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Analysis of global and hemispheric temperature records and prognosis

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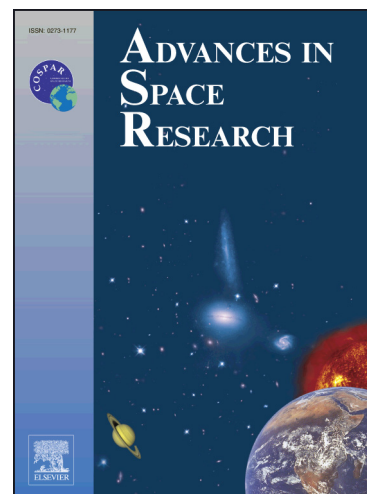
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## Abstract

Climate changes are connected to long term variations of global and hemispheric temperatures, which are important for the work out of socio-political strategy for the near future. In the paper the annual temperature time series are modeled by linear multiple regression to identify important climate forcings including external climate factors such as atmospheric CO<sub>2</sub> content, volcanic emissions, and the total solar irradiation as well as internal factors such as El Niño-Southern oscillation, Pacific decadal oscillation and Atlantic multidecadal oscillation. Adjusted temperatures were determined by removal of all significant influences except CO<sub>2</sub>. The adjusted temperatures follow a linear dependence toward the logarithm of the CO<sub>2</sub> content, and the coefficient of determination is about 0.91. The evolution of the adjusted temperatures suggests that the warming due to CO<sub>2</sub> from the beginning of the studied here time interval in 1900 has never stopped and is going on up to now.

The global warming rate deduced from the adjusted temperatures since 1980 is about 0.14±0.02°C/decade. The warming rate reported in the IPCC assessment report 4 based on observed global surface temperature set is about 20% higher, due to the warming by the Atlantic multidecadal oscillation additional to the anthropogenic warming.

The predicted temperature evolution based on long time changes of CO<sub>2</sub> and the Atlantic multidecadal oscillation index shows that the Northern Hemispheric temperatures are modulated by the Atlantic multidecadal oscillation influence and will not change significantly to about 2040, after that they will increase speedily, just like during the last decades of the past century. The temperatures of the Southern Hemisphere will increase almost linearly and don't show significant periodic changes due to Atlantic multidecadal oscillation. The concrete warming rates of course are strongly depending on the future atmospheric CO<sub>2</sub> content.

Key words: Climate change; multidecadal variability; climate impacts; long time trends; warming rates; forecast

## 1. Introduction

Global warming means the increase of the average global temperature over a long time period. The global temperatures inferred from direct observations show a temperature rise of approximately 0.7°C during the 20<sup>th</sup> century. The temperatures don't increase continuously. Longer periods of warming alternate with periods in which the temperature doesn't increase or cooling is observed. A cooling period was registered from the beginning of the systematic observations of the global temperature in 1880 up to 1910, followed by warming up to approximately 1940. After that the temperatures on the average are going down again. Since about 1970 a strong warming period is observed. The global temperature series are characterized also by shorter

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