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What led to the May 2003 Floods?

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The May 2003 Rainfall

Heavy rainfall deluged the South-Western corner of Sri Lanka between the 11th and 19th of May 2003. Floods and landslides claimed 260 lives. Schools, homes and other infrastructure were destroyed. It was the worst disaster in 50 years (http://www.socialwelfare.gov.lk/floods/). The heaviest rainfall for May 2003 of 899 mm was recorded at Gonapenigala Iranganie Estate and the third heaviest rainfall of 755 mm was recorded at Panilkande Estate. The monthly rainfall in Ratnapura was 718 mm and this is a station with reliable data (figure 1). This shows that the rainfall was not as high as past extreme events at a monthly scale. However, half of the monthly rainfall fell on the 17th of May (figure 2) and indeed, the rainfall was highly concentrated to the South-West of Ratnapura.

What caused the Deluge?

What were the weather conditions that led to this rainfall? Strangely, it turns out that it was due to a cyclonic storm. Strange because, there has been no record of a storm making landfall in Sri Lanka during May. This is one reason why people were caught unawares.

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The 2003 cyclonic storm (figure 3) did not make landfall in Sri Lanka but travelled far away in the Bay of Bengal! The storm (figure 4) started 700 km to the East of Sri Lanka on the 11th of May and made its way to the North and North-East until it reached Myanmar on the 20th. As seen in the rainfall estimates for the Indian Ocean (figure 5), there was heavy rainfall along the path of the cyclone and in a spot far away in South-Western Sri Lanka.

Why that corner of Sri Lanka got soaked when the causative cyclone travelled so far away is a freak combination of geography and wind patterns. In that fateful week unusual North-Westerly regional wind patterns stalled the cyclone in the middle of the Bay of Bengal for a few days (data available at http://ingrid.ldeo.columbia.edu/maproom/) and one of the octopus-like spiral arms of the cyclone (which draws in expanses of air to feed its core) gusted over Sri Lanka. During May, the cloud bands that usually deluge Kerala at the end of the month hover over Sri Lanka. The cyclonic gusts from the South-West (which entrained some of these clouds) were interrupted by the South-Western-most mountains (Sri Pada and Gonagala) precipitating the deluge on their south-western slopes (figure 6). The rainfall patterns resemble a shadow of Sri Pada and Gonagala towards the South-West. Later, we found out that Kerala and Tamil Nadu had high rainfall deficits in June.

This mechanism of mountain-induced rainfall is the reason why the westward slopes of the central mountain ridge running from Kirigalpotta to Hantanna mountains and Knuckles get such heavy rainfall during the middle of the year as strong winds blow from the West. This time however the wind was from the South-West and the rainfall pattern for May 2003 was largely on the South-Westward slopes. This is why Deniyaya received heavy rainfall while Matale received relatively low rainfall in May 2003.

Need for Indigenous Computational Weather Prediction

The major disasters affecting Sri Lanka, namely floods, landslides, droughts and cyclones, have hydro-meteorological antecedents. Last May's flooding and landslides and previous hydro-meteorological disasters such as the cyclones in 1978 and 2000 that affected the North-East and the recurrent drought that affects the South-East and North-West underscore the urgent need for computational weather prediction. Of course, it is not only the matter of issuing hazard warnings that will reduce damages but also its translation to hazard warning and the implementation of appropriate communication of warnings and disaster preparedness and mitigation and response systems.

Even with all its shortcomings, computational weather prediction has the potential to forewarn of weather and climate spawned hazards. Indeed, the National Centre for Medium Range Weather Forecasting of India (http://www.ncmrwf.gov.in/) predicted high rainfall in Sri Lanka with rough accuracy three days in advance last May 2003 in an experimental mode. The development of indigenous computational weather and climate prediction capability should be a national priority.

The first author has developed a proposal for climate prediction technology and an outline proposal for using meteorological information for hazard warnings. Given the local availability of computer and Internet resources and skilled scientific and computational expertise, such prediction technology can be developed indigenously in three years as long as there is a sustained will to do it, the right people are engaged and a suitable environment is provided for them to work in.

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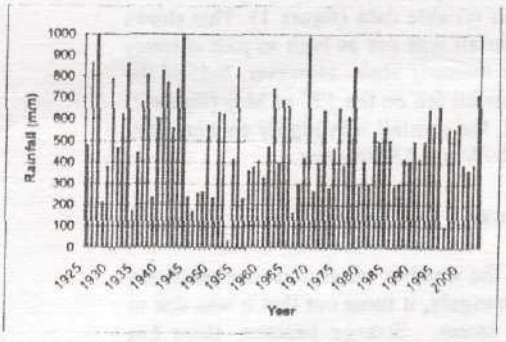

Figure 1: The rainfall observation at Ratnapura, Sri Lanka for May from 1925 to 2003. Data from Department of Meteorology and British ColonialArchives.

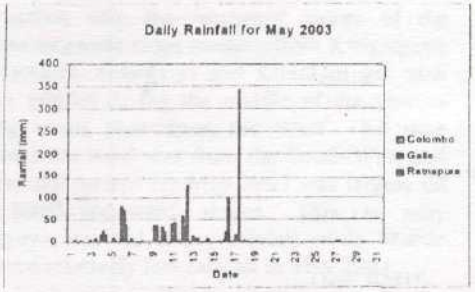

Figure 2: The rainfall at Ratnapura was heavy on the 12th, 16th and 17th of May 2003. A half of the monthly rainfall was recorded on a single day. Data from Department of Meteorology.

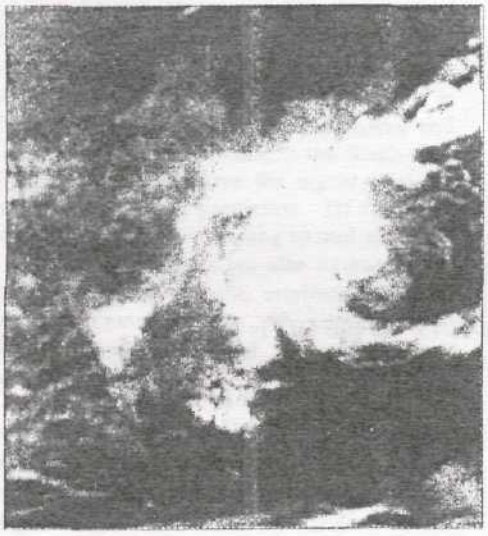

Figure 3: A satellite image of the cyclone on the 14th of May as recorded by the MODIS sensor of USA's NASA Terra Satellite. The eye of the cyclone is 700 km to the North-East of Sri Lanka and heading away from Sri Lanka. The heaviest deluge in Sri Lanka would come on the 17th and 18th of May, when the storm was 1000 km away. Image from (http://modis.gsfc.nasa.gov/ and http://visibleearth.nasa.gov/).

Biographical Sketches

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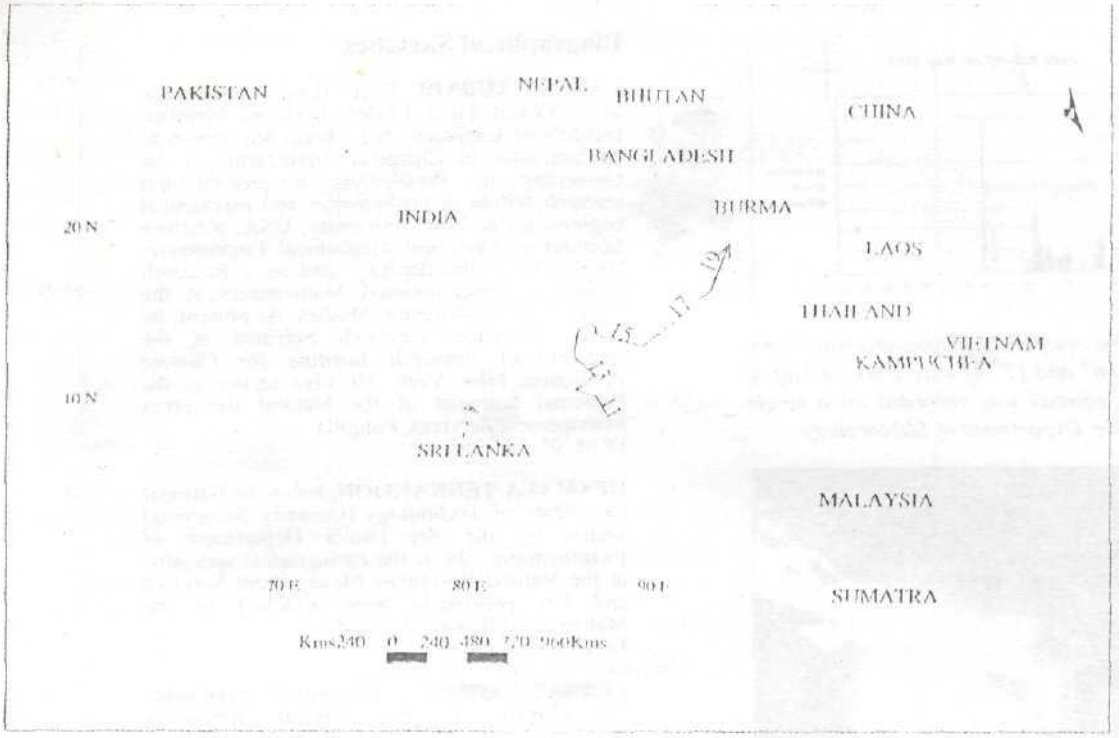

Figure 4: The track of the 01-B storm in the Bay of Bengal from the 11th to the 19th is shown. This was a relatively weak storm that achieved the status of a cyclone only on the 14th of May. By convention, a cyclone has wind speeds of more than 64 knots and a storm between 34 and 64 knots. Data obtained from http://lwf.ncdc.noaa.gov/img/climate/research/2003/may/01b.gif

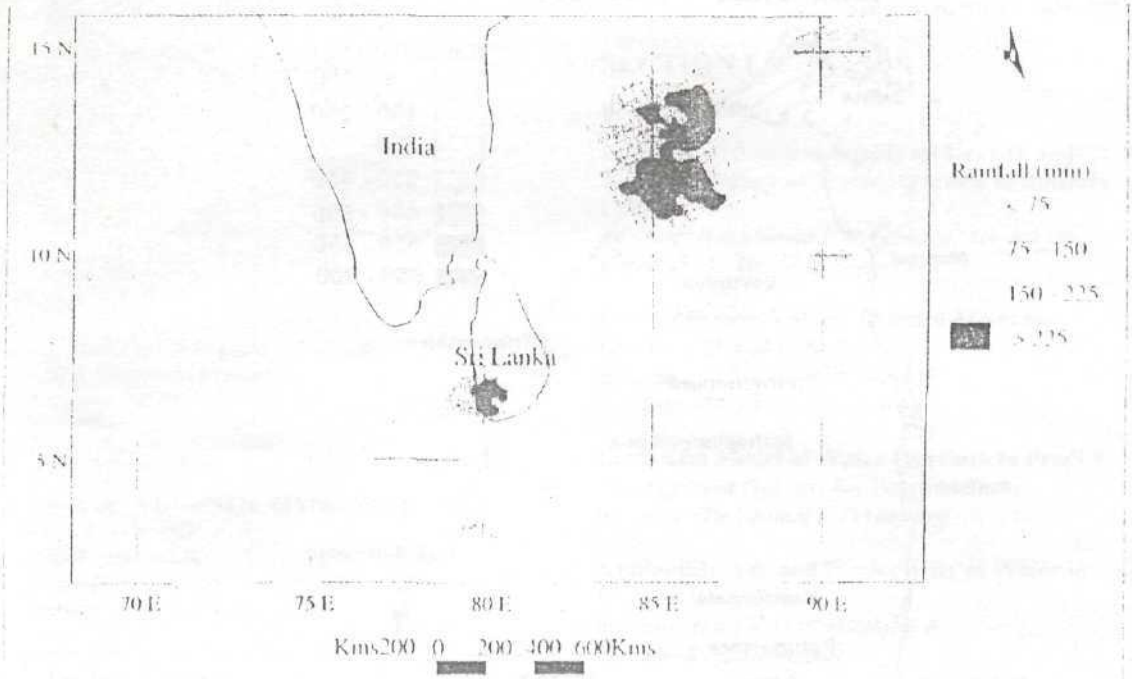

Figure 5. Satellite estimates of rainfall during 15th to19th of May as observed by the Tropical Rainfall Measuring Mission of Japan and USA (http://trmm.gsfc.nasa.gov/) shows that the rainfall was along the track of the cyclone in the Bay of Bengal and also remotely over South-Western Sri Lanka.

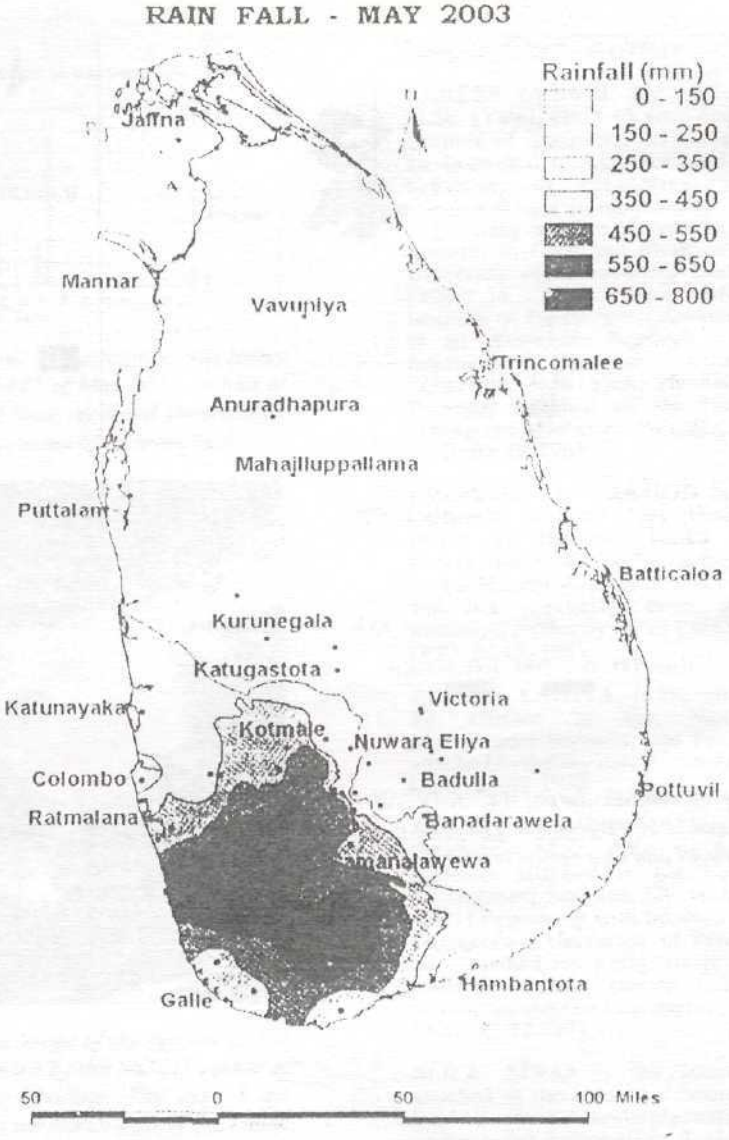

Figure 6: The rainfall during May 2003 is shown and it is heavily concentrated in two areas – one the South-West of Sri Pada (Ratnapura, Kalawana, Badureliya area) and the other South-West of the Gonagala mountain range (Deniyaya). While rainfall is heavily localized, the downstream area will be affected with the resulting floods. Data from Department of Meteorology