OCCURRENCE OF 'SWELL WAVES' ALONG THE SOUTHWEST COAST OF INDIA FROM SOUTHERN INDIAN OCEAN STORM

Intensive wave action and flooding was noticed along the coastal areas of Kanyakumari district of Tamil Nadu and entire Kerala coast during 17th to 21st May, 2005. Several coastal villages were marooned and fishermen displaced. Beach erosion was also reported at Trivandrum, Kozhikode and Kannur districts (Fig.1). As the memory of the tsunami of 26th December, 2004, was still fresh in the minds of the people and the impact was more or less similar,

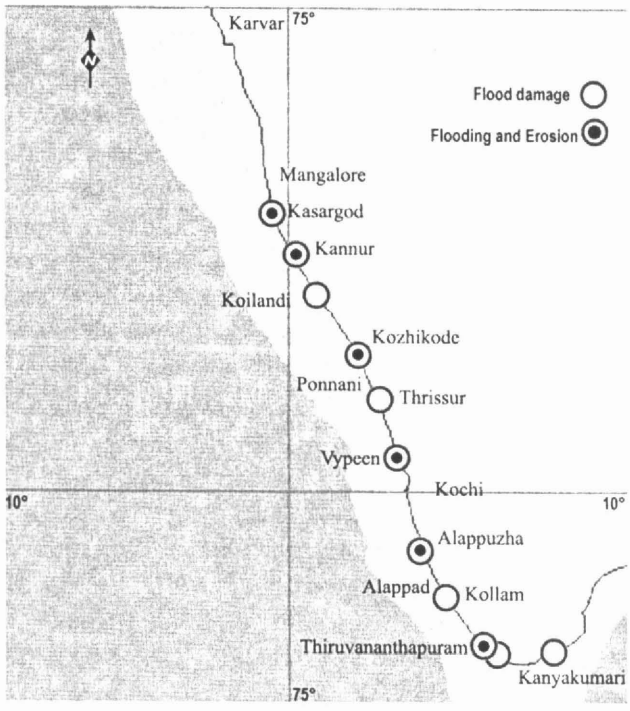

Fig.1. The coastal area of southwest coast where flooding and erosion are reported during 17-21 May 2005.

though with lesser intensity, there was a tendency to relate the incident with tsunami. Field observations of the activity revealed that ocean waves with periods around 15 seconds were approaching the coast continuously during all these days without any winds and with the southwest monsoon not yet set in. The flooding of the coastal areas was higher during the high tide.

Ocean waves generated in a wind field when they leave the generation area are called 'swells' and they may travel thousands of kilometers across entire ocean basins with relatively little energy loss. Waves generated by storms off Antarctica may be measured on the beaches of Alaska (Komar, 1976). According to information now available, the 'swell wave' activity in Kerala and Tamil Nadu Coast that occurred during 17-21 May, 2005 was probably due to a storm that originated on the west coast of Australia. The storm which originated at around 30°S latitude and travelled towards Africa, south of Madagascar, weaning out on 22nd May. A model was developed using information available from NOAA by ASR Ltd., New Zealand, based on a request from the Centre for Earth Science Studies (CESS). According to this (Fig.2), though waves as high as 7 feet (significant wave height, which is the average of the highest one-third waves) were generated at the storm site, the significant height of 'swell waves' which travelled away from the wind source was about 5 feet (with maximum heights of about 8 feet) when they reached the Indian offshore. These waves travelled all over the Northern Indian Ocean. The wave periods of the swell waves in the Kerala Coast were

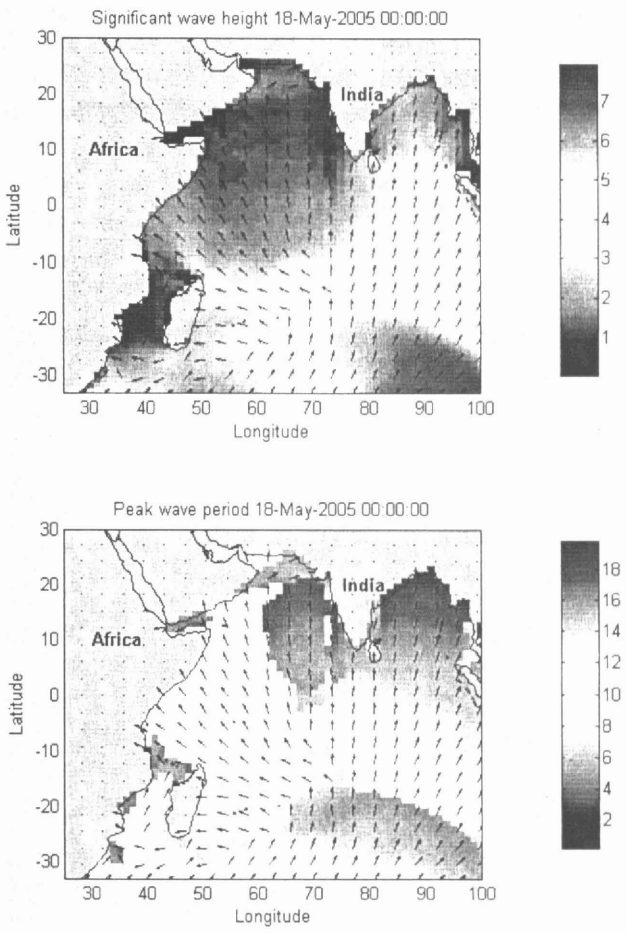

Fig.2. The significant wave heights and peak periods from the storm based on the ASR model.

observed to be of the order of 15 seconds, which matches with the prediction made by the above model. As the waves enter shallow water they undergo transformation, on the first 'feel bottom' at a depth of approximately one-half and becoming significant at one-fourth the deep water wave length (Komar, 1976). The wave velocity and length progressively decrease, and the height increases, only the wave period remaining constant. Finally, the crests become over steepened and unstable and break. The process of wave transformation being known as shoaling effect. Due to this 'shoaling effect of waves' heights up to 10 feet were attained.

According to CESS, the southern Indian coasts, particularly Kanyakumari and Kerala being directly exposed to these waves had received the maximum impact. The higher tidal levels associated with the spring tide and the 'wave set up', which is the super elevation of the mean water level caused by wave action alone, took the impact of these waves to the inland (US Army CERC, 1985). During the month of March also similar situation was reported along the same stretches due to another storm more or less in the same location of the Indian Ocean. Similar wave activity and related flooding of the coast occur almost every year with varying intensity. For hazard management and mitigation it is necessary to clearly understand the processes in the coastal areas.

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HIGH WAVE ACTIVITY ON THE KERALA COAST

On the early hours of 20th May and on 21st May, 2005 high waves lashing a large part of the Kerala coast created panic among the local population and frenetic activity among the government bureaucracy. High waves lashed the Kerala coast, severely along the Thiruvananthapuram and Kayamkulam coastal stretches on 20th May and 21st May 2005. Incidentally, the Kayamkulam coastal stretch was the worst affected during the 26th December, 2004 tsunami also (Narayana et al. 2005, Jour. Geol. Soc. India, v.65, pp.239-246). Wave attack at Azhikkal (Kayamkulam coast) was severe with waves reaching up to a maximum height of 5 m. The high waves started rolling in from the early hours of 20th May, 2005. There was significant inundation by the run up of these high waves and visual observations revealed that the high waves had significant wave periods of the order of 1.0 minutes. The inundation resulted in substantial flooding of the TS canal situated about 100 m from the shore similar to what happened during the 26 December tsunami. All along the Kayankulam coast new sediment was deposited with thickness varying from 5 cm to 10 cm and extending for 30 m to 50 m from the shore. Along this coast the most severe wave action was observed on the northern side at Valiya Azhikkal, again similar to what happened during the 26 December, 2004 tsunami (Narayana et al.2005). The thickness and extents of the sediment deposits were also large compared to the southern side of this coast. It was also observed that some of the granite boulders, which constitute the adjoining seawall along this coast, were uprooted by the high waves. Fig.1 shows the high wave activity observed on the Kerala coast on 21 May 2005.

One of the explanations advocated for this unusually high wave velocity was that the phenomenon was an artifact of pre-monsoon conditions. However, during this

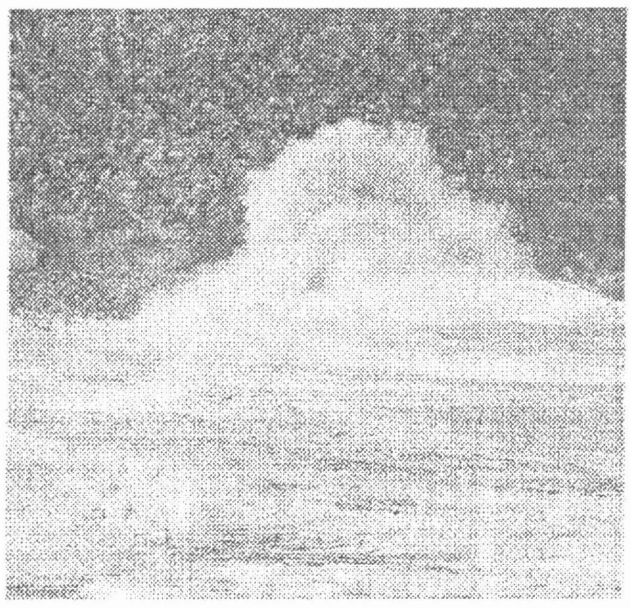

Fig.1. A giant wave moving towards the coast near Thiruvananthapuram on 21 May, 2005 (source: *The Hindu,* 22 May, 2005).