

Lee lows - Orographically enhanced cyclogenesis by coastal mountain ranges - Rogue waves.

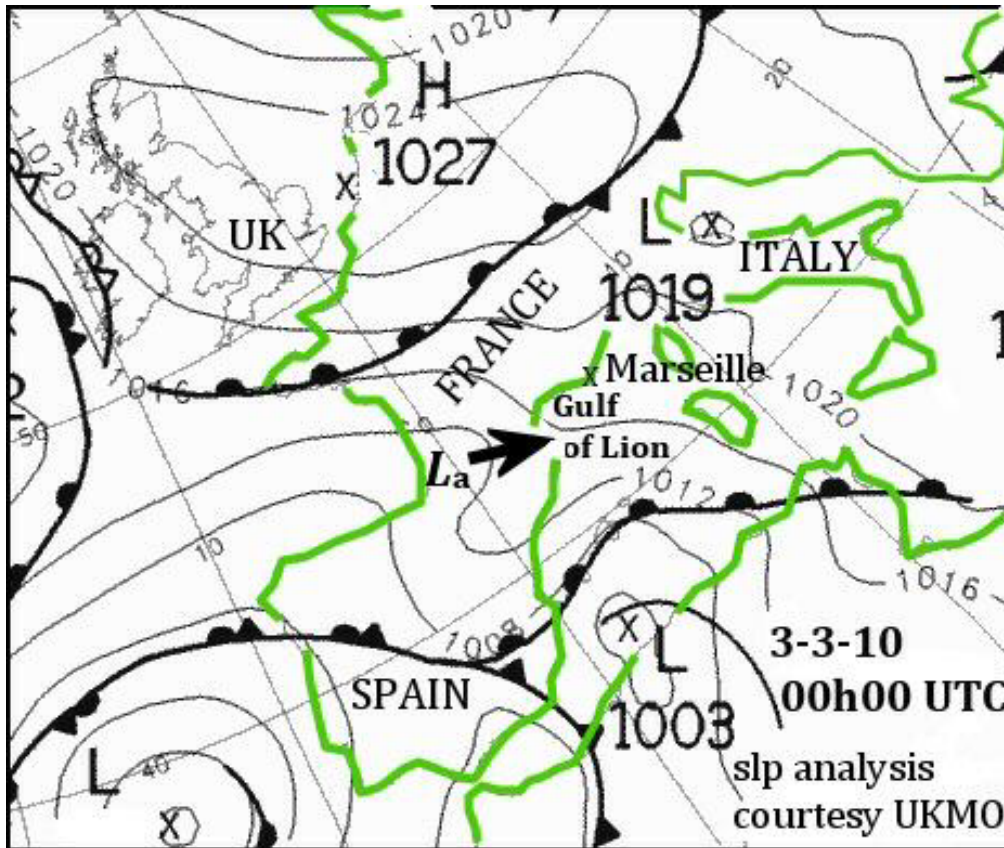
Rogue waves may be generated in a number of different metocean environments: focusing by currents and eddies – interaction between different wave trains – an optimum speed of propagation and rate of development of the fetch zone..

Last Wednesday 3 March 2010 the cruise liner *Louis Majesty* was on the southwestern side of the Golfe du Lion headed from Barcelona to Genoa when she was struck by a series of three abnormally large waves. They were estimated to have been over 10m in height. Tragically, there were two fatalities as glass windows were smashed and the rapid ingress of water also turned other objects into deadly projectiles. The time was approximately 14h00 UTC. The ship had to return to Barcelona for repairs :

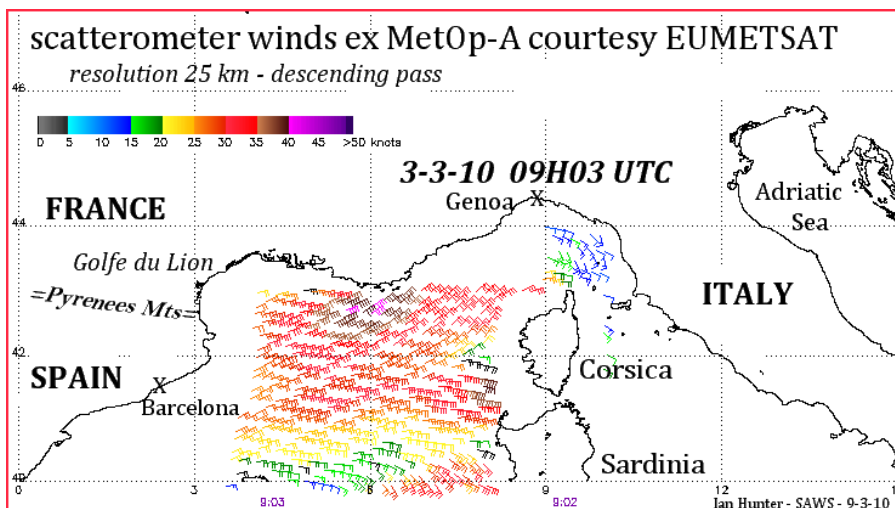


Although rogue waves can be misaligned from the background swell direction, one can assume that these waves also had an easterly component, since the vessel was headed northeast and the damage was in the forward section of the ship. This would tie in with a low pressure system centred southwest of Marseille.

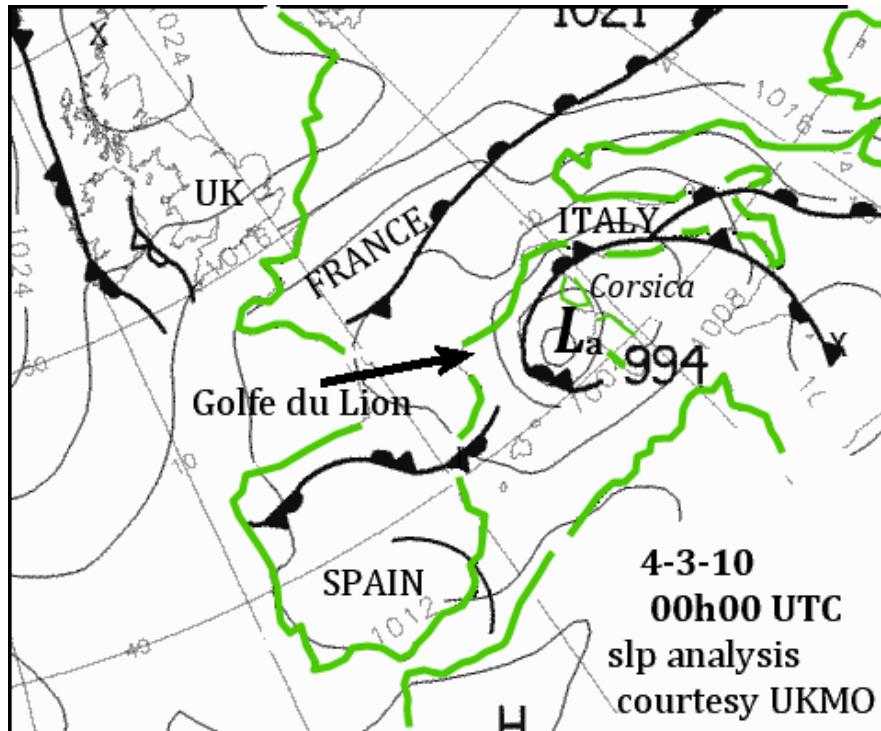
However at 00h00 UTC on Wednesday the 3rd there was only a weak trough extending into SW France (**La**) – from the Bay of Biscay. There were no low pressure systems of any significance in the Western Mediterranean :



Later in the day, the *Louis Majesty* - sailing into the Gulf of Lion - was reporting E'ly winds increasing rapidly, up to 60 kts. However, considering the data from Meteo-France's moored buoy 61002, located to the southeast of the rogue wave incident, sustained wind speeds did not go much above 40 kts (mid afternoon). This is generally supported by the ASCAT data from MetOp-A. The reported 60 kts was probably more of the nature of a gust.



Interpolating between surface analyses it seems likely that the low **La** crossed the Pyrenees on Wednesday morning 3 March, displaying rapid intensification as it moved towards the Gulf of Lion. Topographically enhanced cyclogenesis in the Mediterranean is well-documented – Atlas Mts – Alps – to a lesser extent the Pyrenees. This low then swung to the east towards Corsica. An upper air trough was intensifying west of the Gulf.



The maximum wave height recorded by buoy 61002 reached 6.3m at 21h00 UTC. A rogue wave is very roughly defined as one which has wave height more than double the significant wave height H_s – i.e. in this instance greater than $\sim 13\text{m}$. A sudden increase in wave height would also result in a significantly increased wave steepness – a situation in which even a large passenger ship such as the *Louis Majesty* could bury her bows, causing ‘green’ water, associated in this case with the so-called “three sisters” – to crash into the forward part of the superstructure.

In Southern Africa, although we do have a high plateau which is in part responsible for the coastal low, we have no real equivalent to Morocco's Atlas Range or the Pyrenees, separating France and Spain. However we do see cut-off lows over the interior moving seaward off the south and east coasts - in some cases intensifying rapidly, with the rapidity of the intensification often not caught by the numerical weather prediction models. In this case (COL's) it is probably more to do with improved upper air circulation and/ or the warm ocean environment.

As regards rogue/ abnormal/ 'freak' waves we tend to be preoccupied with wave-current interaction and its effect on shipping, neglecting the localized, inshore events involving local bathymetry, the shape of the coastline etc.

Ian Hunter – SAWS – 10-3-10