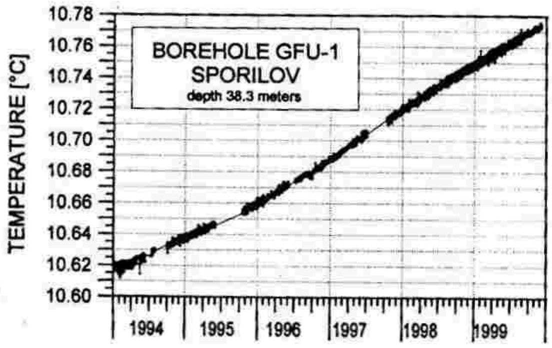


**Fig. 1.** Six year temperature monitoring at 38.3 m depth (Spořilov borehole).

the last six years. Similar but shorter one-year record from Kocelovice hole revealed warming rate of 0.0176 K/yr.

## Interpretation

In an attempt to use the older temperature logs done for heat flow studies (Bodri and Čermák, 1997) almost one hundred temperature-depth T(z) profiles were inverted to assess the ground surface temperature (GST) history on the territory of the Czech Republic. The results were used to project a regional GST warming pattern which was then compared with a similar pattern constructed for long-term SAT series (1961–1996) from 30 local meteorological stations. Both patterns revealed certain similarities suggesting higher warming rates characteristic for areas generally more densely populated and with higher concentration of industry while lower warming rates correspond to generally farming land (Bodri and Čermák, 1999). Both present values found at Prague-Spořilov and at Kocelovice sites are in good agreement with pattern obtained from meteorological SAT series. The difference between the observed higher warming rate at Spořilov compared with information from Kocelovice confirms the assumption of the regional character of the present warming rate reflecting certain potential anthropogenic contribution in large urban conglomeration.

## Concluding remarks

The experiment proved that the magnitude of the present-day warming corresponding to the last one to several decades is reasonably well extractable by precise temperature monitoring at shallow boreholes below the depth of the penetration of the annual variations. So far data sets from only two experimental boreholes (one of them being only one year long) are preliminary, but well confirmed the applicability of the method.

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# Extraterrestrial Influences on Meteorological Parameters

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*ABSTRACT. We studied the long-term trends of meteorological time series and their relations on extraterrestrial factors. All our series were processed by integral curve method consisting in addition of deviations of the parameter of interest. We can conclude that the 90–100 year solar cycle plays the first rate role in the forming of these trends and in this way it influences the climate changes too. In Bohemia, the temperature and solar activity have their trends parallel and precipitation opposite. After the year 1989 the long term trend of solar activity began to decrease. According to the searched relations we can expect colder and wetter epoch in this region in next years until the green-house effect forcing prevails these extraterrestrial factors. The tropical cyclone occurrence in North Atlantic and solar activity are parallel. It means in average an occurrence decrease of tropical cyclone in further development. The courses of the position of planetary height-level frontal zone and solar activity are parallel. It means shift of this zone southward and so the cooling on the Northern Hemisphere in the future.*

*KEY WORDS: solar activity, meteorological series, climate changes.*

## Introduction

We searched relations between extraterrestrial factors and secular meteorological series to improve our long-range weather forecasts.

## Methods and material studied

We used the integral curve method to dicscover the long-term trends in time series. This method consists in addition of deviations of element of interest. The examined time series were the mean annual temperature in Prague-Klementinum 1771–1999, annual precipitation totals in Bohemia 1876–1999, the German synoptical pattern classification "Grosswetterlagen" 1881–1999, the mean annual Wolf's numbers of solar activity, the mean annual geomagnetic indices Cip 1884–1999, the tropical cyclone annual totals in the North Atlantic area 1871–1994, mean annual position of planetary height-level zone 1967–1998. Some parameters were studied in their monthly values too.

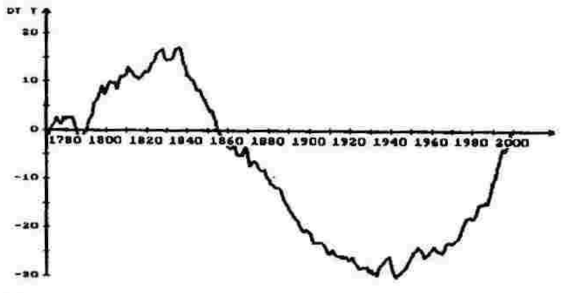


**Fig. 1.** Integral curve of the mean annual temperature (1771–1999, Prague-Klementinum). DT T - temperature deviation totals.

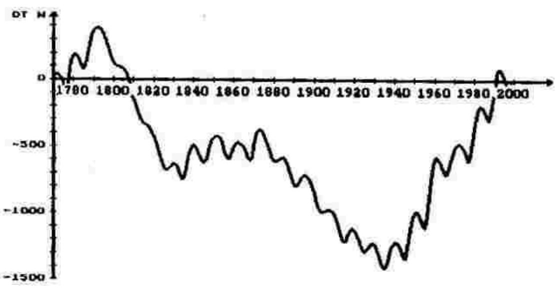


**Fig. 2.** Integral curve of the mean annual Wolf's numbers (1771–1999). DT W - Wolf's number deviation totals.

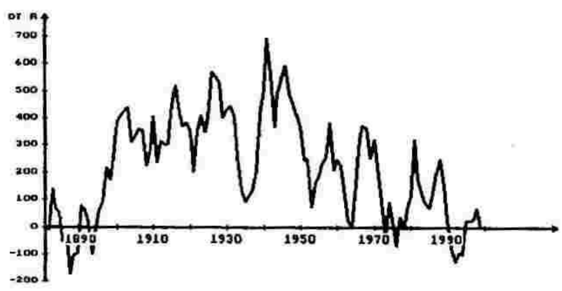


**Fig. 3.** Integral curve of the annual precipitation totals (1881–1999, Bohemia). DT R - precipitation deviation totals.

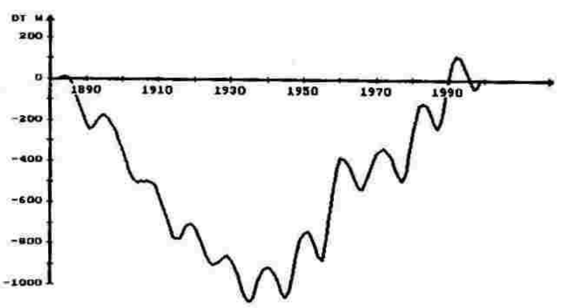


**Fig. 4.** Integral curve of the mean annual Wolf's numbers (1881–1999). DT W - Wolf's number deviation totals.

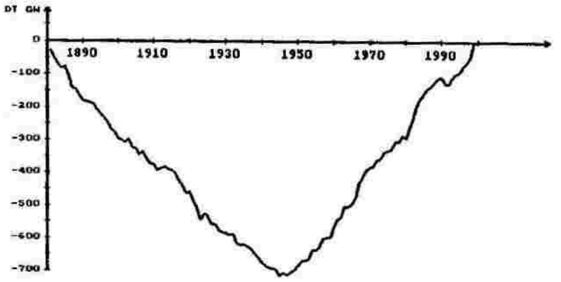


**Fig. 5.** Integral curve of the GWL synoptical group (SWz, SWa, Sz, Sa, TB, TRW, 1881–1999). DT GW - annual deviation totals of this group.

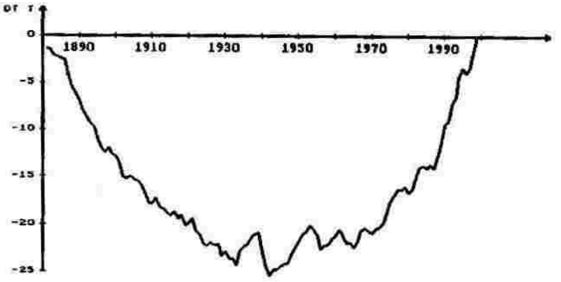


**Fig. 6.** Integral curve of the mean annual temperature (1881–1999, Prague-Klementinum). DT T - temperature deviation totals.

In the periods in which the positive deviations prevail, the intergral curve increases and vice versa. The increasing or decreasing trends determine the warmer (wetter) or colder (drier) epochs, etc. The integral curves of all parameters were compared to get some forecast conclusions.

## Results and analyses

The integral curves of mean annual temperature in Prague-Klementinum 1771–1999 (Fig. 1) and mean annual Wolf's numbers (Fig. 2) are "parallel". The integral curves of mean annual precipitation totals in Bohemia 1881–1999 (Fig. 3) and Wolf's numbers (Fig. 4) are "opposite". The next figure presents integral curve of the circulation Grosswetterlagen group SWz, SWa, Sz, Sa, TB, TRW (Fig. 5). This circulation group brings warmer air masses from southern and south-west sectors into Central Europe. Fig. 6 presents integral curve of temperature in Prague-Klementinum 1881–1999 . Both curves (Fig. 5, Fig. 6) must be parallel. There are two significant trends. The first decreasing, the other, since forties, increasing. The integral curve of monthly mean temperature (1.1981–4.2000) (Fig. 7) and Wolf's numbers (Fig. 8) are "parallel". The relevant integral curves of monthly mean precipitation totals (Fig. 9, Fig. 8) are "opposite". We state that geomagnetic activity influences on the meteorological elements are similary as the solar activity ones Fig. 10. In the case of the tropical cyclone occurrence in the North Atlantic Ocean 1871–1994 (Fig. 11) and solar activity, the long-term trends are "parallel" and the position of their minima are in a good coincidence. Further we studied the mean annual position of planetary height-level frontal zone at the level AT 500hPa by means of the isohypse 552 hPa according to the German materials "Die Grosswetterlagen Europas". We found out the positions of the points of intersection of the isohypse 552 hPa and 18 meridians after 20 longitude degrees on the Northern Hemisphere beginning at the Greenwich meridian. We received 18 points of intersection and reckoned their average

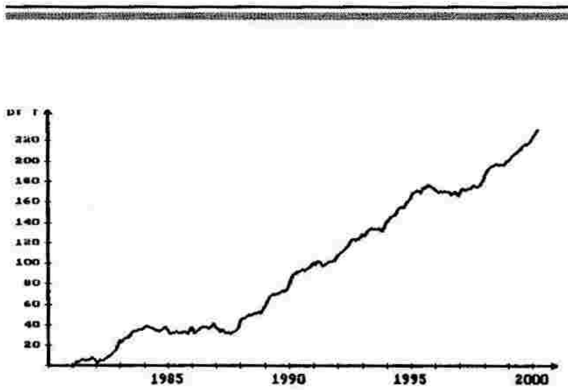


Fig. 7. Integral curve of the monthly mean temperature (January 1981–April 2000, Prague-Klementinum). DT T - temperature deviation totals.

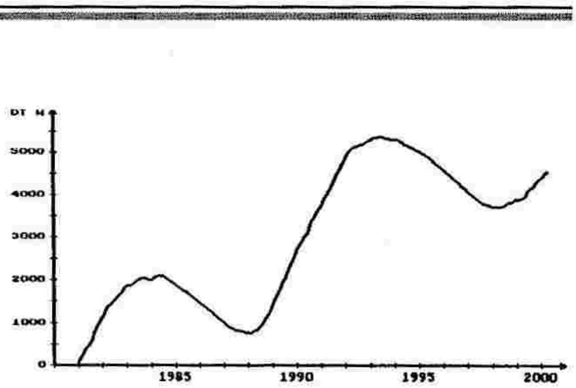


Fig. 8. Integral curve of the monthly mean Wolf's numbers (January 1981–April 2000). DT W - Wolf's number deviation totals.


Fig. 9. Integral curve of the monthly precipitation totals (January 1981–April 2000, Bohemia). DT R - precipitation deviation totals.


Fig. 10. Integral curve of the monthly mean indices Cip (January 1981–April 2000). DT M - Geomagnetic indices totals.

for each year. This average was taken as the annual mean position of the zone Fig. 12. We can see that this position and solar activity are "parallel" excepted 15.6% of years 1968, 1969, 1972, 1975, 1996 only.

## Discussion and conclusion

It is apparent that the 90–100-yr cycle of the solar activity and geomagnetic activity play remarkably important role in the forming long-term changes of meteorological parameters and through them also in climatic changes. They could be used as predictors. The 11-yr solar cycle is not so expressive. The maximum of long solar cycle appeared in 1989. Since 1990 the long-term trend of solar activity decreases. According to the parallel or opposite trends of searched parameters we can expect following climat changes until the green-house effect forcing prevails these extraterrestrial factors. Current drier and warmer epoch in our country beginning in the forties this century will change in a wetter and colder epoch lasting 40 or 50 years (half of solar cycle). We can expect the less occurrence of tropical cyclones in average. The transfer of the planetary frontal zone southward (extend of cold arctic air masses in equator directions) will bring cooling on the Northern Hemisphere. The green-house effect forcing will stress our planet principally by general circulation changes. That will be evoked first of all by melting of the Ice Ocean. The synoptical opinion could give the following orientation. In this way, the temperature gradient equator-poles have to decreas, it means the decrease of intensity of zonal and meridional circulation. It means decrease of advection of wet ocean air masses from Atlantic Ocean into Central Europe and so the drier weather. The Siberia Anticyclone will stress its influence in winter. In summer we can expect expressive warming. It represents the continental climate in Europe. Extraterrestrial influences will affect for ever and will intensify the continental climate in the period of the in-

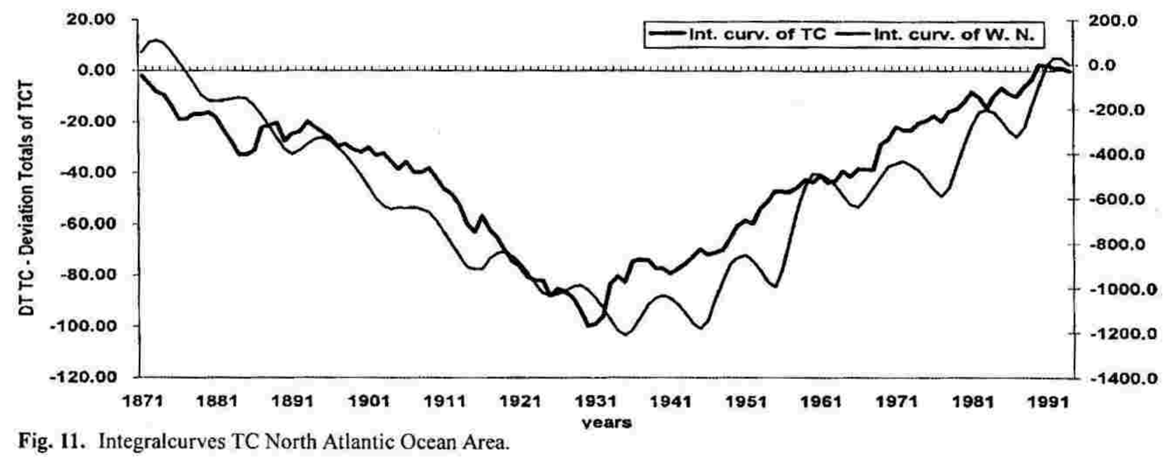


Fig. 11. Integralcurves TC North Atlantic Ocean Area.

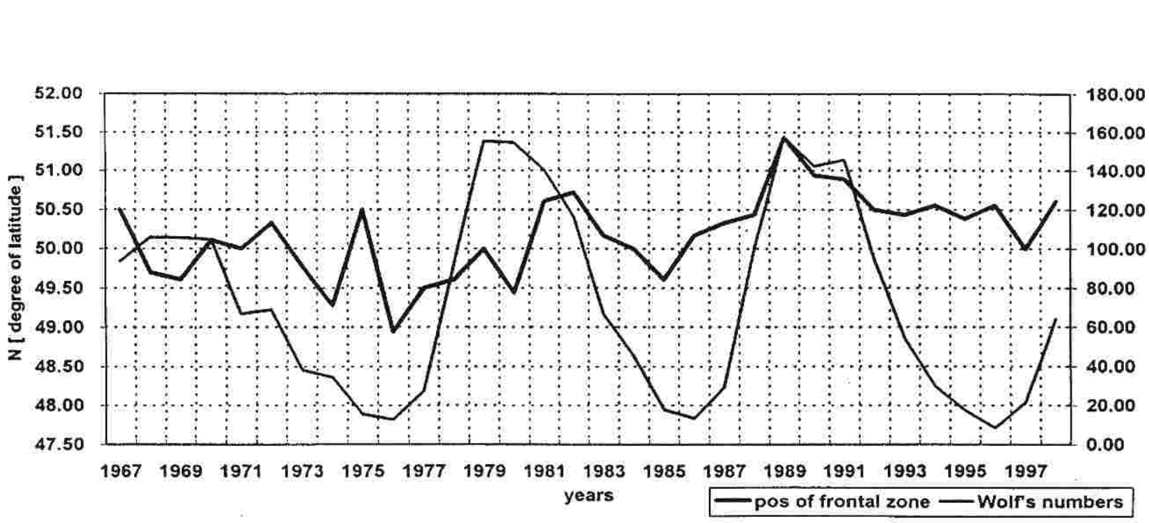


**Fig. 12.** The courses of solar activity (W) 1967–1998 and the position (N) of the frontal zone.

creasing trends of solar and geomagnetic activities and around their maxima (temperature and extraterrestrial trends are parallel, precipita-tion has its trends opposite). In this case we can expect inforcing of drier and warmer (in summer) weather in this region, it means extraordinary dry period. During the decreasing trends of extraterrestrial influences and around their minima we can expect only partial and weak moderating of continental clima because the green-house effect (melting of Ice Ocean = decreas of circulation intensity = less advection from Atlantic Ocean) will for ever retain the continental climate in Europe.

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# What do we Learn on Tropical Cooling at the Last Glacial Maximum from Data and Modelling within the Framework of Paleoclimate Modelling Intercomparison Project and Associated Sensitivity Experiments

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*ABSTRACT. Concerning past climate changes in tropical areas, one of the key issues after 2-years study of Glacial/Interglacial oscillations is: Are the tropics able to drastically change during Last Glacial Maximum? This question has been investigated through marine and continental data using different proxies to reconstruct temperature changes. An inconsistency raises when modellers prescribed global sea surface temperatures (SST) reconstruction (CLIMAP, 1981) to Atmospheric General Circulation Models (AGCM) and compared simulated results to continental data. The first to point out this problem were D. Rind and D. Peteet in the famous paper (1985) "Terrestrial conditions at the last glacial maximum and CLIMAP (1981) sea surface temperature estimates: are they consistent?"*

*More recently, within the framework of Paleoclimate Modeling Intercomparison Project, this question has been re-investigated from modeling point of view (Pinot et al., 1999), (9 different simulations) and from data perspectives with new estimates for SST from alkenone (Bard, 1999) and terrestrial data (synthesis of a large number of temperature reconstructions derived from different paleo-indicators (Farrera et al., 1999). This contribution will summarize the new results brought by the community (see two recent publications in Climate Dynamics 1999 (Pinot et al., 1999; Farrera et al., 19993), (see also Fig. 1 which summarize the state of the art in model/data comparison reaches by PMIP sub project "Tropics at LGM") and compare these results to new coupled simulations using AOGCMs (Bush and Phillander, 1998; Weaver et al., 1998) or intermediate complexity model (EMIC) (Ganopolski et al., 1998). Moreover, a short discussion of why possible changes in the lapse rate values may lead to a consistent*