

Antarctica warms, which threatens penguins

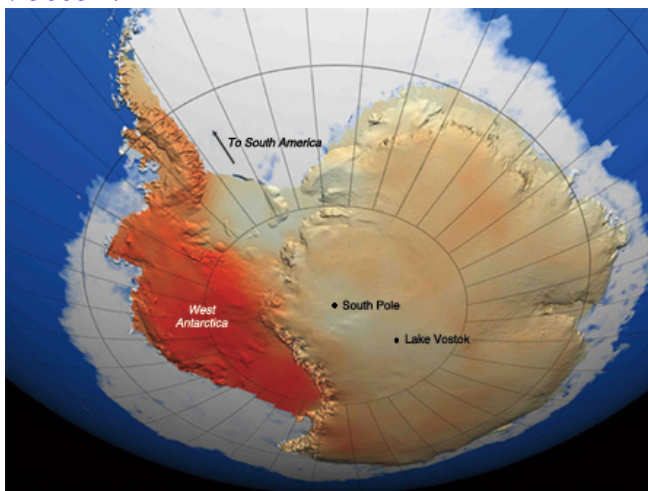
New evidence from satellites and weather stations suggests that way down south, Antarctica is feeling the heat. And that's not good news for penguins.

Scientists studying climate change knew some coastal areas of Antarctica were warming. But data from weather stations inland — at the South Pole and Lake Vostok — indicated these sites were actually getting colder. Researchers suspected that the whipping winds and freezing temperatures that grip these interior regions were keeping the rest of the continent cool, as well.

To check that out, a group of scientists decided to take a cold, hard look at the data. The team combined meteorological records from 42 weather stations in Antarctica together with data collected from satellites. Some of the data went back 50 years. The scientists then devised a new estimate of temperature trends in Antarctica.

It shows that much of this continent — particularly the West Antarctic Ice Sheet — had been warming in recent decades. This region makes up about one-quarter of the continent and has a lower average elevation than does East Antarctica. The new analysis showed that, overall, West Antarctica is warming about 0.17 degrees Celsius per decade, a rate comparable to the average elsewhere in the world. A description of their findings appeared in the Jan. 21 issue of Science News.

Just as the scientists suspected, parts of East Antarctica had cooled slightly between 1957 and 2006. But overall, warming in that portion of the continent — a far larger area — more than offset the cooling noted at the South Pole and Lake Vostok.



Since the 1950s, some portions of Antarctica have cooled, but many areas, including West Antarctica, have warmed substantially. The stronger the tone, the larger the warming or cooling.



Emperor penguins could be on their way to extinction if climate change affects sea ice around Antarctica as expected.

Antarctica's warming began somewhat recently, the scientists suspect. The rise in temperature was most likely spurred by various dramatic changes. For example, vast areas of sea ice off the Antarctic coast have shrunk over the past 25 years. The loss of that sea ice has, in turn, helped open West Antarctica to storms carrying warm, moist air and snow.

"The new results ... indicate that there's warming related to greenhouse gases on all seven of Earth's continents," says Drew Shindell. He's a climatologist at the NASA Goddard Institute for Space Studies in New York City and coauthor of the new study.

Melting ice sheets could also spell disaster for the continent's wildlife. In another new study, this one reported in the January 26 Proceedings of the National Academy of Sciences, researchers focused on emperor penguins that rely upon the winter sea ice to breed.

Data gathered at a penguin rookery in Terre Adélie, Antarctica, showed that when winter sea ice dropped an average of 11 percent for several consecutive years, the penguin population also took a nosedive. During that period, the population fell to half its normal number. When the sea ice reached high levels, penguin populations remained high.

If Antarctic ice sheets continue melting at a high rate, emperor penguins could nearly be wiped out, says Hal Caswell, a mathematical ecologist at the Woods Hole Oceanographic Institution, in Massachusetts.

Even if sea-ice melting slows, the overall number of penguins is still likely to continue falling. A study developed by Caswell and his colleagues looked at current penguin-population trends together with estimates of how much sea ice will be available in coming years. These analyses indicate that the Terre Adélie rookery could host only 400 breeding pairs by the end of this century. Forty years ago, there were 15 times that many.

Lunch Time Video Shows: 12:20 p.m. @ Chem. Lab. (Room 512)

Date	Name of Program	Language / Subtitle	Area
14/2 (Mon)	How Earth Made Us – Wind 天造地設 – 風 (Part I)	English / Chinese & English	Earth Science 地球科學
17/2 (Thu)	How Earth Made Us – Wind 天造地設 – 風 (Part II)	English / Chinese & English	Earth Science 地球科學
22/2 (Tue) Mon Timetable	The Miracles of Jesus, Episode 3 (Part I) 神蹟透視(三)	English / Chinese	Archeology 考古學
24/2 (Thu)	The Miracles of Jesus, Episode 3 (Part I) 神蹟透視(三)	English / Chinese	Archeology 考古學
28/2 (Mon)	Megafactories – A380 (Part I) 偉大工程巡禮：空中巴士 A380 客機	English / Chinese	Engineering 工程

你的衣服，能夠超導嗎？

科學家成功的製造出奈米碳管紗線，並將各種特性材料粉末包覆其中，可望能在做出具有電池、超導體等新穎科技的紡織物。

在現代的紡織技術中，如何賦與紡織素材更多的功能，是一項重要的課題。以往在纖維中混合添加物的作法，附著性不甚理想，而且添加物所佔比例並不高，除此之外，纖維本身的耐用度也對其實用性大打折扣。

為了解決這些技術困難，美國德州大學達拉斯分校教授 Ray Baughman 的研究小組，利用靜電鍍粉、氣凝膠、濺鍍、噴墨印刷等各種方式，將不同的特性材料粉末附著於厚度約 50nm 的奈米碳管薄膜的表面，接著再將奈米碳管薄膜以旋撚 (twist spinning) 的方式製成紗，而原先附著於薄膜表面的材料粉末，則被包覆於紗線當中。以這種技術製成的奈米碳管紗線，其添加物含量可達到 95%；換句話說，只需佔總重量 5% 的奈米碳管，就可以把大量的特性材料包覆於紗線之中，這是奈米碳管密度極低的緣故 (約 1.5 mg/cm^3)。

即便具有如此低的密度，奈米碳管仍具有極強韌的特性。研究小組所使用的奈米碳管薄膜具有高達約 $150 \text{ MPa}\cdot\text{cm}^3/\text{g}$ 的比拉伸強度 (specific tensile strength)，緻密化後更可達到 $560 \text{ MPa}\cdot\text{cm}^3/\text{g}$ 。這樣的比拉伸強度有多大呢？一般使用的超高強度鋼材的比拉伸強度大約 $125 \text{ MPa}\cdot\text{cm}^3/\text{g}$ ，而鋁合金則有 $250 \text{ MPa}\cdot\text{cm}^3/\text{g}$ 。

研究小組將各種具有重要特性的材料包覆於紗線中，其中包括硼化鎂，具有 39K 的超導臨界溫度；石墨烯及磷酸鋰鐵，分別可作為鋰離子電池的陽極和陰極；二氧化鈦，具有光催化及自淨的功能，也是染料敏化電池的重要材料；參雜氮的奈米碳管，是燃料電池中氧氣還原反應的有效催化劑。這些材料與紡織物的結合，不僅拓展材料應用的範圍，也將來智慧型衣物開啓了無限可能。

藉由調整旋撚的軸心及其他實驗參數，可以得到不同螺旋堆疊結構的奈米碳管紗線，以達到更好的耐用度及功能性。Ray Baughman 表示，研究小組會持續嘗試將各種具有重要應用價值的材料加入奈米碳管紗線當中。

地球科學：深海漏油中的甲烷竟於數月內消失

針對 2010 年墨西哥灣沿海漏油事件，科學家發現海水中高濃度的甲烷於數月內異常迅速地回歸正常值，此過程與快速增長的深海細菌有關。

近幾十年來，不間斷地海洋漏油事件已引起社會民眾的關注。外泄的有毒物質經常對該海域帶來巨大財物損失與長期性生態浩劫。如何有效地清除大量外漏的油污一直為研究人員所關注的議題。在最新一期 Science，美國德州大學的海洋科學家 John Kessler 與其研究小組針對 2010 年墨西哥灣深海漏油事件提出新的理論，他們發現深海中大量外漏的甲烷可於短期內被快速繁殖深海嗜甲烷菌所吞滅。此細菌移除速度遠越過去各地所觀測的結果。

此次墨西哥灣深海漏油事件始於 2010 年 4 月 20 日，當時路易桑納州沿岸的 The Deepwater Horizon 鑽油台發生爆烈，造二十多人傷亡與 170 萬加侖的石油外漏到墨西哥灣內。該漏油處於 7 月中受到控制，到 9 月中該油井被永久封閉。

John Kessler 與其研究小組於該年 6 月到肇事海域採集海洋樣品，當時海水中的甲烷濃度比正常值超出 10 萬倍。3 個月後，當他們回到同樣地點收集水樣時，海水中的甲烷值已回歸到一般值。為了追蹤油污的流向與周遭環境因子的關係，科學家們於周圍 207 地點收集水樣，並分析水中溶氧度與微生物群結構。他們發現在甲烷快速失蹤的地點，殘留許多嗜甲烷菌與呈現高度缺氧的狀態，意味著水中的甲烷曾遭受大量深海細菌的噬吞。

此發現顯示對於一些突發性深海大量排放的甲烷，大自然的清除能力是不容被忽視的。然而，美國另一名主要研究員 (David Valentine) 回覆 Wall Street Journal 的訪問時指出，目前的發現並不意味許多漏油事件中排放的有毒物質 (多環芳香族碳氫化合物) 亦經生物的過程而迅速消失。

