Indian software for British companies

Faced with reduced budgets British companies have found a way to cut down expenses—by borrowing Indian expertise. Indian computer programmers' salaries are about a fifth of the UK average and the quality of their work is of international standard. London Underground is said to have rejected local companies in favour of the New Delhi-based Computer -Maintenance Corporation (CMC) Ltd.

The number of Western companies relying on foreign firms for software development is on the increase and India could become the main software centre for the West. According to the Indian Electronics and Computer Software Export Promotion Council (ESC), most computer staff have postgraduate degrees and there are nearly 1000 technical institutions training 250,000 staff each year. India has more than 2 million scientific and technical graduates who look upon information technology as a lucrative career.

The Indian information technology market is now worth about $ 1 billion, with software sales accounting for over $ 200 million. Eighty per cent of Indian software exports are from contract services for foreign companies (as opposed to income from exporting software products). Since Singapore, Malaysia, the Philippines, Thailand and China are also in the race for exporting skills, it would be worthwhile for India to heighten international awareness of its potential for handling information technology projects.

Global warming—satellite data should make advocates cool their heels

Anna Mani

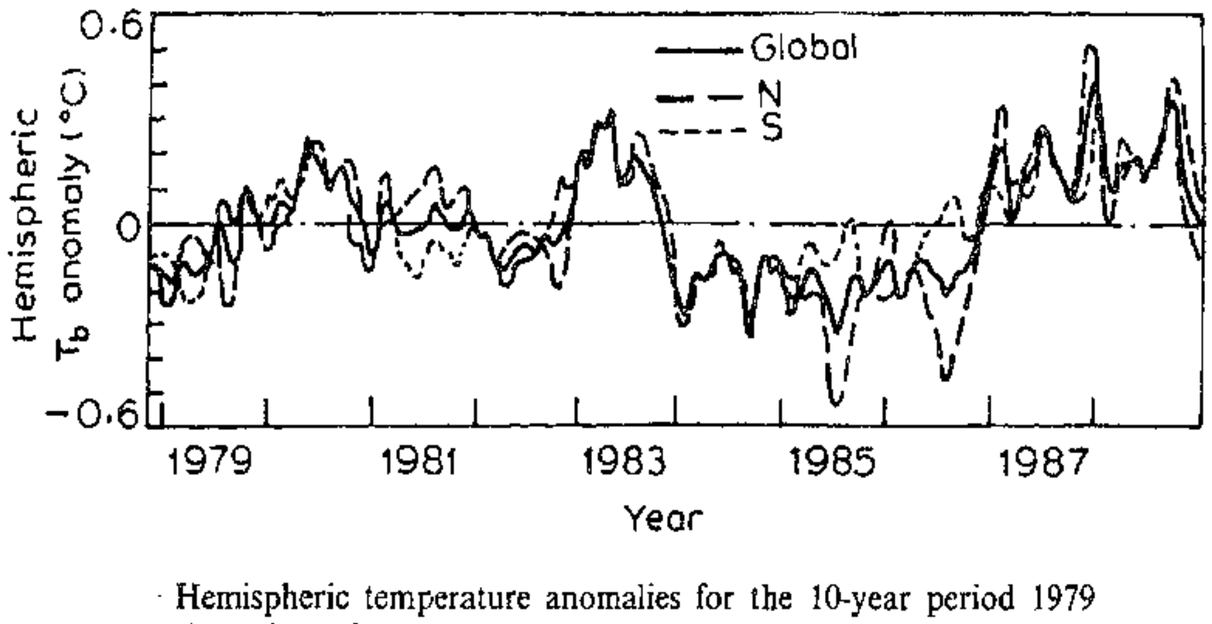
Accurate measurements of global atmospheric temperature are needed for the evaluation of global climate models and for the detection of climate changes, particularly of possible greenhouse warming. There has been much debate in the recent past whether there has been a global warming due to the greenhouse effect or not. Surface temperature records, used to study changes in global temperatures, are generally unsatisfactory, being very sparse, particularly over vast oceanic areas and remote land areas. Even urban areas, where long-term measurements are available, represent a small fraction of the globe, and in cities temperatures are affected by heat from man-made structures, making records at these stations difficult to interpret.

Sensors on satellites, on the other hand, can provide nearly complete global coverage within a day and can also obtain measurements from different levels of the atmosphere. In a very interesting paper[1], Roy Spencer of the Marshall Space Flight Center and John Christy of the Johnson Research Center of the University of Alabama, both in Huntsville, Alabama, USA, show that accurate long-term global temperature measurements can be obtained from satellites now in operation and that passive microwave radiometry from satellites provides more precise atmospheric temperature information than that obtained from the sparsely distributed thermometers over the Earth's surface; they also suggest that satellite microwave radiometers, because of their demonstrated stability and the global cover they provide, should be made the standard for monitoring global temperature anomalies. Their most important finding, however, from an analysis of the first ten years (1979–1988) of satellite measurements of lower atmospheric temperatures, is that, while large temperature variability was recorded on weekly to multi-yearly time-scales, there was *no* obvious temperature trend noted during the 10-year period.

The microwave sounding units (MSUs) used in the US National Oceanic and Atmospheric Administration (NOAA) satellites measure the thermal emission of radiation by atmospheric oxygen at four frequencies near 60 GHz and are calibrated in flight against the cosmic background radiation (constant at 2.7 K) and a warm target in the instrument that has its temperature continuously monitored by redundant platinum resistance thermometers. Comparisons between two MSUs, operating simultaneously on two separate satellites over a period of two years, showed that both satellites were measuring nearly the same temperature variations and that hemispheric temperature anomalies (temperature deviations from the average temperature for a particular time of the year) can be measured with relatively little error from a single satellite. They estimated the precision of monthly satellite measurements to be about ±0.01°C for the globe. Comparisons with radiosonde data from the 66 stations in the US, after correcting for time mismatches and radiosonde calibration errors etc., showed no long-term trend in the nine years of differences between MSU- and radiosonde-calculated 'brightness temperature' values T_b and gave a monthly standard deviation of 0.068°C. Comparisons with records of temperature variability from near-surface thermometers in the US weather observing network for the period 1979 to 1987 showed the monthly temperature anoma-

lies from thermometers and the MSU's monthly mid-tropospheric temperature anomalies to be similar, with a correlation coefficient of 0.89, but the surface anomalies were typically two to three times as great as the MSU anomalies and were probably caused by daytime solar heating and night-time cooling of the surface. Considering therefore the important issue of whether near-surface temperatures or deep-layer temperatures should be monitored for detection of climate change, they suggest that it would be best to monitor both in order to gain an understanding of how the entire troposphere behaves, the latter having, however, the advantage of freedom from surface effects and being capable therefore of providing an earlier signal of possible greenhouse warming.

Large fluctuations in the hemispheric and global temperatures were observed during the 10-year period 1979–1988 (see figure), the warmest years, in decreasing order, being 1987, 1988, 1983 and 1980, and the years 1984, 1985 and 1986 being the coolest. No obvious long-term trend was noticed, anomalies during the first five years nearly balancing those during the last five years. The 1988 and 1980 warm events were traced to the mid-latitudes, while the 1987 and 1983 warm events were associated with El Niño/Southern Oscillation events (ENSOs), the 1983 event causing globally averaged temperatures to rise more in several months than what would be expected in several decades with enhanced greenhouse warming. The period 1984 to 1986 was dominated by cooler-than-normal tropical air. There were nine cool or warm years and only one year (1981) that could be considered 'average' in the 10-year period studied. This makes one, as it does the authors, wonder what 'normal' for global temperatures means, since 'normal' can mean either warm or cool conditions.



Hemispheric temperature anomalies for the 10-year period 1979 through 1988. S and N refer to southern and northern hemispheres respectively; the global time series is in a continuous line.

1. Spencer, R. W. and Christy, J. R., *Science*, 1990, **247**, 1558.

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Solvophobic effects drive self-assembly and neutral molecule recognition in organic media

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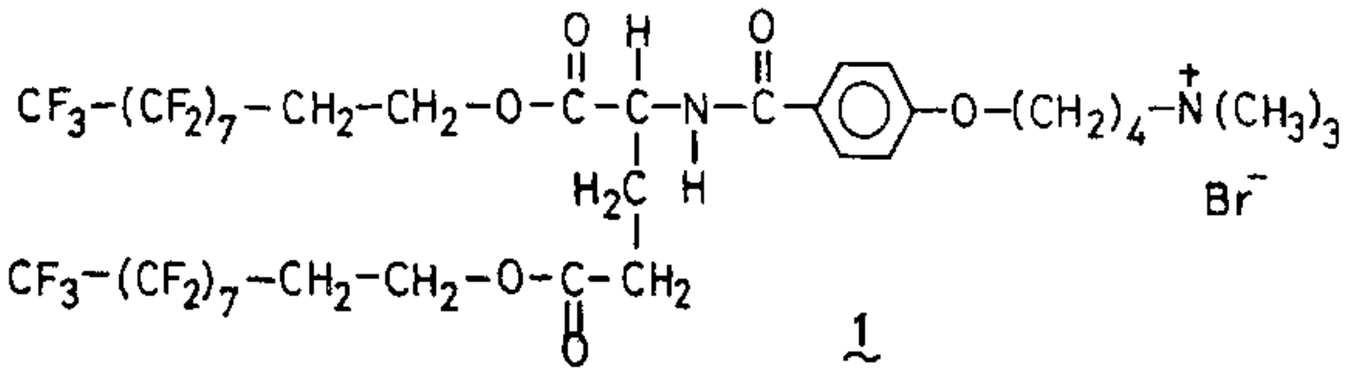
Water and the hydrophobic effect[1] are central to biological organization. Membranes and the convoluted structures of globular proteins are two striking examples of the importance of hydrophobic interactions in facilitating molecular self-assembly and the three dimensional folding of complex macromolecules. Hydrophobic effects, or the tendency of apolar groups to cluster together and avoid exposure to the aqueous medium, are often crucial in biological recognition processes like ligand–receptor interactions. Can self-organization and specific recognition between neutral molecules be achieved in non-aqueous media? The thrust of several recent reports in this area suggests that Nature's devices can be mimicked, in albeit limited fashion, in organic solvents.

An exciting report, from Japan by Ishikawa *et al.* at Kyushu University, describes the spontaneous formation of bilayers by perfluoroalkyl derivatives, in organic media[2]. Compound **1** is amphiphilic and forms bilayers in water[3]. Modification of the structure to replace the polar head by a neutral apolar group yields **2**, which forms highly organized aggregates in cyclohexane. This feature is evident from the high intensity of the circular dichroism bands due to the aromatic rings (**2** is chiral and is derived from L-glutamate). Electron microscopy of samples stained with Pb(II)*bis*(acetylacetonate) revealed the presence of vesicles of diameter 200–1000 Å. Alternative morphologies like twisted tapes are also observed as a function of temperature. The authors interpret their electron micrographs and CD data in terms of formation of a bilayer structure (Figure 1). The fluorocarbon chain by virtue of its limited



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