might be ensured by the requirement for a high concentration of a cocktail of specific toxins or a synergic combination of a toxin together with other *Conus* metabolites. We have demonstrated the ecological relevance of this phenomenon in field experiments. This is, to the best of our knowledge, the first documented case of a defined peptide acting as an interspecific alarm cue in marine ecosystems. In the ecological interaction described herein, a prey animal is able to turn the tables on its selective predator by taking advantage of its attack allomones as specific warning signals.

Another intriguing aspect is the implication of structural and functional similarities between chemosensory receptors and nervous system receptors. Such similarities might have provided *Strombus* with a preadaptation, whereby any selective chemical targeted against a receptor in its nervous system would be specifically recognized by the related chemosensory receptors.

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Next step for weekday warming

SIR — The assertion[1] that the lower troposphere (1,000 – 400 hPa, or about 0 – 7,000 m) shows a weekly periodicity in temperature is surprising in view of available estimates of human energy consumption and its direct impact on the temperature of the lower troposphere. The world energy consumption per unit area for 1992 has been estimated at 7.2×10^5 J m^{-2} yr^{-1} (ref. 2).

On the conservative assumption that this consumption occurs solely in the Northern Hemisphere, this amounts to about 0.045 W m^{-2}. If all this energy is transformed into sensible heating of the lower troposphere, this leads to a heating rate of 6.4×10^{-4} K per day, or only about 9% of the observed maximum rate of increase seen in the weekly temperature cycle[1], which shows a heating rate of about 0.02 K in 3.5 days, or 0.006 K per day for the Northern Hemisphere.

The energy rate required to produce this observed change in temperature is 0.40 W m^{-2}. Therefore, even if human energy consumption were turned off long enough for the atmosphere to come to equilibrium, then suddenly turned on, the rate of temperature increase would be about an order of magnitude smaller than that observed.

For comparison, it is interesting to estimate how much the Earth can heat up owing to human energy consumption, assuming the Earth would reach a new radiative equilibrium and that all the energy consumption is transformed into sensible heating of the atmosphere (neglecting change in the Earth's surface temperature). The amount of infrared radiation emitted by the atmosphere to space is around 155 W m^{-2} (ref. 3). Assuming the total human energy consumption is used to increase the radiative temperature of the Northern Hemisphere atmosphere leads to a steady-state temperature increase of about 0.02 K. (The same assumptions applied only to US energy consumption lead to a temperature increase over the conterminous United States of 0.15 K.) Thus, the problem is not that the magnitude of the observed temperature change is obviously unreasonable, but that the rate of change is too large to be accounted for directly by human energy consumption.

Before dismissing this suggestion, it may be worth investigating other physical processes that might be triggered by weekly variations in human activities. Certainly variations do occur in, for example, vehicle use, power-plant production, and agricultural and recreational activities during the week. Therefore, it is likely that human activities do impose a weekly cycle on aerosol production and distribution, with higher production during the week. This could alter the solar heating or infrared cooling rate of the lower troposphere, or the precipitation rate, which in turn could modify the temperature of the lower troposphere.

Some of the terms in the Earth's radiation budget that might be affected are[3,4]: backscattered solar radiation, 21 W m^{-2} (2); solar radiation absorbed in the clear atmosphere, 56 W m^{-2} (0.7); solar radiation reflected by clouds, 70 W m^{-2} (0.6); solar radiation absorbed by clouds, 14 W m^{-2} (2.9); and infrared radiation emitted by clouds, 91 W m^{-2} (0.4). (Numbers in parentheses are the percentage magnitudes of the weekly oscillation in these processes averaged over the entire Northern Hemisphere which could lead to the observed temperature change.) Similarly, the latent energy rate released by precipitation averaged over the Northern Hemisphere (estimated[3] to be 1 m yr^{-1}) is 79 W m^{-2} (0.5).

Although the per cent changes required in these processes are small, it is not obvious that they could be modulated on timescales of a week even if human activities are modulated on a weekly basis. Furthermore, the maximum of the microwave radiometer weighting function is in the range of 500 – 700 hPa (ref. 5), above the usual height of the atmospheric boundary layer, and contributions from heights greater than 400 hPa are not insignificant. Because coupling between the boundary layer, where anthropogenic aerosols are predominately produced, and the air above is episodic and of the order of several days, it is likely that only boundary-layer aerosols can be modulated significantly on a weekly cycle. As pointed out above, their direct impact on the global radiation budget is less than for clouds. Therefore, it is not likely that the observed temperature changes are directly a result of aerosol impact on radiation.

At first glance, clouds seem to be a more likely candidate. They commonly incorporate boundary-layer air, and changes in aerosols can have significant impact on the microphysical structure of clouds, which can affect both solar and infrared radiation and rainfall rates[6,7]. But the impact of increased aerosols is likely to be increased albedo and decreased rainfall, which would result in cooling during the week and warming at weekends. Therefore, there seems to be no plausible physical mechanism that could account for the observed midweek temperature maximum.

But it is more likely that the observations are not statistically significant. Because the results are not significant at the 5% level, this would seem to warrant further testing. For example, is there any significance if the time series are split into two samples? What is the statistical distribution of the means? Examples of the microwave temperature data show monthly and seasonal variations[5]. How does this affect the significance of the weekly temperature variation estimates?

To investigate further the possibility of a weekly periodicity, is it possible to look for weekly variations in hemispheric averages of other variables such as the solar reflectivity (albedo), infrared radiation, or rainfall rate of the Earth? Admittedly, the magnitudes of the changes would be small, but if they can be found, they would lend credence to the observation of a weekly temperature cycle in the Northern Hemisphere, and would suggest the possibility of deducing anthropogenic effects before climate change had occurred.

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