CLIMATE CHANGE

Agricultural impacts

J. Clim. http://doi.org/htt (2012)

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The popularity of harvesting crops twice a year — double cropping — in China has grown in recent years as a result of rising food demand. However, the practice significantly alters regional climate, according to an analysis of observational data.

Chang-Hoi Ho of Seoul National University and colleagues used satellite observations of vegetation cover and land surface temperatures, together with meteorological data, to examine the climatic impact of double cropping in the plains of northern China between 1996 and 2005. According to the satellite data, this practice was common throughout the measurement period. Double-cropping regions experienced greater land surface temperatures than single-cropping regions in May and June, coincident with the mid-year harvest. Indeed, maximum temperatures in the double-cropping regions exceeded those in the single-cropping regions by up to 1.27 °C during June. Specific humidity, in contrast, was lower in these agriculturally intensive zones.

The researchers suggest that an intensification of agricultural production could exacerbate regional warming and enhance aridity in the northern China plains, with potential consequences for regional atmospheric circulations. *AA*

PALAEOCLIMATE

Southern extent

Geophys. Res. Lett. http://doi.org/htw (2012)

Cool climatic conditions between AD 1400 and 1800 — a period known as the Little Ice Age — have been well documented in temperature reconstructions from the Northern Hemisphere. Borehole data from West Antarctica show that this cooling also extended to the high southern latitudes.

Anais Orsi and colleagues at the Scripps Institution of Oceanography in California reconstructed the temperature of snow on the surface of the West Antarctic ice sheet over the past 1,000 years. They combined calibrated borehole data from the flow divide of the Western Antarctic ice sheet with modelling to reconstruct the timing and magnitude of the temperature change. The data show an unusually cold period centred around AD 1600, with average temperatures approximately half a degree colder than those of the past 100 years. Cooling during this time is further supported by changes in bubble density and water isotopes previously reported from ice cores at this site.

The coincidence of cooling in both the Northern and Southern Hemispheres is inconsistent with a bipolar seesaw model for this recent climate shift. Instead, the team argues that the cool interval can be best explained by low solar irradiance and frequent volcanic eruptions at that time. *AN*

CORE DYNAMICS

History of instability

Phys. Earth Planet. Inter. http://doi.org/htx (2012)

If the solid inner core cooled and grew slowly at the centre of a hot, early Earth, it should be homogeneous, an expectation not borne out by seismic waves that travel through it. Numerical models of the thermal and chemical history of the inner core indicate that an episode of thermal convection could explain seismic observations of heterogeneity.

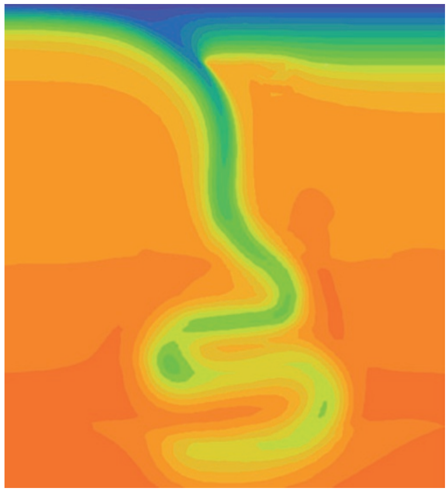
Sanne Cottaar and Bruce Buffett at the University of California, Berkeley, assessed how the inner core would have evolved under a range of conditions using numerical models. The simulations showed that it is plausible that the early inner core was thermally unstable. This instability could have allowed convection at a range of cooling rates, especially in the early stages of core growth. Convection would persist longer if there was a period of rapid cooling during the initial stages of growth.

The termination of convection at an early stage of the core's evolution may explain the observed heterogeneity of the inner core. Furthermore, the weakening of convection over time could account for stronger heterogeneity in the innermost part of the inner core as compared with the outer regions. *TG*

PLATE TECTONICS

Immature subduction

Geology http://doi.org/htv (2012)



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Some continental rocks were formed during the Archaean eon, but it is unclear whether modern-style plate tectonics operated on a younger, hotter Earth. Geodynamical modelling indicates that any subduction occurring more than 2.5 billion years ago would have been short-lived and episodic.

Jean-François Moyen at the Université Jean-Monnet, France, and Jeroen van Hunen at Durham University, England, used numerical models to simulate the style of plate tectonics that might have existed during the Archaean. Under the assumption of a mantle that is 200 K warmer than today, the simulations indicate that the tectonic plates had a thicker crust than today, whereas the lithospheric portion of the mantle was thinner. The hot underlying mantle was also weaker, and so provided less support for the sinking slabs. Overall, slabs broke off the subducted plate more frequently, which prevented the formation of long-lived subduction systems like those that characterize Earth today. Instead, the simulated subduction systems quickly halted and re-initiated within a few million years. This progression is recorded in the geologic record by the succession of subduction and non-subduction-related volcanic rocks in areas such as the Canadian Superior Province.

The researchers suggest that rather than appearing suddenly, the Earth's system of plate tectonics matured over many millions of years, becoming increasingly stable through time. *AW*

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