

# Piracy and the Indian Monsoon

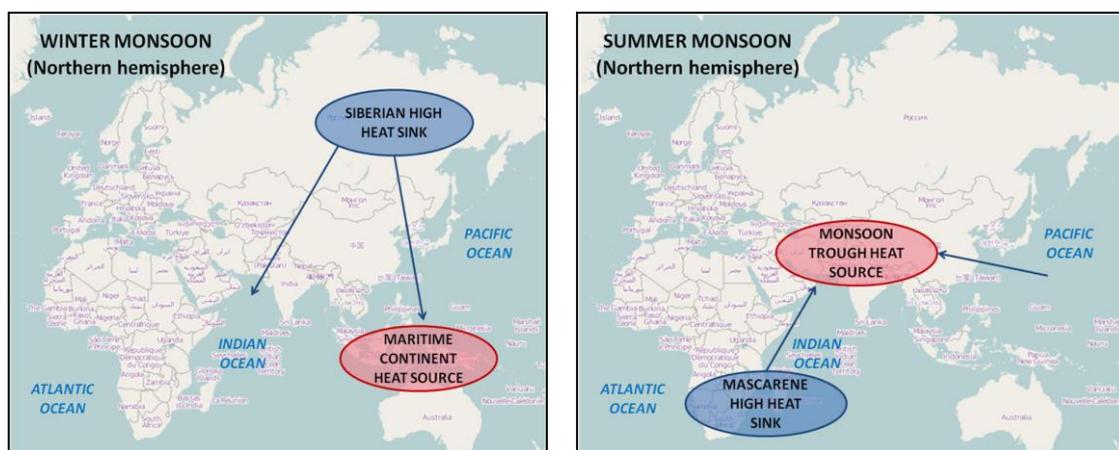
## Introduction

The Indian monsoon has been known and used by mariners for centuries; indeed in the age of sail it shaped the patterns of trade between China and Africa. Now the monsoon seasons are closely linked to piracy in the Indian Ocean and mariners would be well advised to renew their understanding of the phenomenon.

## Monsoon mechanisms

The monsoon can be viewed as being very large scale sea and land breezes. It is defined as a seasonal wind regime in which surface wind persistently blows from one general direction in summer and just as persistently from a markedly different direction in the winter. Over the Indian Ocean and Arabian Sea, the winds persistently blow from the southwest during the summer period and from the northeast during the winter. These seasonal wind shifts are produced by temperature variations between continental and maritime regions in the area, and large semi-permanent pressure systems that set up over the Asian continent over the course of the year.

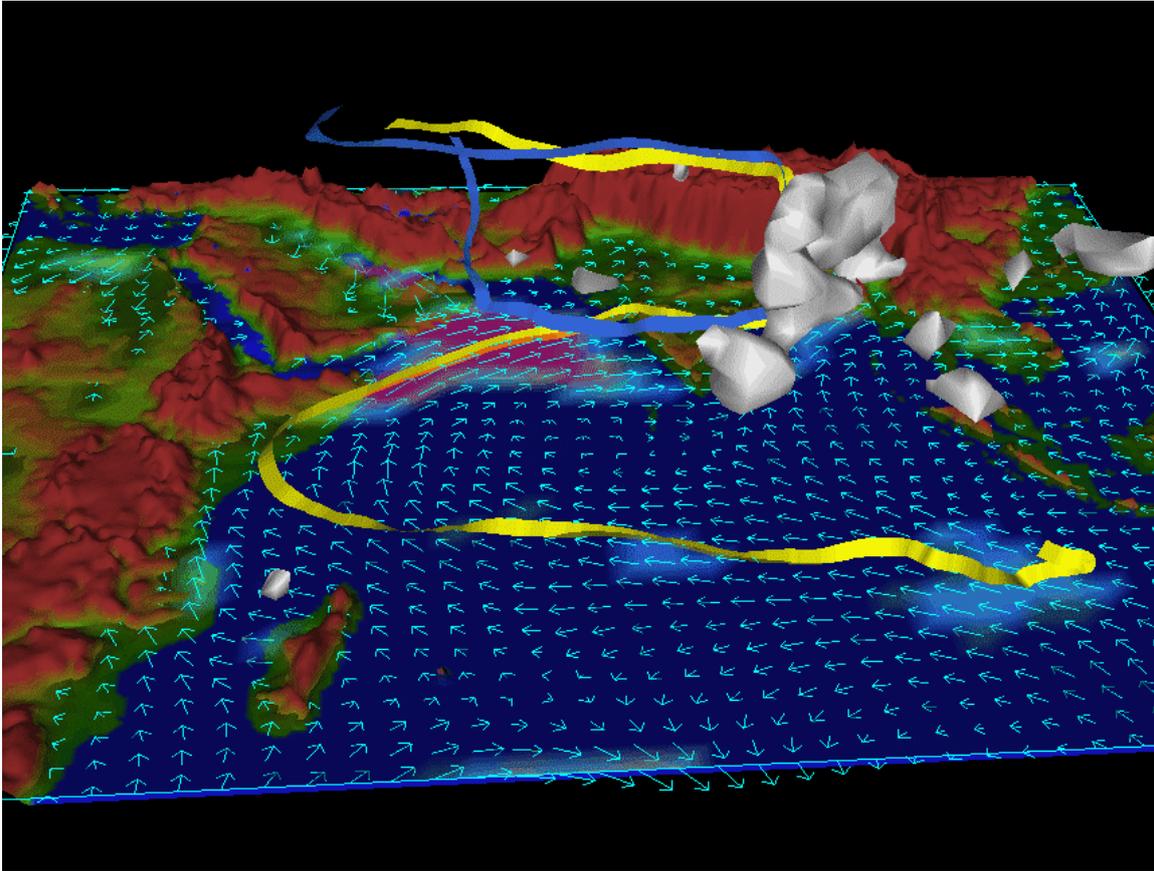
In the Northern hemisphere winter, the low heat capacity of the land, as compared to the seas, causes the air over the southern portion of Asia to become colder than that over the seas. A cold dome of high-pressure air builds over the Asian continent, north of the Himalayas, and the mountain ranges of southern Iran and Turkey. This situation produces a large-scale pressure gradient that causes cold, dry air to flow southward off of the Asian continent towards the warmer sea areas of the western Indian Ocean and Arabian Sea, this is known as the northeast monsoon over the region. The cool air has to rise over mountain ranges however, and the flow is hindered so that only a moderate northeasterly wind flow develops during the winter. This situation is shown in Figure 1.



Figures 1 & 2: Monsoon mechanisms

As the Northern Hemisphere summer moves northward during April, India heats up rapidly as the Himalayas protect it from incursions of cold air. Northern India and Pakistan becomes a vast heat-source region. At the same time the southern Indian Ocean begins to cool, creating a heat sink. Monsoon winds at the surface blow from heat sink to heat source. This situation is shown in Figure 2.

## The Southwest (Summer) Monsoon



*Figure 3: Windflow in the South West Monsoon (courtesy Centre for Atmospheric and Oceanic Sciences)*

By May the southwest monsoon is established over Sri Lanka and advancing northwards. India's inverted triangular shape, leads to the amount of land being heated increasing progressively as the sun moves northward. The cooler air that is drawn in off the Indian Ocean is partially blocked from moving northward over the Himalayas and is therefore relatively ineffective at cooling the hot air generated over the region. As the season progresses, and temperatures over southern Asia increase and the strength of the southwest monsoon intensifies reaching its peak during July.

The summer southwest monsoon is therefore much more intense than the winter northeast monsoon, wind speeds of 25-30 knots and gusts to 35 knots are not uncommon with seas building to 5-6 metres in the central and northwest portions of the Arabian Sea. Inland some of the highest precipitation totals in the world are recorded along the western coast of India. The windward slopes of the Western Ghats in India receive 20 to 50 cm of rain during the monsoon season.

By August the intensity and duration of sunshine have decreased and temperatures begin to fall. The strong flow of southwesterly air gradually decreases from the northwest and by September dry, cool, northerly air begins to make incursions into northern India pushing back the moist southwesterlies. By the end of October the northerly air has covered the entire Indian region and the surface flow begins to flow towards the relatively warm ocean and a northeasterly flow becomes established creating the winter monsoon.

## The Northeast (Winter) Monsoon

The Northeast winter monsoon does not have the intense heating of the northern summer and the general circulation is disrupted by the mountain ranges to the North. It therefore does not have the intensity of the summer monsoon. The northeasterly flow is firmly established by the end of

November and a steady wind of 12-17 knots is maintained across the Arabian Sea until February by which time the northern Indian Ocean has cooled down and the flow begins to decrease.

### The monsoons and piracy

The wind speeds over the Indian Ocean are directly related to the monsoon and the wind speed has a direct impact on the prevalence of piracy. Average monthly wind speed is shown in the Figure 4 in meters per second (m/s), 1 m/s equates to 2 knots.

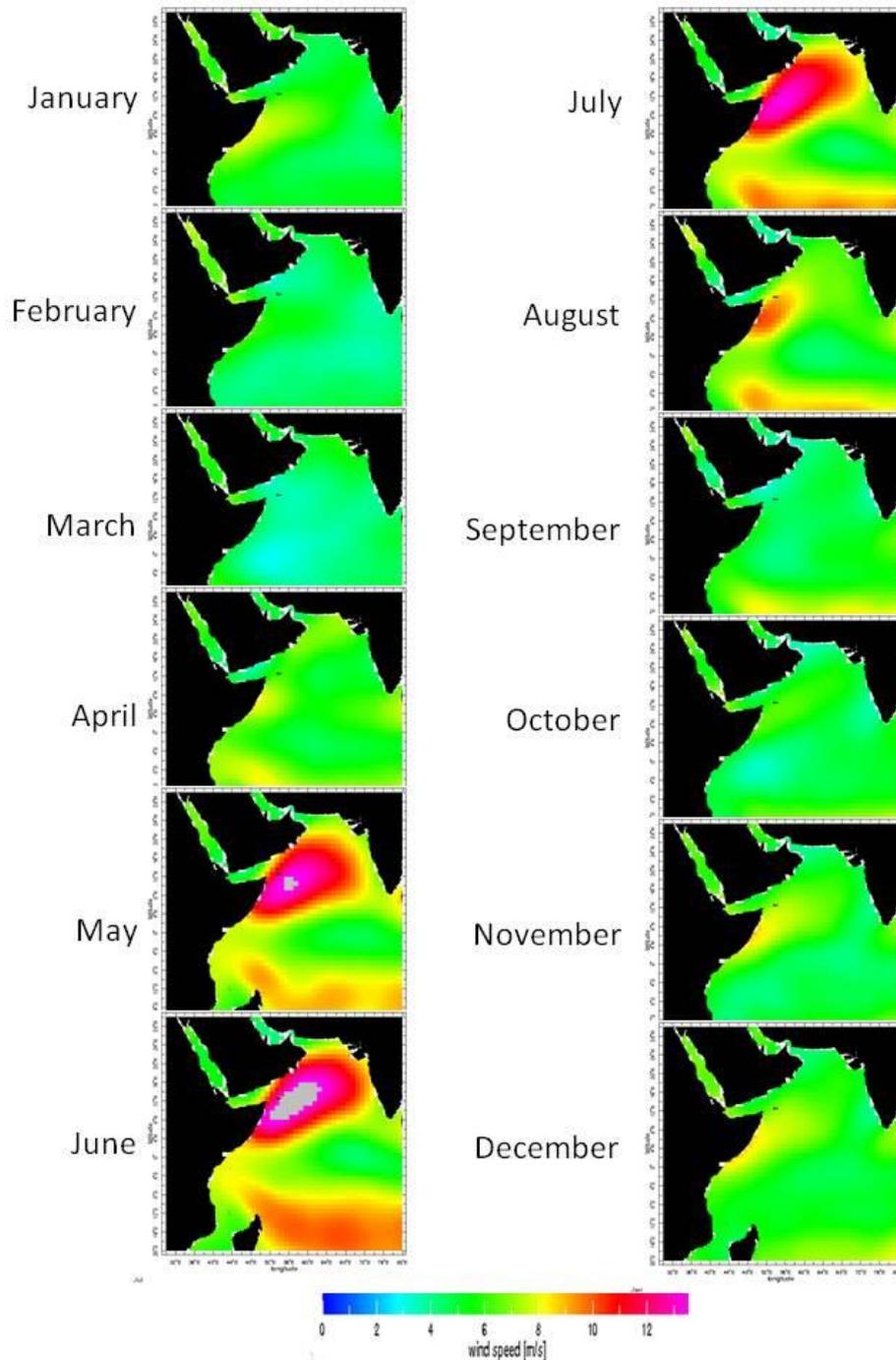
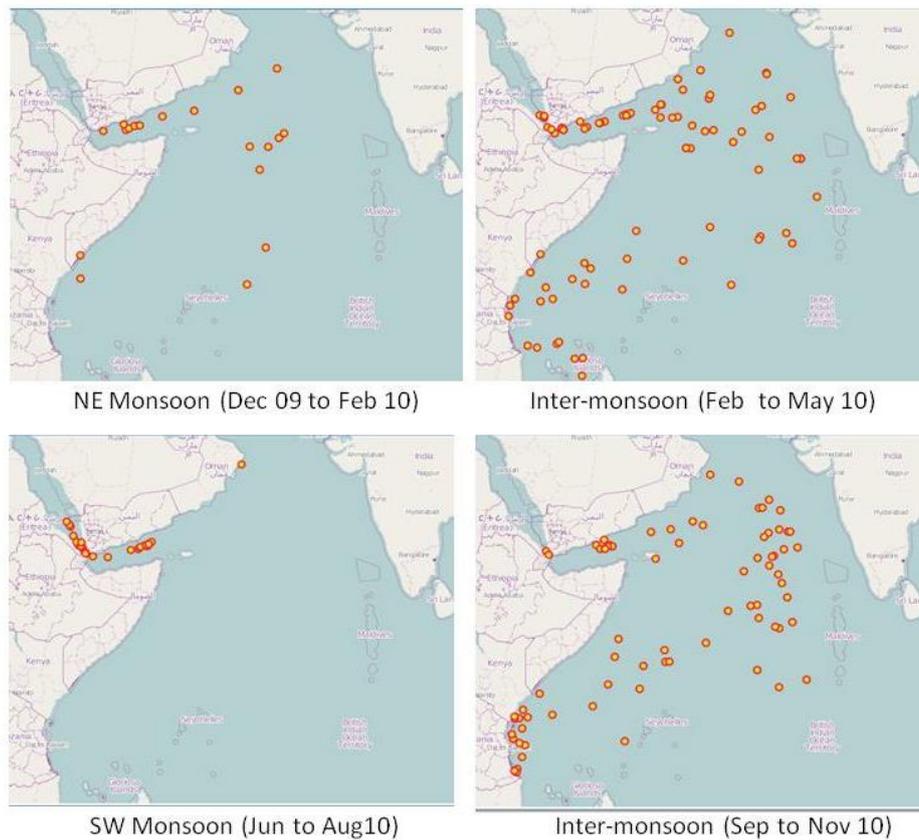


Figure 4: Monthly mean wind speed (courtesy IRI/LDEO Climate Data Library)

Piracy Incidents are restricted to the Gulf of Aden during the Southwest monsoon and there is only limited activity in the Indian Ocean during the North East monsoon. During the inter-monsoon periods pirate activity is unrestricted and attacks spread out across the whole Indian Ocean as the

monsoon withdraws. Figure 5 shows the occurrence of attacks by pirates from December 2009 to November 2010.



*Figure 5: Distribution of pirate attacks by season 2009 to 2010 (data courtesy of Marine and Remote Sensing Solutions Ltd)*

## Conclusions

Pirate activity is clearly shaped by the monsoon, much as trade was shaped during the age of sail. This can be used to provide a 'strategic' assessment of risk. However, a word of caution, the actual day to day conditions are variable in time and over short distances and the pirates have an unsurpassed knowledge of their environment and consistently position themselves in areas of relatively low wind speed. To reduce the risk of attack we must match their knowledge of the environment and in the Indian Ocean that means understanding the monsoon.

About the author:

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Huw is a World Meteorological Organisation accredited weather forecaster with Masters degrees in Applied Meteorology and Oceanography, and Physical Oceanography. He is a former Commander in the Royal Navy with extensive experience in marine and aviation meteorology and oceanography both at sea and ashore.