What are monsoons?

Derived from the Arabic *mausam* (season), the word monsoon refers to a major wind pattern which seasonally reverses its direction. The main driver of monsoons is the change in the distribution of surface heating between winter and summer, primarily associated with the seasonal variations in the position of the sun. for a monsoon to be established, a thermal contrast between the land and ocean must exist. This occurs when large land masses, such as Asia, Africa and Australia, heat up rapidly during the spring and summer. These hot land masses draw humid air in from the surrounding oceans, like a massive sea breeze. As the moisture-laden air reaches the warm land, it rises and the moisture condenses as rain. By contrast, in winter, the land becomes much cooler than the surrounding oceans and the cold, dry air then flows from the land out over the ocean. So monsoon climates are seasonally arid with drought in winter and rain in summer. Because the monsoon is so closely tied to the movement of the sun, its arrival occurs with remarkable regularity every year

Why do they matter and what needs to be done?

Over 60% of the world's population depend on monsoon rains, but despite their regularity, there are year-to-year variations which place enormous strain on food and water resources. Following the great Indian drought of 1877, scientists have continually tried to predict the behaviour of the monsoon a month, a season or even decades ahead. In the future, the stress of increasing world population will be felt most strongly in the countries of S.E.Asia and Africa, which depend on monsoon rainfall. So these

countries need to know what the variations in climate are likely to be, and how they may impact on key factors such as water resources, agriculture, incidence of extreme events and the risk these events pose to infrastructure (e.g. roads and buildings). The management of water resources is a top priority for monsoon-affected countries. The planning of adequate reservoirs or flood control structures requires detailed information on the expected climatic fluctuations, with assessment of their return period. At the same time, land-use changes (e.g. deforestation) may alter the character of the land surface and hence lead to further changes in climate.

Food production in seasonally arid areas is inherently risky. By the end of the dry season, the soil is parched and planting cannot begin until the rains arrive. A late or weak monsoon can lead to a short r poor growing season and hence low yields, as happened during the drought of 1987. An excessively strong monsoon can be just as detrimental. For example, in Pakistan, heavy rain during September 1992 flooded cotton plantations and caused the crop to fail. Agricultural failure has a profound effect on the economy of monsoon-affected countries, such as India, where farming accounts for 30% of the gross domestic product and 67% of the workforce.

What is PROMISE doing?

PROMISE is a three-year (2000-2003) research project funded by the European Union with a total budget of 1.6 million Euros. It brings together state-of-the-art climate and seasonal prediction models with sophisticated models of ground hydrology, water balance for large river catchments, land use changes, crop development an dproductivity to attack the following issues:

- the potential for seasonal prediction and the benefits that would accrue in terms of the management of water resources and agriculture
- the impacts of anthropogenic climate change on tropical countries, in particular on the availability of water resources for human use, and on the productivity of crops and the potential changes in the natural vegetation

In the past, the agricultural and hydrological impacts of the monsoon have generally been considered separately from the predictability and variability of the climate. A key objective of PROMISE is therefore the development of an integrated approach towards seasonal and climate change modelling which incorporates local hydrology and agriculture into the prediction process.

Part of PROMISE is the creation of a data archive, which scientists from monsoon-affected countries will both contribute to and benefit from. This will help foster pro-active links between the European and non-European partners – one of the aims of PROMISE.

The scientific objectives will mainly be met through individual research by the PROMISE partners (see the PROMISE web site for further details of how the research will be divided up). To aid collaboration, there will be several conferences, with the biggest planned for spring 2003.

The PROMISE data archive

The PROMISE data archive will consist of observed and simulated data on meteorology, hytdrology and agriculture in monsoon-affected countries. Daily time series of surface air temperature, precipitation and other key variables will be created from the 20-year simulations of the perturbed (e.g. 2041-2060) and control climates for use in driving crop models, analyses of extreme events and other impact applications. The data will be accompanied by the provision of scientific advice on the interpretation analysis and statistical significance of the model results

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