clouds could be made but also the precipitations. The mechanism of the precipitation formation has been explained by the electronic valence principle. Thus, not only the phenomenon of cloudiness and precipitations, but the phenomenon of hot waves and drought periods also,

are mainly caused by the electromagnetic characteristics of the SW, the location where from they are ejected from the Sun and their chemical structure as well. Depending on these parameters the atmospheric processes as well as the places of their origin, including the directions of developing, will also be depended on.

The SW which spreads like interplanetary front represents an output flux of the particles from the Sun and magnetic fields. The Sun's magnetic field is generated by dynamo action, though the details are still not entirely understood. ...The Sun's energy output varies on time scales ...and takes two principal forms: electromagnetic radiation and the emission of charged particles (<http://umbra.nascom.nasa.gov/spd/secr/>). At strong eruptions the SW also carries the highly energetic particles- nucleons, the energies of which are measured in millions of electron volts. The satellites which detect the particle flow measure the electric convectional current, which flows from the Sun towards the Earth. When cosmic rays hit Earth's upper atmosphere, they produce a shower of secondary particles that can reach the ground (http://science.nasa.gov/headlines/y2005/07oct_afraid.htm).

Landscheidt (2000) thought similarly: "The strongest contributors to the solar wind intensity are energetic solar eruptions (coronal mass ejections, flares, and eruptive prominences) which create the highest velocities in the solar wind and shock waves that compress and intensify magnetic fields in the solar wind plasma. Coronal holes have a similar effect. So it suggests itself to investigate whether periods of strong plasma ejections on the Sun are connected with temperature on Earth. Not all strong eruptions have an impact on the near - Earth environment. The effect at Earth depends on the heliographic position of the eruptions and conditions in interplanetary space. Indices of geomagnetic disturbances measure the response to those eruptions that actually affect the Earth". For Palamara and Bryant (2004) the existence of an interactive connection is not a question any more. "The crucial question now relates to how solar/geomagnetic activity is coupled to the lower atmosphere".

According to Stevancević (2004, 2006) the key which explains the mentioned causative- effective link represents the vector circulation of the interplanetary magnetic fields. It is interesting that there are similar confusions concerning the SW ejections from the Sun. Wang (2005) says: "Without the detailed knowledge about the vector magnetic fields in the photosphere, the coronal heating and activity can not be properly understood".

Therefore, while making the prognostic models the extremely rough process-

es manifested by unusually strong energy emissions can be a particular problem. Sometimes referred to as magnetic clouds, these parcels can be bigger than planets and have much greater impact on Earth than flares (Cowen, 2001). "2005 has been a surprisingly active year on the sun... Since January, astronomers have counted 14 powerful X-class solar flares and an even greater number of CMEs" (http://science.nasa.gov/headlines/y2005/07oct_afraid.htm).

While studying storms in Britain, Wheeler (2001) relied on the general aspects of the procedure which Corbyn used. Those aspects were based on the variations of the Sun's behavior, its magnetic field, coronal eruptions and fluctuating character of the SW. Therefore it is the methodology about that has nothing in common with most of the contemporary prognostic models which WMO officially uses. The result was that in period from October 1995 to September 1997 four out of five strong storms were correctly forecasted. The fifth one had a mistake of 48 hours, but such mistake can be considered as marginal simply because the forecast had been made a few months before publishing the expected results. As far as we know, mentioned Corbyn did not publish his methods in the public because they have been used for the commercial purposes.

It is useful to mention that independently from Corbyn and Wheeler, Stevancevic developed his own methodology "daring" to make for the first time in our country three months long weather forecast in 2003 which was based on the similar elements that were mentioned by the two previous authors (Ducić and Radovanović, 2005). What turned out in that forecast was that the best agreement between expected and measured maximum daily air temperatures for Belgrade were in the first and third month. It is necessary to point out that in many further attempts smaller or larger mistakes were emerging. However, Stevancevic and his collaborators have never realized the forecasts as a project task nor did any institution stand behind them. In other words, it is the enthusiasts about who on the basis of their personal interests exclusively try to get through certain knowledge. Is it necessary to emphasize that such attempts from the aspect of the "official science" are silently ignored or even rejected as unfounded in our country.

Conclusion

Generally, the conclusions can be summed up into the following:

- Global warming definitely exists as a phenomenon, but generally viewed such problem is at least over dimensioned. The regional aspects of the climate changes are the essence of the processes which are current, including

the regions where the relative stagnation is being emerged as well as the negative trend of air temperature.

- Air pollution is a large problem of the modern humanity and we have to put great effort into stamping out the progressive toxin emission just because of the disturbances they are causing in the atmosphere (the negative effects are especially expressed when it is anticyclone conditions about over the industrialized valleys and cities). However, the greenhouse effect is, on the basis of many studies, the factor which influences on the global climate disturbances considerably less than it has been thought recently.
- The processes on the Sun (including the cosmic radiation), on the basis of presented papers, represent a dominate factor which dictates as global climate changes (observing in the context of longer periods of time) so the development of separate synoptic situations.
- Climate changes which had been happening in the past, when human beings did not even exist on the planet, had been characterized in some phases both spatially and temporally as far more radical changes than the humanity had ever the opportunity to experience (including the Little Ice Age). From the cognitive point of view, it is unclear why the natural processes are so much abstracted (especially in public) on the account of the green house effect, i.e. anthropogenic impact on the climate changes.

We can get an impression that the historical moment we live in is characterized by rapid change (but also the conflict) of the way of thinking and understanding the causes of the climate conditions development on Earth. Nevertheless, the only way for confirming the ideas of the global warming followers or their opponents is to follow the weather conditions that are approaching us.

References

- Agerup M. 2004. Is Kyoto a Good Idea? Adapt or Die: The science, politics and economics of climate change, Profile Books, London.
- Arking A, Hopkins J, Cooper R, Happer W, Legates D, Lindzen R, Nichols R, O'Keefe W, Schlesinger J, Sedjo R, Sproull R. 2001. Climate Science and Policy: Making the Connection. George C. Marshall Institute, Washington, D. C.
- Barron J. E. 1995. Global Change Researchers Assess Projections of Climate Change. *Eos* 76, 189-90.
- Beniston M. 2004. The 2003 heat wave in Europe: A shape of things to come? An

- analysis based on Swiss climatological data and model simulations. *Geophysical Research Letters* 31, L02202.
- Beniston M, Diaz H. F. 2004. The 2003 heat wave as an example of summers in a greenhouse climate? Observations and climate model simulations for Basel, Switzerland. *Global and planetary change*, 44, 73-81.
- Bhattacharyya S, Narasimha R. 2005. Possible association between Indian monsoon rainfall and solar activity. *Geophysical Research Letters*, vol. 32, L05813, AGU.
- Climate Change 1995. The Science of Climate Change, Summary for Policymakers, Geneva.
- Climate Change 2001. The Science of Climate Change, Summary for Policymakers: Geneva.
- Cowen R. 2001. Stormy Weather - When the sun's fury maxes out, Earth may take a hit. Week of Jan. 13, 2001; Vol. 159, No. 2, p. 26. Stormy Weather Science News Online, Jan_13_2001.htm.
- Dmitriev N. A. 1997. Planetophysical state of the Earth and life. IICA Transactions, Volume 4, <http://www.tmgnow.com/repository/global/planetophysical2.html>, English Presentation Sponsored By: THE MILLENNIUM GROUP <http://www.tmgnow.com/1998>.
- Ducić V, Radovanović M. 2005. Klima Srbije. Zavod za udžbenike i nastavna sredstva, Beograd.
- Gray V. (2000): The cause of global warming (<http://www.john-daly.com/cause/cause.htm>).
- Habbal R. S, Woo R. 2004. The solar wind and the Sun-Earth link. *Astronomy & Geophysics* 45, 4.38-4.43.
- Kristjansson E. J, Staple A, Kristiansen J. 2002. A new look at possible connections between solar activity, clouds and climate. *Geophysical Research Letters*, 29, 2107.
- Kristjansson E. J, Kristiansen J, Kaas E. 2004. Solar activity, cosmic rays, clouds and climate – an update. *Advances in space research* 34, 407-415.
- Landscheidt T. 2000. Solar wind near Earth: indicator of variations in global temperature. European Space Agency Special Publication 463, p. 497 – 500, <http://mitosyfraudes.8k.com/Calen/NinoLand.html>.
- Lockwood M, Stamper R, Wild N. M. 1999. A doubling of the Sun's coronal magnetic field during the past 100 years. *Nature* 399, 437-439.
- Mann E. M, Bradley R. S, Hughes M. K. 1998. Global-Scale Temperature Patterns and Climate Forcing Over the Past Six Centuries, *Nature*, 392, 779-787.
- Marsh N, Svensmark H. 2000. Cosmic Rays, Clouds, and Climate. *Space Science Reviews*, 1-16.
- McGuire B. 2004. Climate Change. Technical paper 02, Benfield Hazard Research Center.
- McIntyre S, McKittrick R. 2003. Corrections to the Mann et al (1998) Proxy Data Base and Northern Hemisphere Average Temperature Series. *Energy and Environment* 14, 751-772. <http://www.climate2003.com/>
- McIntyre S, McKittrick R. 2005. The M&M critique the MBH98 northern hemisphere climate index: update and implications. *Energy and Environment*, 16(1) p. 69-100.
- Michaels J. P. 1998. Long hot year - Latest Science Debunks - Global Warming Hysteria. Policy Analysis, No. 329.
- Monbiot G, Lynas M, Marshall G, Juniper T, Tindale S. 2005. Time to speak up for climate-change science. If debate is left to greens and sceptics, people think the evidence is equal on each side. *Nature* 434, 559.
- Mukherjee S. 2006. Influence of a Star flare on the Sun-Earth environment and its possible relationship with snowfall. The-Eggs News Letter & Information Service of the E_G_U.htm Issue #15 19 April 2006.
- Palle E. 2005. Possible satellite perspective effects on the reported correlations between solar activity and clouds. *Geophysical Research Letters*, 32, L03802.
- Palamara R. D, Bryant A. E. 2004. Geomagnetic activity forcing of the Northern Annular Mode via the stratosphere. *Annales Geophysicae*, 22, 725-731.
- Przybylak R. 2002. Variability of air temperature in the Arctic in the 20th century. Man and climate in the 20th century. International conference 13-15 June 2002, Wrocław, abstract book, 84-85.
- Radovanović M, Ducić V. 2004. Kolebanje temperature vazduha u Srbiji u drugoj polovini XX veka. *Glasnik Srpskog geografskog društva* 84, 19-28.
- Schär C, Vidale P.L, Luthi D, Frei C, Haberli C, Liniger M.A, Appenzeller C. 2004. The role of increasing temperature variability in European summer heat waves. *Nature* 427, 332-336.
- Shnidell D, Rind D, Balachandran N, Lean J, Lonergan P. 1999. Solar Cycle Variability, Ozone, and Climate. *Science* 284, 305-308.
- Soon W, Baliunas S. L, Robinson A. B, Robinson Z. W. 2001. Global Warming a Guide to the Science. Risc Controversy Series 1, The Fraser Institute Centre for Studies in Risk and Regulation Vancouver British Columbia Canada 2001 Risk Controversy Series 1.
- Stevančević M. 2004. Tajne Sunčevog vetra. Beograd.
- Stevančević M. 2006. Teorijske osnove heliocentrične elektromagnetne meteorologije. Beograd.
- Sun B, Bradly R. S. 2004. Reply to comment by N. D. Marsh and H. Svensmark on "Solar influences on cosmic rays and cloud formation: A reassessment". *Journal of geophysical research* 109, D14206.
- Svensmark H, Friis-Christensen E. 1997. Variation of cosmic ray flux and cloud coverage: a missing link in solar-climate relationships. *Journal of Atmospheric and Solar Terrestrial Physics*, 59, 1225-1232.
- Udelhofen P.M, Cess R. D. 2001. Cloud cover variations over the United States: An influence of cosmic rays or solar variability?, *Geophysical Research Letters*, 28, 2617-26-20.
- Usoskin G.I, Marsh N, Kovaltsov A.G, Mursula K, Gladysheva G.O. 2004. Latitudinal dependence of low cloud amount on cosmic ray induced ionization. *Geophysical Research Letters*, 31, L16109.
- WMO 1999. WMO Statment on the Status of the Global Climate in 1998, WMO – No 896.
- Wheeler D. 2001. A verification of UK gale forecasts by the 'solar weather technique': October 1995–September 1997. *Journal of Atmospheric and Solar-Terrestrial Physics* 63, 29-34.
- Zherebtsov G, Kovalenko V, Molodykh S. 2005. The effect of solar activity on the Earth's climate changes. *Memorie della Società Astronomica Italiana* 76, 1076-1079.