Extreme 2010 Russian fires and Pakistan floods linked meteorologically

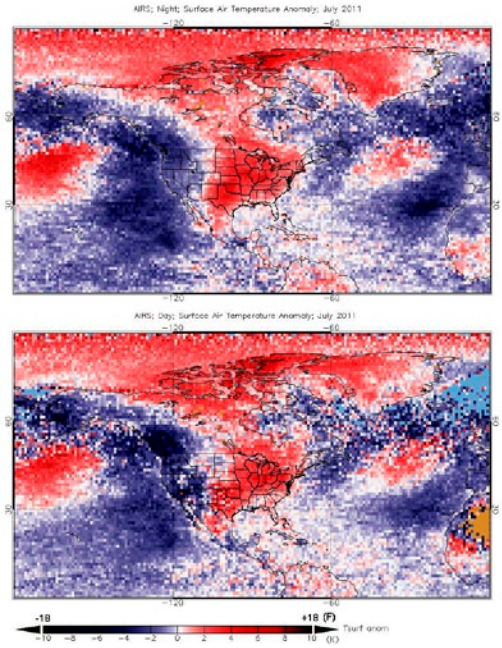
Two of the most destructive natural disasters of 2010 were closely linked by a single meteorological event, even though they occurred 2 400 km apart and were of completely different natures, a new NASA study suggests.

The research finds that the same large-scale meteorological event – an abnormal Rossby wave – sparked extreme heat and persistent wildfires in Russia as well as unusual downstream wind patterns that shifted rainfall in the Indian monsoon region and fuelled heavy flooding in Pakistan. Although the heat wave started before the floods, both events attained maximum strength at about the same time, the researchers found by analysing satellite data generated by NASA instruments capable of measuring the land-surface temperature, precipitation intensity and wildlife activity.

William Lau and Kyu-Myong Kim, atmospheric scientists at NASA's Goddard Space Flight Centre, authored the study, which was published earlier this year in the *Journal of Hydrometeorology*.

The atmosphere, gaseous and transparent, may not seem like a fluid, but that is precisely how the thin layer of air encasing the planet behaves. As Earth spins on its axis, huge rivers of air – scientists call them Rossby waves – meander around the globe in a westerly direction. Currents in the centre of these waves form the jet streams, fast-moving columns of air that push weather systems from west to east.

Rossby waves are not uniform. They tend to undulate and have troughs and ridges. Areas of low pressure typically develop in the troughs of the waves, while high-pressure areas form in their ridges. Parcels of warm air from the tropics and cool air from the poles swirl around the low- and high-pressure parts of the waves creating a complex tapestry of warm and cool fronts that meet and interact constantly. Collisions between warm and cool fronts produce storms and precipitation.



Under normal summertime conditions, the jet stream pushes weather fronts through Eurasia in four of five days, but something unusual happened in July 2010. A large-scale, stagnant weather pattern – known as an Omega blocking event – developed over a high-pressure ridge above western Russia. This blocking event, which divided the jet stream, had the effect of slowing the Rossby wave and prevented the normal progression of the weather system from west to east.

As a result, a large region of high pressure formed over Russia and trapped a hot, dry air mass. As the high pressure lingered, the land surface dried and the normal transfer of moisture from the soil to the atmosphere slowed. Precipitation ceased, vegetation dried out and the region became a taiga tinderbox.

Meanwhile, the blocking patter created unusual downstream wind patterns over Pakistan. Areas of low pressure on the leading edge of the Rossby wave formed in response to the high that pulled cold, dry Siberian air into lower latitudes.

"From NASA satellite data and wind analysis, we can clearly see the connection between the two events," said Lau. "Think of the atmosphere like a loose membrane. If you push one part up, something else has to come down somewhere else. If your produce a high in one region, you produce a corresponding low in another."

This cold air from Siberia clashed with warm, moist air arriving over Pakistan from the Bay of Bengal. There is nothing unusual about moisture moving north over India toward the Himalayas. It is a normal part of a monsoon. However, in this case, the unusual wind patterns associated with the blocking high brought upper level air disturbances farther south than is typical, which helped shift the entire monsoon rainfall system north and west. The shift brought heavy monsoon rains squarely over the northern part of Pakistan.

Source: NASA

Aussies proclaim war against invading willows

A project by Australian research organisation CSIRO is investigating the reproductive ecology and dispersal ability of the most aggressive invasive species of willows in Australia.

It is hoped that the study will provide urgently needed information to help land managers more efficiently control this alien invasive plant, which obstructs water flow, increases water temperature, changes water chemistry and displaces native riverine plant species.

According to the organisation, the results are crucial as willow control is expensive, time consuming, and eradication can be unsuccessful because of the willows' capacity to reinfest areas a short time after they have been removed.

CSIRO researcher Tara Hopley investigated the reproductive ecology and seed dispersal strategies of Salix cinerea or grey sallow, which is a weed of national significance. The study focused on three main problems: how willows are pollinated and how much seed they can make; how far willow pollen and seed can move across catchments; and identifying trees and populations within catchments that are key seed 'donators'.

"We discovered that this species of willow is pollinated by both insects and wind, and that the average willow tree can make 330 000 seeds in a season," noted Hopley. "That is about 25 million seeds generated each year by an average infestation of half a kilometre."

Genetic paternity tests and spatial analysis were used to determine how pollen and seeds are dispersed across a typical catchment. "The results show that over half the pollen and seed is moving more than 15 km between rivers. This high rate of spread suggests that land managers have to act urgently on control efforts across the whole catchment if long-term eradication is going to be effective," said Hopley.

Source: CSIRO

Cellphone innovation helps US teenager win international prize

American teenager Alison Bick, seen in the photograph with HRH Crown Princess Victoria of Sweden, has won the 2011 Stockholm Junior Water Prize.

The winner of the annual competition, which is open to young people between 15 and 20, takes home a prize of US$5 000 and a handmade blue crystal sculpture.

Bick worked for four years on her winning project, a low-cost portable method to test water quality using a cellular phone. The technology combines micro-fluidic devices, cellphones and chemical indicators to evaluate water quality. Her innovative method does not only accurately assess the bacteria content of water; it is also up to 200 times less expensive than standard testing procedures.

"This year's winning project reflects truly out-of-the-box thinking to find a solution to an important real world problem that is relevant in both a developing and developed country context. It is the result of a creative-multi-faceted and long-term effort that was triggered by an actual problem in the local community. It has the potential to revolutionise our ability to monitor water quality in a way that is fast, accurate, more flexible and less expensive than existing technologies, said the International Jury in its citation.

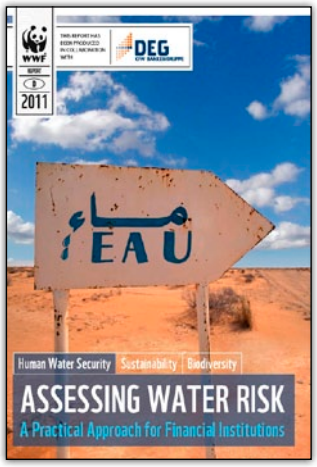
The international Stockholm Junior Water Prize competition brings together thousands of participants in over 28 countries, including South Africa. The representatives at the international final held during World Water Week in Stockholm are the winners of national competitions that fielded over 9 000 submitted projects this past year.

Water shortage becoming growth risk for business – report

According to a new study by WWF and German development bank DEG, the shortage of freshwater is not only becoming more and more of an ecological risk, but is also rapidly becoming a major business growth risk – one that investors need to take into account.

Assessing Water Risk: A Practical Approach to Financial Institutions, states that climate change, population growth and increasing living standards are contributing to the rising pressure on existing and already scarce water resources, particularly in developing countries. In Southeast Asia and Africa, for example, water shortages constitute a threat to entire ecosystems and to the living standards of the population.

"The availability of water is becoming a development bottleneck for companies. With the water risk filter we have now developed a new tool to identify such risks to companies and to offer support in water management," noted Dr Peter Thimme, head of DEG's department for Sustainable Development. Access to a sufficient quantity of water of adequate quality, he added, is therefore a considerable economic significance. "Business risk stemming from a company's relationship to



water can be broken into three broad, inter-related categories: physical – as a result of too little, too much or polluted water; regulatory – with dwindling availability and increased pollution, the regulation of water is bound to become stricter; and reputational – public and media awareness of water and how companies are handling this resource is on the rise."

The report goes on to state that "all of these risks can cause disruption of supply and, in worst cases, termination of business operations."

To access the report, Visit: http://assets.wwf.org.uk/downloads/deg_wwf_water_risk.pdf

Want to protect wild species? Then grow more food on less land

In parts of the world still rich in biodiversity, separating natural habitats from high-yielding farmland could be a more effective way to conserve wild species than trying to grow crops and conserve nature on the same land.

This is according to a study published in the 2 September edition of the journal, *Science*.

Researchers at the University of Cambridge and the Royal Society for the Protection of Birds, collected information on more than 600 species in southwest Ghana and northern India, two parts of the world where demand for agricultural land is putting ever more pressure on wild species. The researchers measured crop production as well as the abundance of birds and trees in forests and in various types of farmland.

"Farmland with some retained natural vegetation had more species of birds and trees than high-yielding monocultures of oil palm, rice or wheat but produced far less food energy and profit per hectare," reported lead author Dr Ben Phalan from the University of Cambridge. "As well as requiring more land to produce the same amount of food, the 'wildlife-friendly' farmlands were not as wildlife-friendly as they first appeared. Compared with forest, they failed to provide good habitat for the majority of bird and tree species in either region.

The researchers discovered that, under current and future scenarios of food demand, most species would have larger total populations if farming was restricted to the smallest area feasible, while protecting as much natural forest as possible. This was true not just for rare species, but for common species as well.

This strategy, called 'land sparing', uses higher yields on existing farmlands to spare land for nature (in contrast with 'land sharing', which aims to conserve wild species and grow crops on the same land). Because high-yielding farming produced more food from less land, it could be used as part of a strategy to protect larger tracts of natural habitats such as forest.

"It would be nice to think that we could conserve species and produce lots of food, all on the same land," said study author, Dr Malvika Onial from the University of Cambridge. "But our data from Ghana and India show that is not the best option for most species. To produce a given amount of food, it would be better for biodiversity to farm as productively as possible, if that allows more natural habitat to be protected or restored."