The study highlighted the role of changes in the tropospheric Hadley circulation and midlatitude jet stream as the mechanism for propagating the solar-cycle signal to the surface.

An earlier modelling study suggested that the stratospheric Brewer–Dobson circulation (see Fig. 1) could be strengthening in response to a changing climate[8]. This circulation shapes the global stratospheric ozone distribution as well as climatic features such as the height and temperature of the boundary between the troposphere and stratosphere, known as the tropopause. There is now a growing consensus amongst models that the effect of climate change on the strength of the Brewer–Dobson circulation is robust (N. Butchart, Met Office, UK), but the mechanisms involved remain controversial. New observational and modelling results point to a previously unrecognized contribution to the forcing of the circulation — that of waves in the tropics forced by convection (W. J. Randel, National Center for Atmospheric Research, USA).

No one would question the benefit of a full representation of the stratosphere in an atmospheric model. But given limited computational resources, modellers have to decide whether to invest in an improved representation of the stratosphere versus other processes, such as ocean circulation. A recent modelling study suggests that the inability of current climate models to reproduce the Arctic circulation trend over the past 40 years is largely a result of the lack of representation of observed stratospheric circulation trends[9]. This highlights the need to quantify the benefits of a full representation of the stratosphere in a systematic fashion. To do so, a natural approach is to compare models with and without stratospheric representation, termed 'high-top' and 'low-top' models, respectively. Preliminary comparisons have revealed significant differences in the impact of El Niño on the tropospheric high-latitude circulation, with high-top models better able to represent the spatial structure of the observed tropospheric response (S. Ineson, Met Office, UK; C. Cagnazzo, INGV Bologna, Italy; C. Bell, Univ. of Reading, UK).

The question of the stratospheric influence on tropospheric weather and climate has been growing in importance for some time[10]. Tools such as seasonal prediction systems and low/high-top model comparisons are finally in place for a systematic study of this issue. The meeting in Greece showed the increasing potential of these approaches and the growing importance of studying the role of the stratosphere in weather and climate research.

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ENVIRONMENTAL BIOLOGY

Trees of extremes

Tierra del Fuego — the windswept hook of rugged land stretching towards Antarctica at the southernmost point of South America — is not known for its hospitable climate. When visiting the area in the southern summer of 1832, Charles Darwin wrote "the atmosphere, likewise, in this climate, where gale succeeds gale, with rain, hail, and sleet, seems blacker than anywhere else" (C. Darwin, *The Voyage of the Beagle*; 1839). The presence at the timberline of gnarled and dwarfed trees, as seen in this image, seems testament to the harsh weather of the region. But Hector D'Antoni at NASA and colleagues have found that it's not the weather that makes the environment extreme: the area is subject to high levels of ultraviolet radiation (*Geophys. Res. Lett.* **34,** L22704; 2007).

The researchers measured a number of environmental parameters on vertical transects of the steep slopes forming the northern shore of the Beagle Channel near Ushuaia, Tierra del Fuego. They found that although the temperature, moisture, acidity and nutrient content of the soils were not unusual for the region, levels of ultraviolet solar radiation were sufficiently high to classify the upper timberline environment as extreme. As ultraviolet radiation is dangerous to life — it damages important biological molecules like proteins and DNA — trees growing under these conditions must have evolved strategies for coping with such high levels in order to survive.

Previous work showed that leaves from the dominant tree genus in the area — the beech *Nothofagus* — contain glycoside compounds, which protect the leaf by absorbing the ultraviolet radiation. The local evergreen *N. betuloides* contains higher concentrations of these protector compounds than the two deciduous species, *N. antarctica* and *N. pumilio*. D'Antoni and colleagues suggest that the leaf shape of these trees, with a rippled profile and glossy surface, may have evolved to maximize the reflection of ultraviolet radiation.

Studies of extreme environments may help understand the conditions in which the early stages of life have evolved, for example high temperature,

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pressure or salinity. The high elevation forests on Tierra del Fuego broaden the repertoire by adding high ultraviolet solar radiation.

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