2.2 Apparent Mechanism

Different explanations have been proposed for freak waves. For example, Dawson (1977) suggests they can be attributed quite directly to the bottom topography, an idea "found to be fallacious" according to Shillington and Schumann (1993). The most plausable mechanism is a focusing process, described by Crapper (1984) and further studied by in Gerber (1993), (1996).

Emperical statistics on ocean waves tell that, on the average, one wave in 23 is over twice the mean wave height, one in 1,175 over three times it, and one in 300,000 over four times the average height. This random process can, quite unpredictably create dangerous freak waves in most situations of very rough weather. Regarding the SE coast of South Africa (known as the "Wild Coast"), there are however several special circumstances that should be noted:

- One of the fastest and largest ocean currents in the world (the Agulhas Current, 4-6 knots - transporting about 70 km^3/second) flows along the coast (cf. Figure I2.1-1). The current follows very closely the edge of the continental shelf, and it is fairly free of side-eddies while it makes a slow turn.

- This current meets nearly head-on a steadily incoming near-monochromatic wave swell, constantly generated in the 'roaring forties' - c.f. Figure 1.

  Waves can travel very long distances before loosing energy due to internal viscosity. Crapper (1984) notes that a wave with time period T = 9 s (average for ocean swell; wavelength $\lambda \approx 126$ m) looses about 1/10th of its height in a distance corresponding to three times around the earth. For a short T = 2 s - wave ($\lambda \approx 6.2$ m), the distance is much smaller - about 62 km.

- Freak waves have been found to occur particularly frequent during weather situations such as the one shown in Figure 2. This supports the notion of the incoming swell as a major factor.

Waves meeting a current not only get their wave length reduced (coming closer to breaking) - their directions also change. These circumstances are all consistent with the process now viewed as most likely - a focusing of the incoming wave energy.

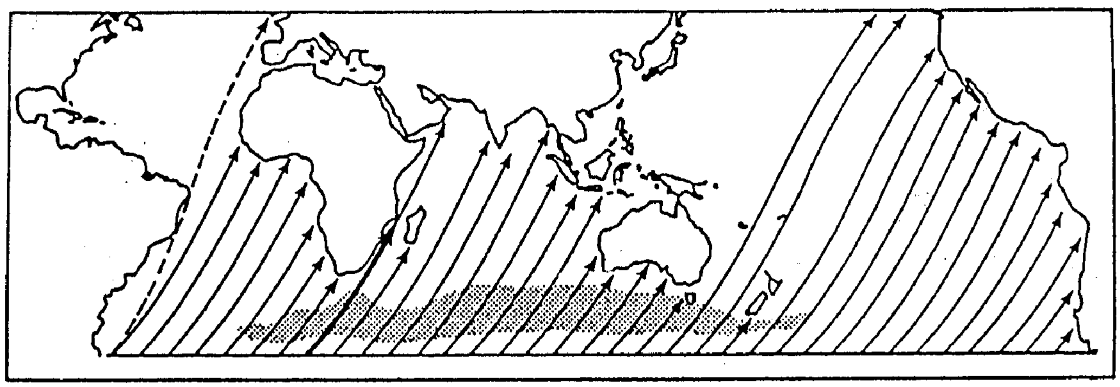

Figure 1. Typical swell paths. In the shaded area, average wave heights exceed 4.5 m. (Data from Chelton, Hussey and Parke, 1981).

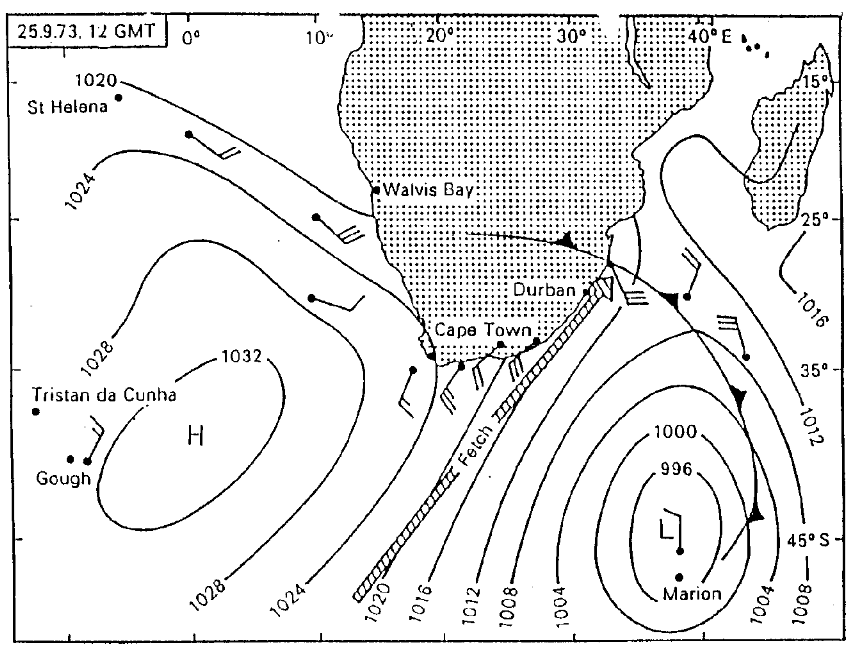

Figure 2. Weather situation most likely to generate freak waves (long 'fetch' strengthening the incoming swell; illustrarion from Mallory, 1974).