Change in magnetic field: an early warning system to understand seismotectonics

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Abstract. A correlation is attempted with the occurrence of global earthquake and earth directed coronal mass ejections and change in magnetic field of earth-sun environment. On 24th January 2001 an earth directed coronal mass was ejected which took two days to reach the earth surface and a major earthquake of magnitude 7.9 occurred in Gujarat, west coast of India. In entire world, a total of 65 earthquakes have been reported on the same day . Earth directed coronal mass ejection produced a suspected invisible tail of electrified gas. The tail which streams from earth towards Sun was spotted by IMAGE spacecraft. Explosive events on the Sun can charge the magnetosphere with energy, generating magnetic storms that occasionally may affect the active faults in igneous geosphere to trigger the shallow focus earthquake. This correlation is observed in case of many more earthquakes in entire world. Besides these it has been observed that there is an increased occurrence of earthquakes globally in this period of solar maximum. Sunspots are continuously increasing in 2001 and there are increased chances of earthquake during this period. Earthquake prone active fault areas of whole world may be monitored by high-resolution satellite data. In hundreds of cases it has been observed that earth directed coronal mass ejection be followed by change in Sun-Earth magnetic field leads to remarkable changes in Earth environment. If the Coronal mass ejection (CME) is earth directed, it may produce earthquakes if active fault zones are falling in that latitude. It is possible to forecast the possibility of triggering of earthquake by looking into the location of active sunspot before it harbors energy towards earth. Whatever be the manifestations in the environment of the atmosphere or geosphere there is a positive correlation of CME with change in magnetic field followed by aurora borealis or sudden spark of light from sky before earthquake. It is recommended that all the coronal mass ejections should be watched carefully.

Key words: Sun: CMEs – solar-terrestrial relation – eartquakes

1. Introduction

The energy released during a sun flare is typically of the order of 1027 ergs per second. Large flares can emit energy up to 1032 ergs per second. The energy is ten million times greater than the energy released from a volcanic explosion (Hathaway 2001). Different types of earthquake lights have been reported before, during and after severe earthquakes. Some observers have seen red, blue or white glows, while others have described them as balls of fire or flashes from the sky. Such observations have been assigned different causes. Some attribute them to the lightning from a thundercloud; some to sparks in the electric power lines, while others to the generation of static electricity in the vicinity of focal zone of earthquakes where relative movements of rocks may produce heat and light. Over the sea, such light could arise from luminous marine organisms excited by the vibrations produced by the earthquakes (Srivastava 1983).Earthquake lights have been reported before several earthquakes globally. It has been suggested that adsorption of condensation of water could be thought of an energy source for the release of light from solid particles suspended in a cooling column of air above ground. But this theory could not explain the occurrence of light from sky (Srivastava 1983).Occurrence of lights during earthquake may be explained by the sunspot activities during solar maximum (NASA 2001).

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2. Correlation of coronal mass ejection with triggering of earthquakes

Coronal mass ejection, increase in Kp values (more than 4), sudden increase in X-ray flux and electron flux can be forewarning of seismic disturbance in earthquake prone active fault areas (Mukherjee, 2001). On 24th January 2001 an earth directed coronal mass was ejected which took two days to

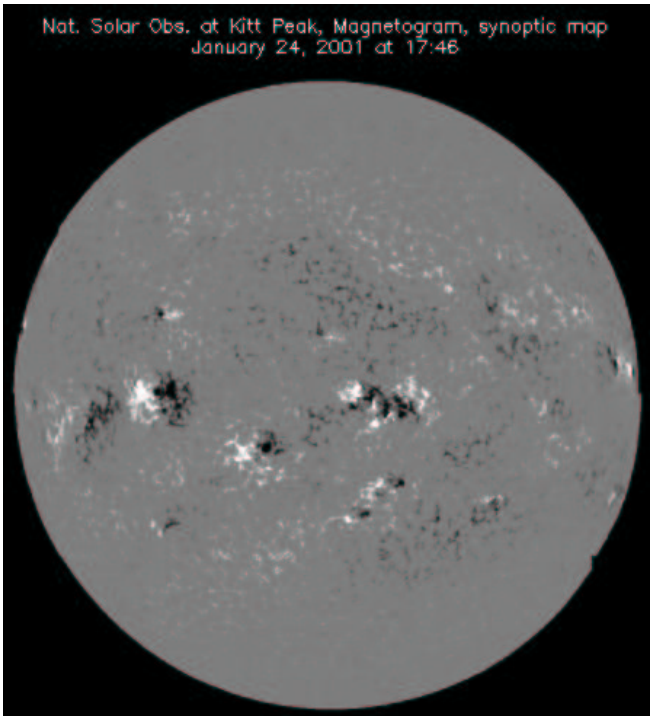

Fig. 1. Increasing Sunspots on 24.1.2001 (Courtesy NASA). CME was earth directed, before the occurrence of earthquake of Gujarat, India on 26.1.2001.

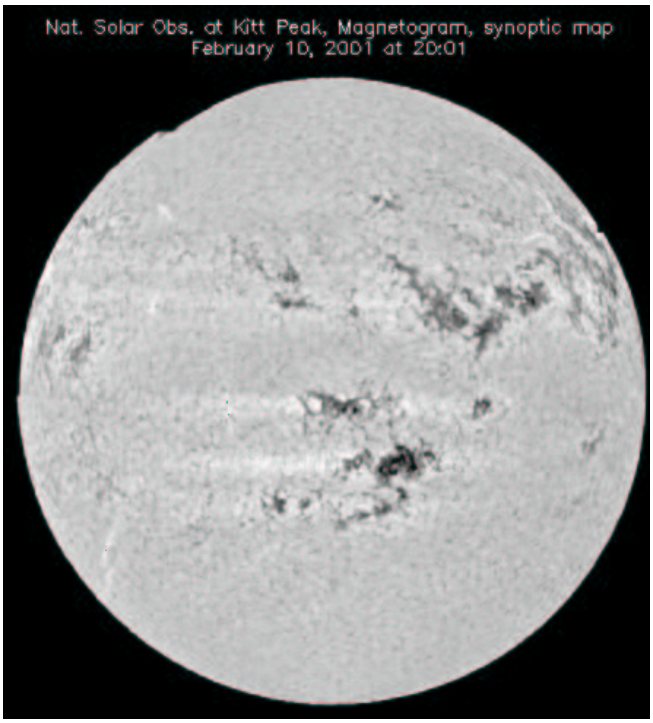

Fig. 2. Increasing Sunspots on 10.2.2001. No earth directed CME... no earthquake triggering.

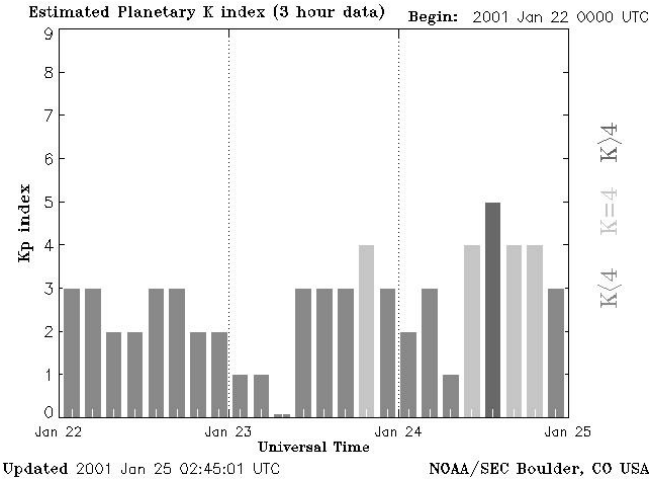

Fig. 3. Increase in Planetary K index(more than 4), 36 hours before January 26, Gujarat earthquake.

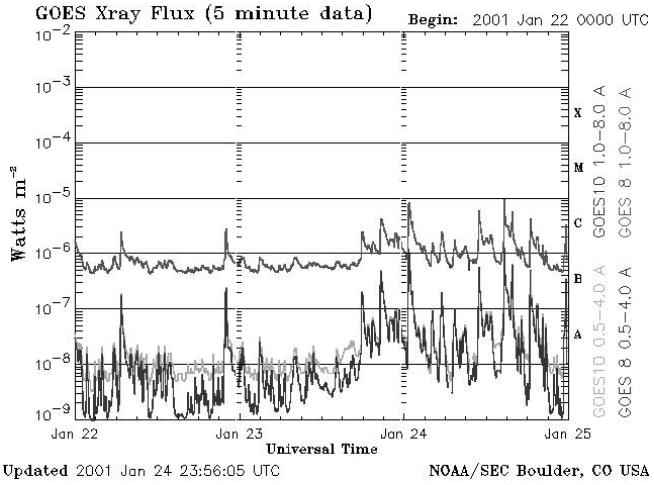

Fig. 4. X-ray flux increase due to CME, 36 hours before occurrence of Gujarat earthquake of 26.1.2001.

reach the earth surface and a major earthquake of magnitude 7.9 occurred in Gujarat, west coast of India. This area was reported as seismically active (Mukherjee 1999). In entire world, a total of 65 earthquakes have been reported on the same day (NEIC-2001). Earth directed coronal mass ejection produced a suspected invisible tail of electrified gas. IMAGE spacecraft (NASA science news 2001) spotted the tail, which streams from earth towards Sun. Explosive events on the Sun can charge the magnetosphere with energy, generating magnetic storms that occasionally may affect the active faults in igneous/sedimentary/metamorphic geosphere and change its viscosity (Marsh 1981; Brandish and Marsh, 1989) to trigger the shallow focus earthquake.

It has been observed that there is an increased occurrence of earthquakes globally in this period of solar maximum. Change in geomorphologic studies was carried out to detect active fault areas with seismic activity (Goczen et.al, 1984). The photolineament density maps were also successfully applied in regional (Kibitlewski, 1985) as well as local tectonic analysis (1982). Pixel level changes in active fault areas were possible to detect by synthesis of satellite remote

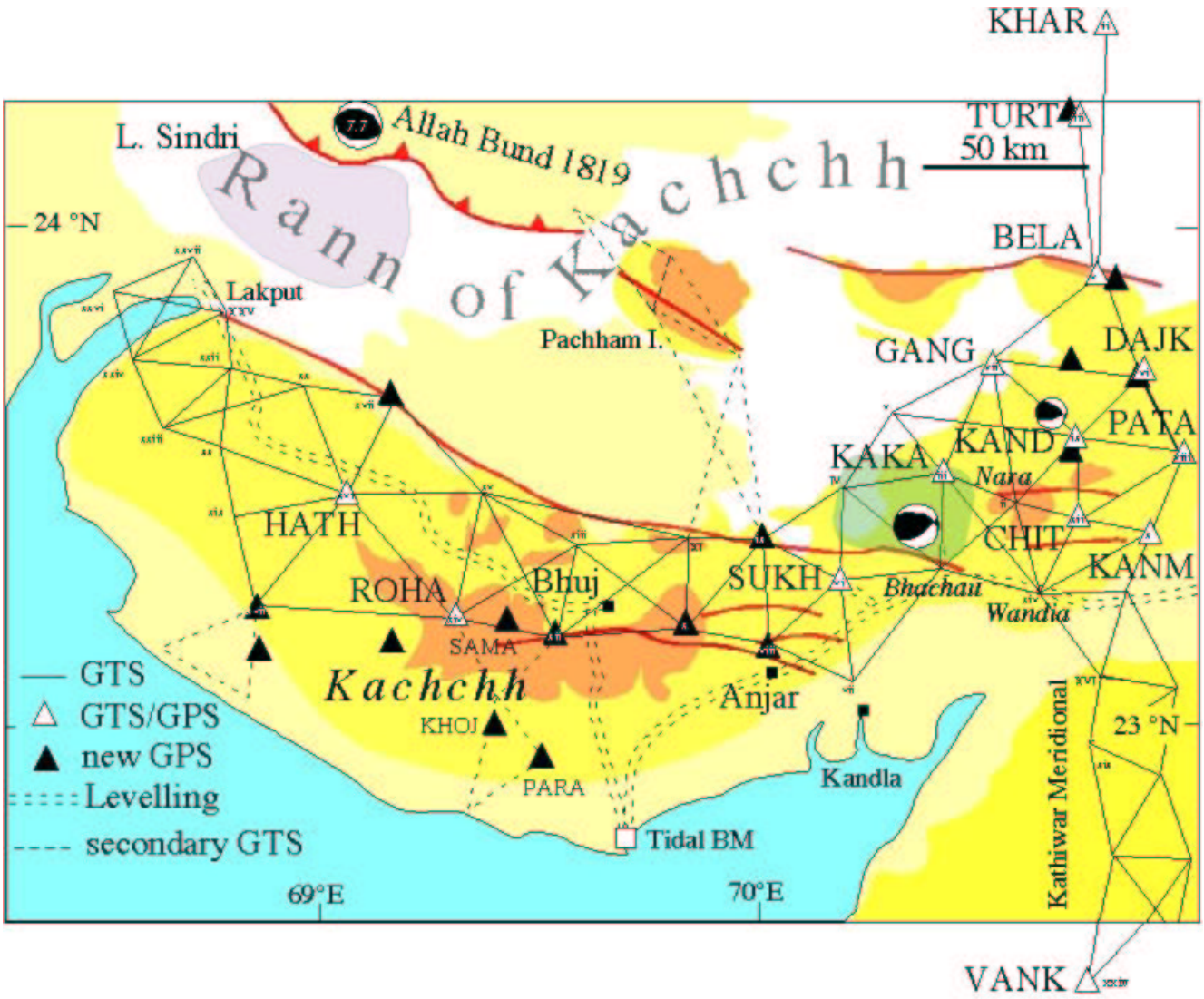

Fig. 5. Location of the January 26th, 2001 earthquake triggered by an earth-directed CME.

sensing, geochemical analysis of soils in and around active fault areas (Mukherjee, 2001, Makorov et.al, 1974, 1984, and Lukina et.al, 1991).

Water level rose by 3 cm. a few hours before the earthquake in Meckening, Australia (1968) at an epicentral distance of 110 km. (Gordon, 1970). In India before the occurrence of Jabalpur earthquake of 1997, water level fluctuation was noticed. In China the upwelling and rise of level of water wells has been observed before several other earthquakes (Liu-quiano and Shanyin, 1979) including the Haichang earthquake (1975.

An interesting instance of unusual behavior of dogs Turkey (Toksoz, 1979)and fishes(Rikitake, 1976) has been reported before the destructive earthquake on November 24, 1976 in. A correlation with the coronal mass ejection and change in magnetopause and biogeosphere is attempted but it will be acceptable after laboratory experiments can be carried out on animals or the phenomena observed almost universally.

This information can be synthesized with the earth directed coronal mass ejection data for socially useful earthquake prediction through this ”Early warning system”.

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