以下四篇短文，包括三篇研究論文書摘及一篇論文簡介，請詳細閱讀後說明各研究的概要。(提示：本研究的研究動機？研究方法？重要發現與推論為何？) 不需逐字翻譯。外文地名與人名可以不翻譯。

1. (20%) The New Madrid Seismic Zone: Not dead yet [*Science* 343, 2014]

Seismic hazard is not isolated to tectonic plate boundaries, as evidenced by earthquakes that occur in stable continental regions. Intraplate earthquakes, which are related to the internal deformation of plates rather than motion at plate boundaries, can be large and damaging, as with the 2001 Bhuj earthquake. In this work, we study the 1811–1812 New Madrid sequence, which is of paramount importance for understanding intraplate seismogenesis and for probabilistic seismic hazard assessment in the central and eastern United States and other midcontinental regions. The sequence included four events that were widely felt throughout the central and eastern United States, conventionally regarded as three primary mainshocks and the large dawn aftershock following the first mainshock. Magnitude estimates for these events have varied widely, from a low of magnitude (M) ≈ 7 for the largest mainshocks to values over 8 in magnitude.

2. (30%) Processes and patterns of oceanic nutrient limitation [*Nature Geoscience* 6, 2013]

Microbial activity is a fundamental component of oceanic nutrient cycles. Photosynthetic microbes, collectively termed phytoplankton, are responsible for the vast majority of primary production in marine waters. The availability of nutrients in the upper ocean frequently limits the activity and abundance of these organisms. Experimental data have revealed two broad regimes of phytoplankton nutrient limitation in the modern upper ocean. Nitrogen availability tends to limit productivity throughout much of the surface low-latitude ocean, where the supply of nutrients from the subsurface is relatively slow. In contrast, iron often limits productivity where subsurface nutrient supply is enhanced, including within the main oceanic upwelling regions of the Southern Ocean and the eastern equatorial Pacific. Phosphorus, vitamins and micronutrients other than iron may also (co-)limit marine phytoplankton. The spatial patterns and importance of co-limitation, however, remain unclear. Variability in the stoichiometries of nutrient supply and biological demand are key determinants of oceanic nutrient limitation. Deciphering the mechanisms that underpin this variability, and the consequences for marine microbes, will be a challenge. But such knowledge will be crucial for accurately predicting the consequences of ongoing anthropogenic perturbations to oceanic nutrient biogeochemistry.

3. (25%) A perspective on the future of physical oceanography [*Phil. Trans. R. Soc. A, 370,* 2012]

The ocean flows because it is forced by winds, tides and exchanges of heat and freshwater with the overlying atmosphere and cryosphere. To achieve a state where the defining properties of the ocean (such as its energy and momentum) do not continuously increase, some form of dissipation or damping is required to balance the forcing. The ocean circulation is thought to be forced primarily at the large scales characteristic of ocean basins, yet to be damped at much smaller scales down to those of centimetre-sized turbulence. For decades, physical oceanographers have sought to comprehend the fundamentals of this fractal puzzle: how the ocean circulation is driven, how it is damped and how ocean dynamics connects the very different scales of forcing and dissipation. While in the last two decades significant advances have taken place on all these three fronts, the thrust of progress has been in understanding the driving mechanisms of ocean circulation and the ocean's ensuing dynamical response, with issues surrounding dissipation receiving comparatively little attention. This choice of research priorities stems not only from logistical and technological difficulties in observing and modelling the physical processes responsible for damping the circulation, but also from the untested assumption that the evolution of the ocean's state over time scales of concern to humankind is largely independent of dissipative processes.

4. (25%) Ice loss and ocean life [*Nature Geoscience* 6, 2013]

Sea ice cover in the Arctic Ocean has declined significantly in the past three decades. Model simulations suggest that the biological draw-down of surface-water CO_2 to depth has increased as a result. Researchers assessed temporal changes in Arctic Ocean carbon uptake between 1996 and 2007, using a regional physical–biogeochemical model forced with reanalysis data. According to their simulations, the Arctic Ocean took up an additional 1.4 Tg of carbon per year over this period. A rise in phytoplankton productivity in the surface waters of the Laptev, East Siberian, Chukchi and Beaufort seas was responsible for the increase in carbon uptake. In contrast, net carbon uptake declined in the Barents Sea, where a warming-induced outgassing of surface-water CO_2 countered the rise in primary production. The findings suggest that the continued decline of Arctic sea ice cover could be accompanied by a rise in the oceanic uptake of carbon dioxide, although uncertainties in the response of physical, chemical and biological processes to sea ice loss hinder reliable predictions at this stage.

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