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An Ice Age Within the Biblical Time Frame

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AN ICE AGE WITHIN THE BIBLICAL TIME FRAME

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ABSTRACT

The ice age is one of many physical processes believed by evolutionists to require much more time than the Bible allows. However, there is evidence that the climatic consequences of Noah's Flood caused a rapid ice age. All uniformitarian ice age mechanisms, including the astronomical theory, have serious scientific difficulties.

INTRODUCTION

Many physical processes are believed by evolutionists to require much more time than the Bible allows. One of these is the ice age. However, an ice age can occur rapidly due to the climatic consequences of Noah's Flood (1,2). The basis for this will be briefly summarized. The time for the ice age will be estimated from reasonable assumptions of the post-flood climate. Evidence will be presented for a single event.

THE RAPID ICE AGE

An ice age at mid and high latitudes requires cooler summers and a much larger supply of moisture than in the present climate. Scientists, who assume only a uniformitarian model have serious difficulty explaining these changes. A new study of the energy balance for Northeastern North America indicates that a summer temperature drop of at least 12°C is required (3). However, this will cause a 50% decline in the available moisture. This and other serious problems have resulted in a proliferation of more than 60 theories (4). Charlesworth, a well-known expert on glaciation, says: "Pleistocene phenomena have produced an absolute riot of theories ranging 'from the remotely possible to the mutually contradictory and the palpably inadequate'" (5). The recent solution, the old astronomical theory, has been thoroughly discussed and shown to be highly inadequate (6-8). Consequently, the available evidence leads to the conclusion that a catastrophic mechanism is needed.

According to my model, a rapid post-flood ice age depends upon summer cooling over mid and high latitude continents caused by volcanic dust and aerosols and an abundant supply of moisture from a much warmer ocean. The initial volcanic dust is a remnant of the tremendous tectonic and volcanic activity of the Genesis Flood. The cooling effect of dust is the basis for the recent interest in "nuclear winter." Significant volcanic activity probably continued long after the Flood as the earth adjusted to a new equilibrium. Supporting evidence is seen in the extensive post-flood lava plateaus and volcanic cones around the earth. After a snow cover is established, another powerful mechanism would reinforce the cooling over mid and high latitude continents. Although a pre-flood vapor canopy would contribute to a warmer ocean, the primary source of heat is the volume of hot water added to the pre-flood ocean from the eruption of "all the fountains of the great deep." The water would be a uniform temperature following the flood. Evaporation from the ocean is proportional to the surface temperature, the air-sea specific humidity difference, and the wind speed. It would be strongest near the cold continents. Storms would tend to track parallel to the edge of the Laurentide ice sheet, and most moisture would fall over the cold continents. The conditions would be ripe for a catastrophic ice age.

HOW MUCH TIME?

Is there enough time within the Biblical framework for even a rapid ice age? Is there really any legitimate way of estimating this? It is my opinion that a sound scientific estimate can be made. The time to reach glacial maximum would depend upon the controlling conditions, the volcanic activity and the warm ocean. The magnitude of the former cannot be estimated, but as long as high snowfall continues, the cooling effect of a snow cover will maintain the ice age during periods of volcanic lulls. Heavy snowfall will be maintained as long as the ocean surface is warm enough. Thus, glacial maximum will depend upon the cooling of the warm ocean, which can be estimated from the heat balance equations for the ocean and atmosphere (9). The melting time can be calculated from the energy balance equation for a snow cover (10,11).

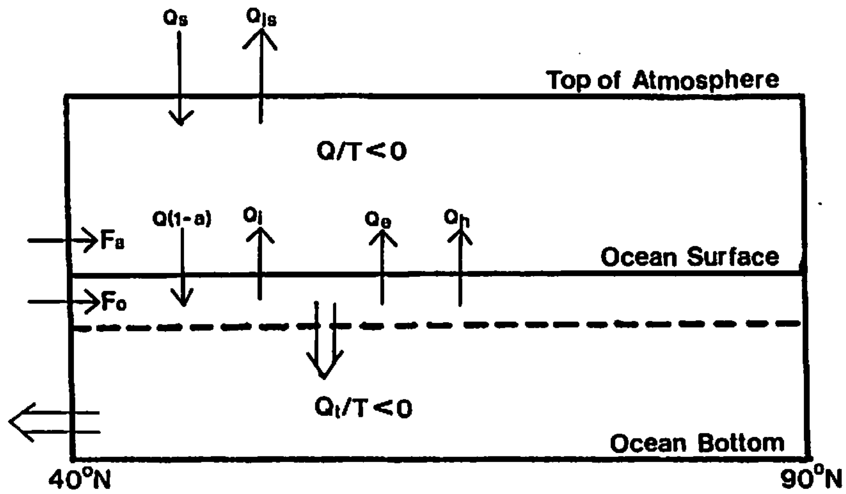

Figure 1. The heat balance of the ocean and atmosphere north of 40 N. Dashed line is the lower boundary of the ocean surface layer. Single arrows represent the direction of the heat flux. Double arrows are the flow of colder water. Symbols are defined in text.

Figure 1 shows the components of the ocean-atmosphere heat balance for the mid and high latitudes of the Northern Hemisphere. The heat balance for the ocean is:

$$Q(1-a) - Qi - Qe - Qh + Fo = Qt/T \quad (1)$$

where Q(1-a) is the absorbed solar radiation, a is the surface albedo or reflectivity, Qi is the net infrared radiation loss, Qe and Qh are the heat given off to the atmosphere from evaporation and conduction respectively, and Qt is the total cooling of the ocean needed to reach glacial maximum in time T. Fo is the surface layer higher latitude heat transport by ocean currents. Calculations of the other terms on the left hand side of Equation 1 need be made only for the higher latitudes, since Fo is a measure of the lower latitude heat balance. An estimate of Qt is -2.8×10^{25} calories based on an initial average ocean temperature of 30°C and a temperature at glacial maximum of 10°C. The latter is warmer than the current average of 4°C because the melting process is very efficient in the present climate. Using reasonable post-flood assumptions in the equations for Qe and Qh, calculations revealed that the heat liberated to the atmosphere likely was too high. Three conclusions can be drawn: 1) the atmosphere would regulate the oceanic cooling, like a thermostat or negative feedback mechanism, 2) the length of the ice age would be longer than previously estimated, and 3) the post-flood climate would be rather mild with cool summers and mild winters, especially at high latitudes. Thus, an estimate of Qe and Qh from the atmospheric heat balance for higher latitudes is needed.

Qe and Qh were found by subtracting the present atmospheric heat balance from the post-flood heat balance and estimating the differences between the two climates for each variable. The resulting equation with superscript 1 referring to the present value is:

$$(Rs - Rs') + (R' - R) + (Fa - Fa') + [(Qe + Qh) - (Qe' + Qh')] + Q/T = 0 \quad (2)$$

where Rs is the radiative heat balance at the top of the atmosphere, R is the radiative heat balance at the earth's surface, Fa is the higher latitude heat transport in the atmosphere, and Q is the net cooling of the atmosphere in time T. The term corresponding to Q for the present climate is zero. Rs is equal to the absorbed solar radiation by the earth and atmosphere, Q_s, minus the outgoing infrared radiation at the top of the atmosphere, Q_{is}. The first term in Equation 2 would be highly negative because of volcanic dust and aerosols and stronger infrared radiation due to warmer temperatures in the higher latitutdes of the post-flood climate. The second term would be positive because of reduced solar radiation reaching the ground due to volcanic activity and a much higher water vapor content in the post-flood climate. The higher moisture would also cause more infrared radiation absorption, but its effect on the surface balance would probably be small. The difference in surface albedo between the two climates would be insignificant because a higher albedo in summer over snow covered areas would be balanced by a lower albedo over the high latitude oceans with no sea ice. The third term would be negative due to less solar radiation in the tropics and a reduced north-south temperature difference. The fourth term is strongly positive. The fifth term would be slightly negative because the total cooling of the post-flood atmosphere divided by T would be small. The second, third and fifth terms would mostly balance. Therefore, Equation 2 becomes:

$$(Rs - Rs') + [(Qe + Qh) - (Qe' + Qh')] \approx 0 \qquad (3)$$

Thus, the heat added to the post-flood atmosphere from the warmer ocean would be approximately balanced by a greater loss of solar and infrared radiation at the top of the atmosphere. The eruption of Krakatoa decreased the total solar radiation by about 4% (12). Two Late Quaternary volcanoes, based on the size of the ash layer and relationships with modern eruptions, probably reduced the solar radiation more than the worse nuclear winter scenarios (13,14). Therefore, the reduction of solar radiation during glacial buildup was significant and assumed to range from 25% to 75% less than presently. The infrared radiation at the top of the atmosphere was assumed 10% higher than today, but still significantly lower than modern tropical values. Calculating these differences for each 10° latitude belt for both hemispheres and adding the present values, Qe and Qh range from 6.9×10^{22} calories/year to 12.4×10^{22} calories/year. The surface radiation balance and Fo in Equation 1 would not be reduced as much by volcanic activity because of compensating process. Substituting Qe and Qh into Equation 1 and assuming the surface radiation balance, the first two terms, and Fo are reduced 10% from present values for a 25% decrease in solar radiation, T equals 690 years. Assuming the radiation, T equals 270 years.

To estimate the melting time, the average depth of ice is needed. Figure 1 shows there are two sources of moisture for ice sheet growth, the first from Qe and the second from Fa, which includes the northward transport of latent heat. Qe is about three times Qh (15,16). I assumed a more realistic precipitation distribution of two times more over land than over the oceans. I neglected the proportion of re-evaporated moisture from non-glaciated land that would be precipitated over the ice sheets because in a mild ice age summer run-off would be significant and balance this process. The range of ice depths, calculated by the method of a previous paper (17), was 500 meters and 840 meters for the Northern Hemisphere and 880 meters and 1850 meters for Antarctica.

The ice sheet melting rate using an energy balance model has been attempted only recently (18). The area chosen for this calculation was Central Michigan, about 450 kilometers north of the ice sheet boundary at maximum extent. Several conservative assumptions were made. First, the annual temperature was 10°C colder than today due to the presence of the ice sheet (19). Second, the average cloud-base temperature was 5°C. Third, the winter snow melted and the top layer of ice was 0°C by May 1. Fourth, the melt season lasted until September 30. Fifth, other variables including relative humidity, cloudiness and wind speed were the same as in the modern climate. Neglecting small terms, the energy balance over snow is:

$$Qm = Q(1-a) - Qi + Qc + Qh \qquad (4)$$

where Qm is the melting heat and Qc is the heat added to the snow or ice from condensation of atmospheric water vapor. The radiation balance, [Q(1-a) - Qi], is the strongest effect. Qh and Qc will be positive when the air temperature above the snow is warmer than 0°C and the water vapor pressure is greater than the saturation vapor pressure at 0°C. This is practically always the case in summer. Qc and Qh depend upon a number of variables and are difficult to quantify, but were averaged from the data for 24 glaciers given by Paterson (20). Thus, Qh is 30% and Qc is 10% of the radiational balance. The albedo of fresh snow is high, but will drop to 0.4 after several weeks of melting (21). The albedo of ice ranges from 0.2 to 0.4. Using an albedo of 0.4, present values for solar and infrared radiation at East Lansing, Michigan, and converting Qm to melted ice, 9.7 meters/year is the rate for clear skies and 6.1 meters/year for cloudy skies (22,23). For typical cloud conditions, the rate would be between these values.

There is meterological support for stronger, drier storms tracking parallel to the ice sheet during melting, which would cause large quantities of blowing dust. The extensive loess and blowing sand deposits south of and within the periphery of the old ice sheet attest to this. The snow or ice surface would become dusty and the dust would concentrate on the surface during the melting season (24), which would reduce the albedo and increase the melting. The albedo over a permanent snow field in Japan was observed to drop to 0.15 during the summer after 4000 ppm of pollution dust was added to the surface (25). Also, crevasses greatly aid the absorption of solar radiation (26). Consequently, using an albedo of 0.15, clear sky melting is 13.5 meters/year and cloudy sky melting 7.4 meters/year. The average is 10.5 meters/year. At this rate the melting time at the periphery would vary from 48 years to 80 years for the postulated range of volcanic activity. The interior of ice sheets would obviously melt slower, but the added time would be insignificant. Therefore, the melting of the ice would be very rapid.

This agrees well with modern observations. For example, Sugden and John state that glacier melting can be rapid as indicated by "...many mountaineers whose tents in the ablation areas of glaciers may rest precariously on pedestals of ice after only a few days" (27). Twelve meters/year is the average melting rate at the snout of some Norwegian, Icelandic and Alaskan glaciers (28). Due to crevassing on the Jakobshanvs Glacier on Greenland, Huges calculated an ablation of 55 meters/year (29). Andrews says: "...the wastage of the interior of the Laurentide Icesheet occurred dramatically over a few decades, centuries at most" (30). In conclusion, the total time for a rapid post-flood ice age is estimated in the neighborhood of 600 years and this is well within the Biblical time frame.

HOW MANY PLEISTOCENE ICE AGES?

Glacial geologists believe there were many Pleistocene ice ages. In the early history of the glacial theory, considerable debate ensued whether there was one ice age or many. Those favoring the astronomical theory preferred many (31). Four ice ages became established, based primarily on river terraces in the Alps. However, some apparently continued to believe in one ice age up until the middle of this century (32). During the past 15 years, as many as 30 ice ages have been proposed based on ocean sediments. This has caused considerable controversy with the continental evidence. The gravel terraces in the Alps are now viewed as possibly "...a result of repeated tectonic uplife cycles not widespread climatic changes per se" (33). The complex and confusing classification on land has come to rely mainly on paleosols, loess, fluvio-glacial sediments, and organic remains between till deposits. Consequently, no matter how fast or slow any one ice age was, the time for all would greatly exceed Biblical time. The evidence for multiple glaciation from ocean cores has been examined in previous papers on the astronomical theory of the ice age and found to be very poor (34,35). This section will take a brief look at continental deposits.

Before examining the basis for interglacial periods, which are at the core of the multiple ice age concept, many serious inconsistencies with the multiple glaciation theory will be presented. Modern energy balance climate models have revealed that a uniformitarian ice age is practically impossible (36). The difficulties are compounded infinitely when more than one is considered. The deposits at the interior of past ice sheets are very thin and coarse-grained (37). This is inconsistent with many ice sheets several kilometers deep repeatedly melting back through this area. The evidence for multiple glaciation comes from the periphery of the ice sheets. However, in this area, the till is not that deep. Flint suggests an average of about 30 meters, but much deeper in buried valleys and massive end morraines (38). Till can be deposited rapidly in end morraines. For example a glacier in Spitsbergen was observed to deposit 30 meters of till in less than 10 years (39). Most till and loess come from the last glaciation in the multiple glacial theory, the deposits from previous ice ages being scarce (40,41). Practically all the till is of local origin (42) and all the ice ages terminated in the same general area with the oldest tills, based on qualitative assessments of weathering, being a little further advanced (43). There are areas along the periphery that apparently were never glaciated, for instance, the well-known Wisconsin driftless area and others in Montana. Pleistocene mammal fossils, like the woolly mammoth, are non-existent or extremely rare in previously glaciated areas (44) and practically all the extinctions were after the last glaciation. These facts are consistent with one thin ice sheet but are extremely difficult to explain in the multiple glaciation theory.

Questions naturally arise concerning the evidence for interglacials. Modern studies of glacial sediments indicate they are more complex than previously assumed with much overlap of till properties from different till sheets and rapid lateral changes in sediment type (45). There has been much misinterpretation. The organic interglacial material is not abundant: "Pleistocene correlations are difficult and uncertain...interglacial accumulations, if fossiliferous, occur in isolated and discontinuous patches..." (46). Paleosols, or the "soils" between till sheets usually have the "A" or organic horizon missing (47) and are difficult to distinguish from sediments that have undergrone diagenesis (48). Most often, the interglacial sediment is a type of sticky clay called gumbotil, the origin of which is still controversial (49). Gumbotil, loess and fluvio-glacial sediments could be deposited on a till sheet before a readvance or surge. Eyles and others suggest that organic remains can even be emplaced in this manner (50). Modern data from glaciers have shown that multiple till sheets can be produced by thrusting at the edge of the ice (51,52). Even in till deposited below the glacier, meltwater stream sediments can make a vertical profile appear to be the product of multiple glaciations (53). In summary, the evidence for interglacials is certainly not conclusive. The glacial deposits can be explained just as well, if not better, by one dynamic ice sheet that fluctuates widely at its margin.

SUMMARY AND DISCUSSION

The model discussed herein shows that a post-flood ice age can occur within Biblical time. Based on assumptions of post-flood climatology and the estimated cooling of the ocean, the time to reach ice age maximum is about 500 years. The melting time is approximately 100 years. Data on the Quaternary ice age reveal many inconsistencies with the multiple ice age theory. One dynamic ice age is the more reasonable model. The basis for interglacials is shown to be very weak. A mild ice age due to the strong oceanic heat source suggests some fruitful areas for future research. For instance, it is known that higher latitudes of the Northern Hemisphere would be much warmer than presently with no Arctic ice cap. This would be more so with an ocean warmer than 0°C. Also much more precipitation would fall over non-glaciated areas. Consequently, several Pleistocene problems may be solved. This model could account for the large number of well-fed mammals that lived in Siberia and their demise. The perplexing intermixture of flora and fauna from widely divergent climatic regimes south of the ice sheets may be solved. Well-watered deserts and pluvial lakes could be explained. A related problem with Biblical time is Pre-Pleistocene "glacial deposits." I believe the Genesis Flood can produce these deposits from gigantic mass movements and turbidity currents, which modern research indicates can duplicate tillite and other glacial diagnostic features.

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DISCUSSION

Michael Oard has faced the reality of the Glacial Epoch as essentially a "catastrophic" post-Flood phenomena. He has made many positive and potential contributions toward an explanation of a single epoch in a geologically short time frame. His contributions toward solving what has been heretofore an essentially unaddressed or poorly addressed major time problem are so many they will not be mentioned.

The following are criticisms and suggestions:

(1) *There is much evidence for a much thicker ice load [e.g. Charlesworth]*

(2) *Include a brief explanation of the "astronomical theory"*

(3) *Provide additional defenses and/or explanations of the equations used. [This is a challenge, i.e., to persuade the reader of the critical data.]*

(4) *The need to address the possibility of epoch related continental drift as a vital part of the epoch's scenario.*

David P. Nelson
Pittsburgh, Pennsylvania

It is unclear to me what the starting conditions are. Were the oceanic temperatures initially 30°C at the poles? If so, how long would it take for the polar regions to cool and cause an amplification of the atmospheric jet stream and associated mid-latitude storms by which snow would be precipitated? It seems possible to me that once the onset of precipitation in the form of snow began, the quantities could be extremely large because of an amplified storm track. Greater pole-to-equator temperature differences than today would have intensified the precipitation rates such that glaciation could have occurred much faster than Mr. Oard's calculations indicate over narrow latitudes belts.

Does Mr. Oard believe there is any mechanism in the ice ages to explain quick-frozen mammoth remains?

Larry Vardiman
El Cajon, California

CLOSURE

I appreciate Mr. Nelson's compliments, suggestions and criticisms. I understand his strong interest in the ice age. I shall answer his questions in the order presented.

The thicknesses of ancient ice sheets are really unknown. Bloom states: "Unfortunately, few facts about its thickness are known... In the absence of direct measurements about the thickness of the Laurentide ice sheet, we must turn to analogy and theory."(1) Many other authors have expressed similar opinions. There are a number of indirect indications of a thinner ice sheet. One study based on "non-movable" ancient sea level indicators revealed that sea level at the time near glacial maximum was 54% higher than previous estimates. This implies "...that substantially less ice was present from 17,000 to 10,000 years B.P." (2) The higher portions of the mountains of Northern Vermont were apparently never glaciated, strongly suggesting a thin ice sheet in this favorable area.(3)

The second comment calls for a brief description of the astronomical theory or Milankovitch theory of the ice ages. This subject has been extensively discussed in references 6-8 of the paper. This theory is actually quite old and states that ice ages or at least glacial/interglacial fluctuations are controlled by periodic variations in the orbital geometry of the earth, namely its eccentricity, the precession of the equinoxes, and the variation of the earth's tilt. Many believe the mystery of the ice ages has been solved because of statistical correlations with oxygen isotope fluctuations in foraminifera from deep-sea cores. The latter have been related to ice volume. The most serious problem is the main period from cores is strongly correlated to the 100,000 year eccentricity cycle, which has negligible effect on solar radiation. In order to interpret oxygen isotope fluctuations, the temperature and the oxygen isotope ratio of the sea water at shell formation needs to be precisely known for the past. There are many poorly known variables. The remarkable statistical correlation to orbital fluctuations is a study in itself and reveals much data manipulation.

The equations used are actually simple energy balance or budget equations that relate all inputs with outputs and changes within a volume. The terms for the present climate are relatively well known. The main challenge is estimating the differences between the present and the post-flood climate. Maximum and minimum volcanic dust scenarios were used to find the time range, since it was the main variable controlling the rate of oceanic cooling. The minimum of 25% less solar radiation was not considered low enough, so a minimum of 10% less was added for the conference. This made the maximum time for glacial buildup 1290 years, but did not consider the substantial runoff that would have occurred with this much sunshine. The main point is that glacial maximum would be short and the time for melting of periphery and interior would add at most another 200 years.

In answer to the final question, a post-flood rapid ice age does not depend upon belief in continental drift or split. In my opinion this concept is based upon many questionable evolutionary/uniformitarian assumptions which most creationists would not accept. Then why accept the outcome of these assumptions? Let us instead thoroughly examine the data. I believe what data is trustworthy, like the close fit of the continents, can eventually be explained by the dynamics and tectonics of the Flood.

The comments by fellow atmospheric scientist Dr. Larry Vardiman are most welcome. I will also answer his questions in order. The initial conditions are cold mid and high latitude continents due to lack of solar radiation and a warm ocean averaging 30°C. This figure was assumed since the "fountains of the great deep" would be hot, and if the oceans were much warmer than this, life on earth after the Flood would have been difficult. This temperature would result if the pre-flood oceans were 10°C due to some warming mechanism, the Flood waters rose 1000 feet with no ocean basin uplift, and the average temperature of the subterranean water was 200°C. The ocean would be uniformly warm from top to bottom and pole to pole due to mixing from the tectonic activity of the Flood. The main storm tracks would develop rapidly in the areas of strong horizontal temperature change south of the developing ice sheets and along the shoreline of cold continents. The warm Arctic would tend to cause an additional westward storm track along the northern edge of the continents until the ocean cooled enough. This may take 100 years. Snowfall would likely be extremely heavy over the continents at the beginning of the ice age. However, moisture given off to the atmosphere also heats it, which would regulate the rate of ice buildup. The more the heating, the less the horizontal temperature differences, which would retard the evaporation from the ocean. Consequently, the heat balance of the atmosphere is needed to calculate the ocean cooling time.

I believe this ice age model provides a possible mechanism to explain the frozen mammoths. They are likely post-flood since the fossils apparently are found in surficial deposits. For instance, the baby mammoth discovered in 1978 was found in an ice wedge in fluvial deposits of the Kirgilyakh Creek.(4) Before explaining how they died, one must first explain why the mammoths and all the other associated mammals would migrate to Siberia and what they would eat. Siberia today is a frozen wasteland in winter and a giant swamp in summer. It is doubtful they could find the half-ton of vegetation they required each day, but they apparently were well fed and healthy. This ice age model can answer these questions. Without an Arctic ice cap and much greater precipitation, the climate would be warmer with much more vegetation. Newson used a general circulation model of the atmosphere without an Arctic ice cap with an ocean temperature of 0°C and found annual temperatures 20 to 40°C warmer over the Arctic and adjacent northern portions of continents.(5) Sea water is very difficult to freeze and it is likely the Arctic Ocean would have remained ice free until near glacial maximum. Siberia would have been a good environment for cold tolerant animals, especially close to the ocean, where most fossils are found.

Before accepting a quick freeze of the mammoths, the data and assumptions behind this must be analyzed. First, there likely were millions of mammoths as well as other mammals, contrary to what some scientists have said. Second, very few mammoths and almost no other mammals actually have been found frozen. So we are trying to explain the exceptions to the general rule, which may depend on local or chance occurrences. Is it possible the digestive state of the vegetation in their stomachs and mouths could be due to cold temperatures and swallowing cold air or possibly some biological mechanism that would slow the digestive process? Other mechanisms should be considered first. However, if a quick freeze is needed, this model provides a possibility. After glacial maximum, the climate of the Northern Hemisphere would become colder and drier than presently, as consistently modeled. The Arctic Ocean would freeze. The change from mild to very cold could be rather quick. Very strong cold fronts with strong winds giving very cold wind chills could occur in early fall. The woolly mammoth could not escape or adapt, so died and became entombed in the developing permafrost. Thus it is possible that this ice age model can explain the existence and demise of the woolly mammoths in Siberia.

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