The Chairman and Members,
Standing Committee on Regional Australia

Submission No 138 SC

Gentlemen,

Long-cycle geomagnetic changes at the core-mantle boundary may be driving climate shifts everywhere, but particularly in the Murray-Darling basin.

I would herewith like to put in a submission to the Standing Committee on Regional Australia, for the report on the Impact of the Murray Darling Basin Plan in Regional Australia. This is it. I apologize for its length, but the ideas it introduces are complex and some will be very unfamiliar. It details the above bold (?) contention. It also summarizes the view of half-a-dozen folk here, all of whom wish the people of the basin well. There may be some minor value in us having no private axes to grind other than hoping the fine food keeps coming and that the wildlife survives. For a couple of decades and following many folk now gone, the majority of the above group, those who live here, have tried to protect our local creek with its rainforest fringe from damage of all sorts. It is a complex-enough story here, so we are in awe of what you face.

I will state my own biases at the outset, so no-one has to guess. I have not lived or worked in the M-D basin and am merely someone who has visited a few times. In 1999 I paddled a kayak, very slowly, from Warwick to St George, marveled at the riverine forest that still extended all the way, at the wildlife and at the beauty and tranquility of the river. On that trip I experienced the most remarkable courtesy and hospitality. I've also had many a fine meal and a few fine t-shirts from the crops grown there. So, this is an attempt at a minor return for the kindness and work of so many folk along the river. I'm a geologist of 40 years standing and sitting, have been at times a professional green activist and have also done some real work that included irrigation. Denise and I once had by far the largest irrigation license on the local creek, but turned it in gratis when asked to reduce it. That made the local water admin folk very happy, as it much improved things on paper. We had not used it, so that was no big deal. We have a pocket-handkerchief organic subsistence farm.

The M-D basin's problems are partly to do with climate change, a topic I have been scratching my head about for a decade, so I will mainly address that. What follows may be a bit surprising and will be difficult to accept, for those who are quite sure that human-generated greenhouse gases are driving climate change.

There's a saying, a neighbor's favorite, that the biggest impediment to science is the illusion of knowledge. Ask Eratosthenes. His calculation of the diameter of the planet to within one percent of the real figure in 250 BC found no favor for seventeen hundred years, as all the best-educated experts knew it was flat. His problem was, most of those experts were not prepared to make the minimum effort to get a grasp of basic geometry. Now it is basic geophysics, geology and oceanography that carbonist climate modelers and carbonists generally, including myriads of politicians, avoid like the plague. That and the curious fact that no-one, on any side in this debate, will seriously or even at all look at

the satellite temperature and CO2 data maps that we now have hundreds of, alongside the excellent deep geomagnetic modeling that we also now have, with the brain in gear. Geologists and suchlike graffiti have been trying to understand the big recent climate changes, the ice ages, for some 200 years now, with little success. It is no wonder, I suppose, that economists, IT experts, solar panel techies, kindergarten teachers, journalists, taxi drivers and politicians have got bored with our attempts and now know so much more about this subject and with so much more certainty than we do.

The current view of the future climate of the basin and hence of its irrigation prospects is bleak from almost all academic, official and public quarters. If greenhouse gases are changing the climate in unprecedented ways, since all attempts to reduce greenhouse emissions have so far failed dismally, if one is logical the future will bring only increased warming and ever less water for the basin, a very depressing picture. As noted, many outside science and not a few inside, believe they now know perfectly well what is changing the climate which is a surprise, since no-one in science has ever yet well understood any other natural system of remotely such complexity. Scientists are clearly a little thick, but as compensation it sometimes allows us to be optimists.

I suggest all who are so sure greenhouse gases are the problem and are genuinely concerned about the future for M-D basin communities, start by very carefully reading Professor Ian Plimer's 500-page book on climate change called *Heaven and Earth – Global Warming. The missing science.* It is a fine piece of scholarly geological work sprinkled with dry humor, but so detailed that few of his more strident critics have ever read it. There he explains in considerable detail (and with some 2000 references, most of them from the sacred peer-reviewed literature so beloved of the more academic carbonists), how the geological evidence repeatedly and beyond question shows that changes in trace atmospheric gas levels are not driving climate change. He shows that neither natural changes in those gas levels nor the far smaller outputs of humans are driving the very real climate change we are seeing. Plimer shows clearly that the present climate changes are entirely within natural limits. And they should not even raise a yawn when viewed against those limits. He shows that during the ice ages and interglacials of the last 2.7 million years and even within the last few hundred years, climate changes have many times been far larger than those of the last (and only) industrialized century.

Where I slightly part company with Professor Plimer (no two geologists, by the rules of the trade, are ever allowed to agree completely on anything) is that, though he also has deep-seated heat as the main driver of climate change, I think that what generates that heat is geomagnetic shifts at the core-mantle boundary, 3,000 km underfoot, a topic he does not tackle beyond a single-sentence mention of the theory. There is plenty of hard evidence, though, that it is the main driver. Here in summary is why:

The satellite maps of where this planet's surface is actually warming most, do not at all match the satellite maps of where excess carbon dioxide is being produced globally, either by humans or in far larger amounts by several natural agencies.

The satellite maps of surface warming, with a complex time-delay pattern, very neatly match maps showing where and by how much and when the vertical component of the earth's magnetic field, generated about 3,000 kms underfoot at the core-mantle boundary, has changed and is changing.

So that lot does not hang unsupported in thin air I have included as part of my submission a cd which has on it an audio waffle, an essay, 71 global NASA CO2 maps, (one per month for seven years), a 485-page book and a couple of relevant papers, one on geomagnetic modeling from old maritime compass records, one on past high sea levels in the lower Murray Basin. Barring the papers by others, included as research material, it is all in the public domain. It is for browsing, not for reading end-to-end, unless you enjoy such stuff or have a strong sense of duty. Use or not to suit.

So what?

Why this obscure stuff is relevant here is that a vertical component magnetic change area, technically known as a flux lobe, has been sitting approximately under the Murray-Darling basin for about four hundred years but is now weakening considerably. It reached the basin some time (shortly?) before 1590, when it still ran back to the south magnetic pole, its origin. It was almost detached by 1890 and was fully detached and in decay by 1990. The modeled maps do not go back beyond 1590, as the modeling is based on magnetic declination records (some 83,000 of them), from old ships logs and the records go back no further. The magnetic compass modeling work has been meticulously done and is not controversial. The magnetic shift maps I have (and that are attached) were done at 100 year intervals. They could be done at yearly intervals and also be checked overall by Geoscience Australia, if the Basin Authority or the Standing Committee of Parliament asks politely. They have excellent numberfield analysis software that will both do and improve the job. But, just keep in mind that CSIRO has bought and is now actively selling the competing carbonist model, so they are not likely to agree at first glance. The geomagnetic vertical flux field maps so far available and on which that comment above is based, are from the paper by Jackson, Jonkers and Walker, 2000, an are pages 978 and 979 of that paper. (*Philosophical Transactions of the Royal Society of London A (2000) 358 pp 957 – 990)* on pdf format. I have taken the liberty of including it in its entirety, for research purposes, on the submitted cd, on pdf format. Unless that is your thing, ignore the fiendish maths, just go to the pretty colored maps. I do not understand the maths either, but have some expertise in guessing about (sorry, "in meticulously analyzing", that should have read) such magnetics maps, having done a lot of such in the past, in mineral and coal exploration.

Australia has a baffling climate and rainfall pattern that has made farming very difficult, since one cannot know what next year will bring, even approximately. A land of floods and droughts, as is often said, such that 700,000 head of livestock have had to be shipped east from WA, this year alone. But maybe deep geomagnetics will in time allow us to see what is coming with regard to ground temperatures and climates and rainfall as, if a crucial component of the heat that arrives on the surface comes up very slowly from below, it can probably be tracked before it arrives. Slowly means just that. I think that the

pulses of background deep heat are at most taking about 500-600 years to travel the 2,880 kms up from the core-mantle boundary, while the heat that the deep magnetic shifts generate at the same time but just underfoot in the thin (35 km max) outer crust, takes a bit over a hundred years to surface. This lot may with luck give a whole new meaning to long-range weather forecasting.

The magnetic changes (or flux lobes) at the core-mantle boundary all start at the nearest magnetic pole, then extend towards the equator and then, in the southern hemisphere, drift westwards or are replaced by new ones further west. Then the cycle seems to start again. A very strong vertical component shift (or magnetic flux lobe) appeared just off the coast of WA near Perth about a century back and presently still extends to there from the south magnetic pole. The previous one is now below the Congo, and was tracked moving all the way there from well to the west of WA and south of India, over the last 500 years. Jackson et al commented on it, though they drew no climate change inferences - that part of it is my guesswork. The present massive warming in the Congo is probably from the one before that. As the Congo jungle was merely riverine rainforest some 2,000 years ago, the pattern of cyclic heating and cooling is probably long-established there.

Why the now-decaying M-D basin flux lobe may matter, is that the satellite temperature maps from NASA show a well-defined present surface high-temperature anomaly, also centered on about the western Murray-Darling basin that geographically matches that flux spur. My assumption is that the deep geomagnetic anomaly in time causes the heat anomaly above. The heat, I think, mostly comes slowly up from the core-mantle boundary, taking 500-600 years to do so, but with short strong bursts of more intense heat coming up quicker from the crust, in somewhat over a century, and then fairly rapidly exhausting themselves. This is not conventional mantle-pluming in convection cells, of the sort that produces seafloor spreading ridges and subduction zones. This is something science has, I think, not previously noticed and if it turns out to be correct, this note is the first thing written on that and on the time-lag resulting from differences in heat source depth and the material state there.

So the climate pattern that has held sway in the Murray Darling Basin over the past 300 years is about to change considerably, if I have this right.

Why I think this complex time-lag pattern is in play is because, when one looks at say a global contour map of the surface temperature changes over the last 100 years, one gets a pattern that looks most like the magnetic flux spur pattern of 1590, but slightly older. There is just such a matching overall pattern on the 103-year average temperature change map attached. There is notably very significant heating to the east of the Argentine and to the east of the Caspian Sea, but while that can be seen 400 years back (except that the Caspian magnetic flux lobe had already crossed to the west of that sea by then) that has not been the picture, in either place, for 400 years.

But, when one looks at individual years, the temperature pattern for some of them looks remarkably like the flux lobe pattern of just a hundred years back. Here is what I think explains that:

Some of the heat anomalies the satellites show for single years are very intense, but they do not persist. That suggests a shallow intense source. As geomagnetic shifts attempt to swing the all the magnetite crystals in the crust but those crystals are not free to move, being locked into solid rock, while the mantle is too hot for magnetite to crystallize deeper at all, such short-lived heat bursts from the shallow, magnetite-crystal rich and far more rigid crust seem to make sense. I assume that geomagnetic shift-generated heat is still coming overall from the entire mantle and crust and not just from the core-mantle boundary and the crust, as all the atoms within the ambit of any magnetic shift, whether ferromagnetic, paramagnetic or diamagnetic (that is, the whole lot on this planet) have their electrons' orbits slightly distorted by such mag shifts and that produces heat. So, heat is coming up from the entire column of the mantle.

Judging by the 71 separate global temperature proxy studies covering the last 2,000 years that Fred Ljungqvist of Stockholm University has collected, the sort of range in the temperature change at the surface that we are considering is generally about 2° C above the long-term baseline, though larger shifts are to be seen occasionally. Those high anomalous shifts, up to 5 or 6 degrees, will often have local surface or volcanic or separate plate tectonics causes. A change in average ground temperature of 2 degrees over a fuzzy baseline is not easy for ordinary folk (or for science) to notice, since annual swings in ground temperatures are far greater. Few of those 71 studies were in regions of high geomagnetic flux shift, but in those few areas, shifts of 4 to 5 degrees above the long-term baseline (often of fifty years, so itself subject to deep heat escaping from the core-mantle-boundary or the mantle) are recorded, in line with the recent satellite temperature recordings. Keep in mind that the entire global climate change fuss is about an overall global rise of 0.8 degrees C in the last century. As much of the deep heat that escapes comes up via the basaltic seabed and expresses as kinetic energy via deep currents in deep ocean basins (that we hardly monitor at all), it is no great surprise that all this has not been noticed by science.

I apologize for all the strange terms and ideas. In more simple terms, it may be that the electric dynamo that was located 3000 kms beneath the Murray Darling Basin and that was heating the ground and so was drying out the basin to some extent, has been shifted to below a spot a bit to the left of Rottnest Island. The basin may, with luck, now get cooler in the short term, the heat from the crust now being exhausted, but we still have some 300-400 years of the deep (but lesser) heat to surface. After that, we will get a genuine cool smoko break. The rest of eastern Australia may also now cool, but not by as much. Whether this means more rain or less I do not know, but on balance it seems to me that more rain is more likely. If the ground cools it will retain surface water longer, as long as we still get the rain, but I am no sort of weatherman. Conversely, weathermen are not used to thinking of the rocks underfoot as a serious data source for their work, but that may now have to change. I think.

If you doubt that shifts in the earth's magnetic field can generate such heat, this may help. Though the geomagnetic field is continuously generated by electric currents in the liquid core, it can be thought of as equivalent to that of a short bar magnet at the earth's centre,

directed towards the south and north magnetic poles. That hypothetical magnet has an average strength of 8×10^{25} c.g.s. units. Assuming, just for the calculation, a uniform magnetic field strength throughout the entire planet, that is equivalent to having a saturated steel magnet of 80cc volume embedded in every cubic metre of the entire planet. (*Encyclopaedia Britannica*, 1962, vol. 10, page 172B). As the volume of the planet is about 10^{21} cubic metres, that is, a thousand billion billion cubic metres, you can see that you would get a bit warmish if you tried to push all those small magnets around a bit, especially if they were all jammed against each other. That is what the planet is trying to do, each time the magnetic field shifts a few degrees, so it gets warmish on the surface, above where that shoving is happening. At magnetic pole reversals the new magnetic field is really up against it. It is trying to swing all those one thousand billion billion 80cc magnets through 180 degrees. Sure, then it gets even warmer at the surface. Without the oceans to soak up the heat, we would perhaps all fry.

If you are still doubtful that magnetic changes can cause heating, this may also help. The temperature of the surface of the sun is about 6,000 °C to 10,000 °C, but the solar atmosphere above that is at millions of degrees C and the conventional explanation is, the heat is the result of magnetic lines of force snapping and reconnecting. That is, it is the result of flux shifts there. Our magnetic flux spurs migrate towards the equator, as do sunspots up there. They are the local equivalent, just moving and operating far more slowly in a liquid and solid planet, than sunspots do in a gas star. So a couple of degrees of temperature change here on the earth's surface is no big deal.

If that still does not work for you, simply look at the maps showing the match between the magnetic shifts and subsequent the temperature shifts. Never mind the theory and the analogies - the real world says it happens.

Can I prove this geomag shift-driven climate theory? No. Am I sure? No. It is just that the geomagnetic and temperature maps match so very well, and that there is more than enough power in the geomagnetic field and its constant shifts to change climates. It has just never been noticed, as very few scientists in the climate game are even remotely familiar with geophysics in general or with geomagnetics in particular. They have been obscure fields, with aeromagnetics being not a little bedeviled by military paranoia, since magnetometers see straight through seawater and can find old yacht anchors on the seabed, never mind nuclear submarines. But, back to the chase:

Time-series contour maps matching each other is two orders of magnitude more coincidence than simple line graphs matching, so with such map-matching, one is usually looking at linked phenomena and often at cause and effect. As the surface temperature shifts cannot possibly be causing the magnetic shifts but the magnetic shifts definitely have the ability to cause the temperature shifts, the latter is highly likely. This eastern Australia geomagnetic vertical-field flux lobe is, or at least was, fairly significant on a global scale, being just a bit down in size from the planet's biggest detached one, now apparently causing delayed havoc in the Congo-Angola basin in central Africa. In time, like previous flux lobes, the one now off Perth will probably detach, cross the Indian Ocean, cross central Africa and, my guess is, will again cause serious warming, crop

failures and warfare there. As ours in eastern Australia is decaying and as we have a half-civilized society here (barring our curious habit of repeatedly committing mass murder overseas on the government screw) we have a far better chance than central Africa of avoiding civil unrest if the coming changes are managed well.

Anyway, we can do exactly nothing, no matter what the color of the recyclable shopping bags we buy or the flags we wave, to affect geomagnetic changes. We have to learn to understand them and then live with them and with the climate change they bring. A good start would be for parliament to stop talking nonsense about trace greenhouse gases controlling the climate and us controlling both of them, given that the government has just had some spectacular trouble merely controlling the climate inside a few people's roofs. The notion that "we must control climate change to within 2 degrees" is delightfully silly, particularly since the 71 independent temperature proxy studies that Fred Ljungqvist collected (about the whole lot available and all from the peer-reviewed literature to boot) show that in the past 2,000 years the climate has only seldom changed, anywhere, by more than that amount anyway. Though with some spectacular exceptions, I should add. But, if the above science is correct, optimism regarding future M-D river flows is perfectly legitimate. It even has a slight edge over the deep pessimism that logically follows from the carbonist model and now controls the thinking of the three major political parties on the M-D water situation.

Two distinct cycles of short-term climate change can, I think, be seen in Australia. The one is shown very well on the Queensland Government's superb Long Pocket national rainfall maps, that show on a single poster the continuous, near-chaotic change in the rainfall of Australia over 114 years, with each year's rain shown on a separate map. The only discernable pattern seems to be that a wet year at any one place is often followed by another, not quite as wet and then by about nine dry ones. There have almost never been three wet years in a row at any place. That may have something to do with the eleven-year solar magnetic and sunspot cycle, but different places all change out of step, so that lot is beyond my understanding. On top of that confusion, in time spans of perhaps a century or six and from a westward-drifting source, come the geomagnetic induction or flux lobe-driven changes described. This is not a simple system. Brisbane has a rainfall cycle, from old records, of about 120 years, Adelaide has a somewhat shorter one, data in between is a bit sparse, but those are of the right sort of length to be geomagnetic flux lobe-driven. The Long Pocket rain maps can to some degree extend that view, now. In the one matched case we have with dates, the present warming off south western WA seems to have surfaced 106 – 108 years after the flux lobe first appeared. Not good news for WA, if true, but that is not the issue here. We need more data, as ever in the geosciences.

If the science guesswork above is correct or even partly so, we do not really know what will happen next with the climate, though we can perhaps hazard an informed guess, but we do now know that we do not make the weather. Someone tell Tim? The carbonist guesswork and computer modeling re the M-D basin is hence, in my opinion, now irrelevant. The hard physical data from the real world, (mainly tens of thousands of compass declination records and billions of satellite observations, with both datasets utterly indifferent to politics) now shows that their model is scientifically invalid.

Scientists should perhaps not try to be shamanistic crystal- and chook-entrail-gazers. Mere geologists have more than enough trouble reading past climate histories, let alone guessing future ones, so my guessing about future M-D basin climates and rainfall is perhaps reckless. But perhaps profound ignorance and error about future rainfall trends is still better than groundless pessimism, when optimism is in short supply? So, I will let that guessing stand.

What's to do?

If the above guesswork is correct the climate system in Australia (as elsewhere) cycles and so does the rainfall pattern. So rural communities and irrigation systems can perhaps survive if they are frugal and can hang on. Eastern Australia, particularly the Murray-Darling basin, should now cool somewhat, perhaps over the next century or five. Whether that means wetter or drier times over that entire time-span, I have no idea, but perhaps the bunyips, the coastal seal version, may come upriver again, if given a bit of help and a TPV each. Hope returns. They have long been the carers of the river.

The Murray-Darling irrigation dilemma has been discussed here by half-a-dozen local people, mostly rural folk with a wide variety of backgrounds. Of course ours is a very minor and uninformed yarn compared to those taking place in the basin. But it may still be worth passing on.

Denise's suggestion is, food growing should continue but cotton growing and biofuel growing should stop. We are drowning in clothing in this country and do not need more t-shirts and skirts. We also have no right to be importing food from third world countries so we can set aside land to grow fuel for mobile armchairs better suited for elephants.

John, a retired parks ranger who specialized in mapping of all sorts, has closely considered the cyclical nature of the rainfall on the Long Pocket maps, does not see any reason to believe that cyclicity has stopped.

Neil, the cattle farmer and ex-Vietnam pilot across the creek, also reckons the basin's ecology, having coped with climate change for millions of years, will cope again. He and I are in favor of considering flooding the salt lakes in South Australia that are below sea level and are only, by minor geological accident, now not part of the sea. That, in order to evaporate the sea water let in, push up atmospheric moisture levels and so enhance the rainfall in the lower Murray region, since the winds from those lakes blow the right way at some seasons. Little canal-cutting is required, gravity will move the water gratis, the calculations can be done and the wildlife will mostly love it. The daily release of water to the lakes could be surfed all the way – 200 kms - great tourist potential, plenty of new birds, etc. There is a worldwide salt market deficit of considerable size looming (50 million tones pa?) so the salt can be harvested and exported. Aboriginal legend tells of the war between the sea birds and the swamp birds when the Spencer Gulf flooded after the last glaciation, so it has happened before and the wildlife coped superbly. Except for

the swamp birds, but they may be compensated by getting the Coorong back. I have seen vast flocks of flamingoes feeding happily on the artificial salt pans of Namibia.

Another friend, a historian and anonymous by request, suggests that a new state be constituted, with its boundaries coincident with the basin, and to include areas dependant on the water. Capital, Adelaide.

My own overall suggestion is, if it rains well in future, good. If it does not, we should collectively, as a people, chance our luck and now use a bit more water than is otherwise environmentally wise, so that the basin farms, towns and businesses can survive. That is based on the rationale that the environment along the river is pretty tough and has got used, over millions of years, to repeated cyclic swings from drought to wet times and back. The local ecologies will more or less survive. We may lose some important and iconic plant and animal species, but since this is Australia's main food bowl, unless we are to bludge off poorer nations for food, we should preserve what irrigation farms we can. We should seriously consider flooding Lake Eyre and the adjacent below-sea-level salt lakes with seawater.

If that all fails or seems a bad idea, we can then mothball farms and towns at public expense. They can be protected against vandalism by properly-supported and funded police and maintained on a caretaker basis by locals who wish to and are publicly supported to stay, while the working population shifts away with a view to shifting back when possible. Or until new and younger settlers or a new generation moves in when the river again flows well, if the dry time is long. It would be a pity if towns and farms are starved of water and lost or seriously degraded, only to have the river return to high flows in a few years. New public buildings should be demountable.

A new state is probably not politically possible and will still face the upriver-down river self-interest problem, so I personally think the existing basin authority is probably the best entity to solve the problem, perhaps with a little more power over the water flows, tempered with a broader-based power structure, with more local folk in the positions that determine policy and actions. And maybe, ask folk, very politely, to voluntarily relinquish their water entitlements, for the general good. You may be surprised.

Thank you for your time and good luck in your very difficult task. You cannot possibly make everyone happy, so perhaps the old "greatest good for the greatest possible number" is the best bet. Keeping in mind that cockatoos, who much like the extra tucker we provide, are also people.

Regards,

Peter Ravenscroft
Geologist. 30 November, 2010

The geomagnetic model of climate change

Geomagnetic field shifts generated at the earth's core-mantle boundary (cmb) are almost certainly the major driver of climate change on centennial scales. Surface temperature change maps such as that of GISTEMP for 1900 – 2003 (figure 1) show a remarkable fit to past vertical-component geomagnetic flux modeling, such as that of Jackson, Jonkers and Walker (2000). That work partly generated and then used the most extensive maritime magnetic compass declination database so far available (figure 2). The fit to temperature shifts, (max. about 2°K per century) is best for the oldest of their flux maps, that of 1590 and the trends in the later maps suggest the fit would have been better yet, had it been possible to model 1490 also. The extra heat seen on the planet's surface in the last hundred years is the result of magnetic induction in the entire lithic column between the cmb and the surface, with the heat generated by that magnetic induction taking some 400-500 years to make its way, by conduction, to the surface, in the case of the deepest heating and from 0-100 years for heat generated in the crust. The major magnetic flux lobes are all closely matched over time by ground surface temperature shifts of the order of 2°K, where continents overlie the past positions of those lobes. That holds for Siberia north of lake Baikal, Canada west of Hudson Bay, Central Africa in the Congo-Angola region, Australia and southern South America-the Antarctic Peninsula. The flux lobe currently extending north from the south magnetic pole towards the coast of Western Australia does not show on the temperature shift maps, probably because the heat has gone to melt both the glacial and sea ice in the Ross Sea, where the ice limit is now far south of that anywhere else and where it has retreated markedly in the last century. The 280-odd global CO2 anomaly maps from the AIRS instrument on NASA's AQUA satellite, in contrast, show that there is almost no match whatever between where CO2 is being generated from a variety of natural sources, (mainly from warming and upwelling seawater, with the human-generated component being almost if not entirely undetectable on the AIRS map evidence) and where the planet has warmed significantly in the last century. The exception is the El Nino upwelling region on the west coast of South America, which anyway coincides with a major past magnetic flux lobe position. The anthropogenic greenhouse warming model of climate change currently favored by the IPCC and many others, is hence invalidated, on this evidence alone.

The top map is the GISTEMP temperature change for the 103 years, 1900 to 2003. The second is ERSST sea surface temperatures. The third is the 1590 vertical magnetic flux change map for the core-mantle boundary, of Jackson, Jonkers and Walker (2000). Compare maps one and three, keeping in mind that 1490 would have been better than 1590, judging by the subsequent trends, but we do not have it. Then see the next four century's flux maps in the Jackson et al paper (on the cd), for the trends. Particularly the steadily improving fit in E. Siberia. So, carbon does what, exactly?

Reference: Jackson, A., Jonkers A.R.T., and Walker, M.R., 2000. Four centuries of geomagnetic secular variation from historical records. Philosophical Transactions of the Royal Society of London A (20000) **358**, 957 – 990.

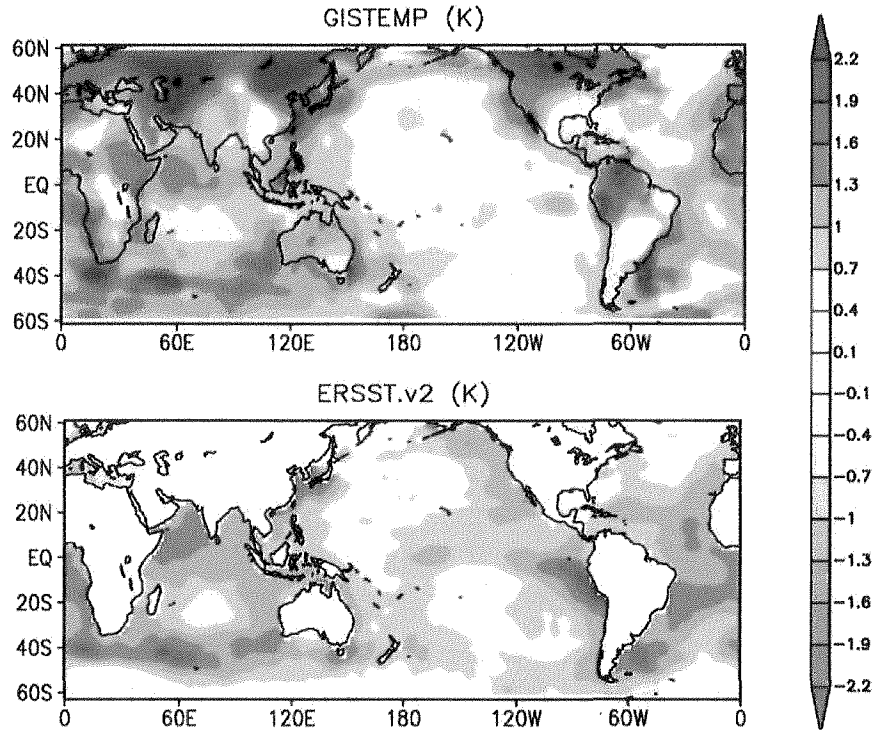

Fig 1. GISTEMP surface (top) and sea surface (lower) temperature shifts, 1900-2003.

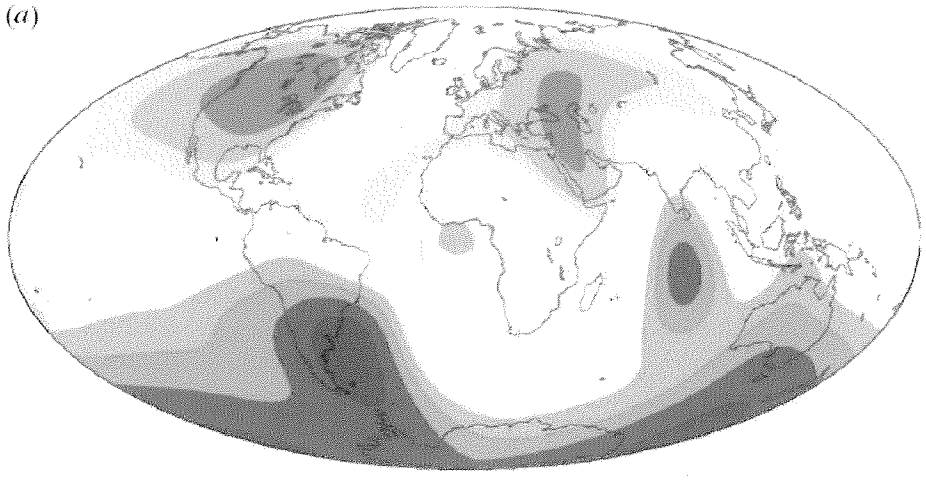

Fig 2. Magnetic flux shifts, vertical (or z or radial) component), core-mantle boundary, from magnetic declination records, for 1590. After Jackson, Jonkers and Walker, 2000.

Peter Ravenscroft. Closeburn, Queensland, 1 December, 2010.

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THE ROYAL SOCIETY

Four centuries of geomagnetic secular variation from historical records

By Andrew Jackson[1], Art R. T. Jonkers[2] and Matthew R. Walker[1]

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We present a new model of the magnetic field at the core–mantle boundary for the interval 1590–1990. The model, called *gufm1*, is based on a massive new compilation of historical observations of the magnetic field. The greater part of the new dataset originates from unpublished observations taken by mariners engaged in merchant and naval shipping. Considerable attention is given to both correction of data for possible mislocation (originating from poor knowledge of longitude) and to proper allocation of error in the data. We adopt a stochastic model for uncorrected positional errors that properly accounts for the nature of the noise process based on a Brownian motion model. The variability of navigational errors as a function of the duration of the voyages that we have analysed is consistent with this model. For the period before 1800, more than 83 000 individual observations of magnetic declination were recorded at more than 64 000 locations; more than 8000 new observations are for the 17th century alone. The time-dependent field model that we construct from the dataset is parametrized spatially in terms of spherical harmonics and temporally in B-splines, using a total of 36 512 parameters. The model has improved the resolution of the core field, and represents the longest continuous model of the field available. However, full exploitation of the database may demand a new modelling methodology.

Keywords: Earth's core; geomagnetic secular variation; magnetic field; maritime history

1. Introduction

The Earth has possessed a magnetic field for more than 4 billion years, generated in the fluid core. Although considerable progress has been made in elucidating the generation process (summaries can be found in this issue), much remains to be understood, not least why the field appears to be so stable for long periods of time punctuated by occasional reversals. Since humans have been observing the magnetic field for the past thousand years or so, and geographically diverse observations are available for the last 500 years, it is likely that there is much to be learned from an analysis of the field morphology and evolution deduced from direct measurements. To this end, we aim to construct the most accurate model of the magnetic field to date from original observations.

The models we create are specifically designed to examine the field at the core–mantle boundary (CMB), and our results are presented as maps of the radial component of the magnetic field at the surface of the core. Fortunately, the mathematical

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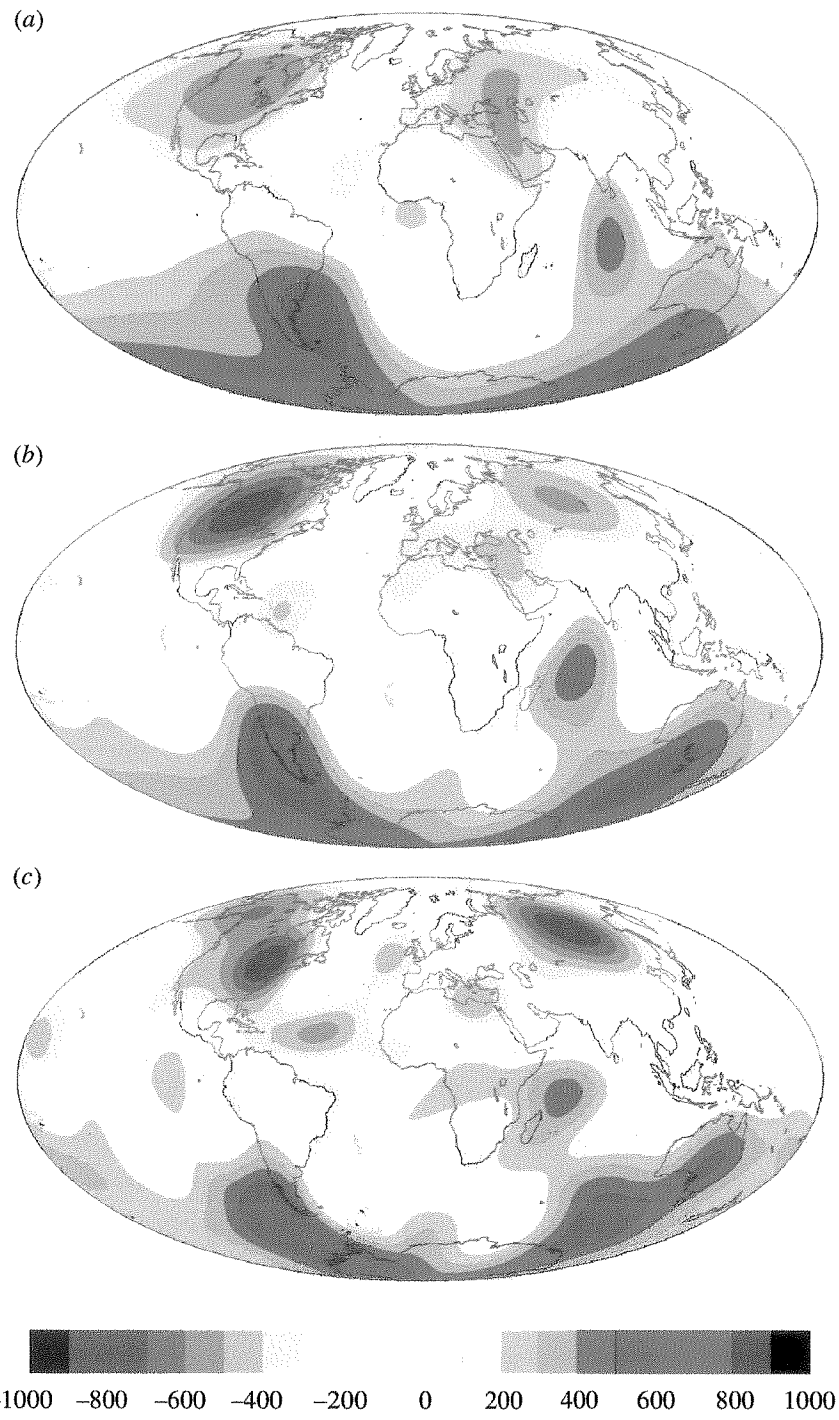

Figure 8. The radial field at the CMB on an Aitoff equal-area projection. The contour interval is 100 μT. Blue shades represent flux into the core, red shades flux out of the core. (*a*) 1590. (*b*) 1690. (*c*) 1790.

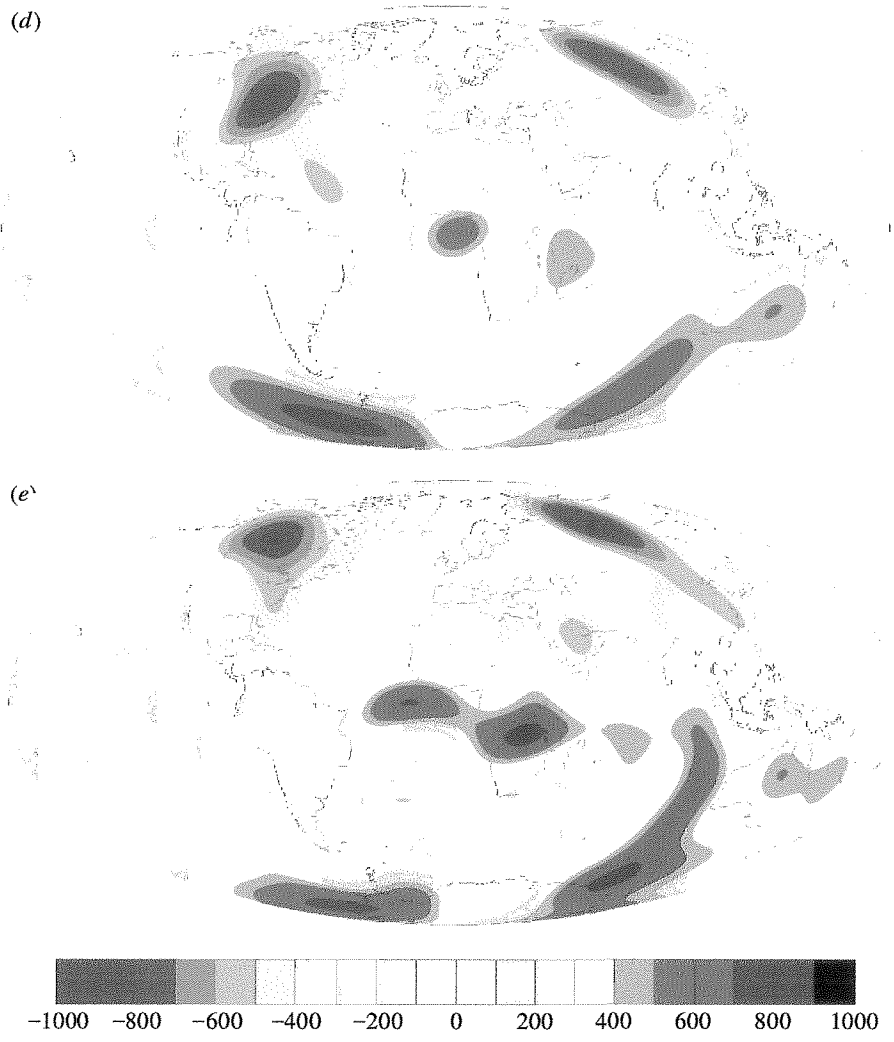

Figure 8. (*Cont.*) (*d*) 1890. (*e*) 1990.

where $\{r_i\}$ are the residuals from the calculated mean $\hat{\mu}$. We are interested in the error σ_μ on the true mean of the observations μ; this is well known to be given by

$$\sigma_\mu^2 = E\{(\mu - \hat{\mu})^2\} = s^2/n. \tag{4.18}$$

We use $\hat{\mu}$ as the single datum for each day, and assign it an error $s/\sqrt{n}$, but we determine a single value for s to apply for all the observations as follows. From the observations database, a total of 18 918 residuals r_i from their daily mean can be derived from days on which 2–4 measurements (or measurement sessions) were taken at different times during a single day. From these we find $s = 0.46°$.

Figure 7*a* shows a histogram of the observed errors. The errors are distinctly non-Gaussian; we have no explanation for this at present. Indeed, the data are very well represented by a Laplace or double-exponential distribution with probability