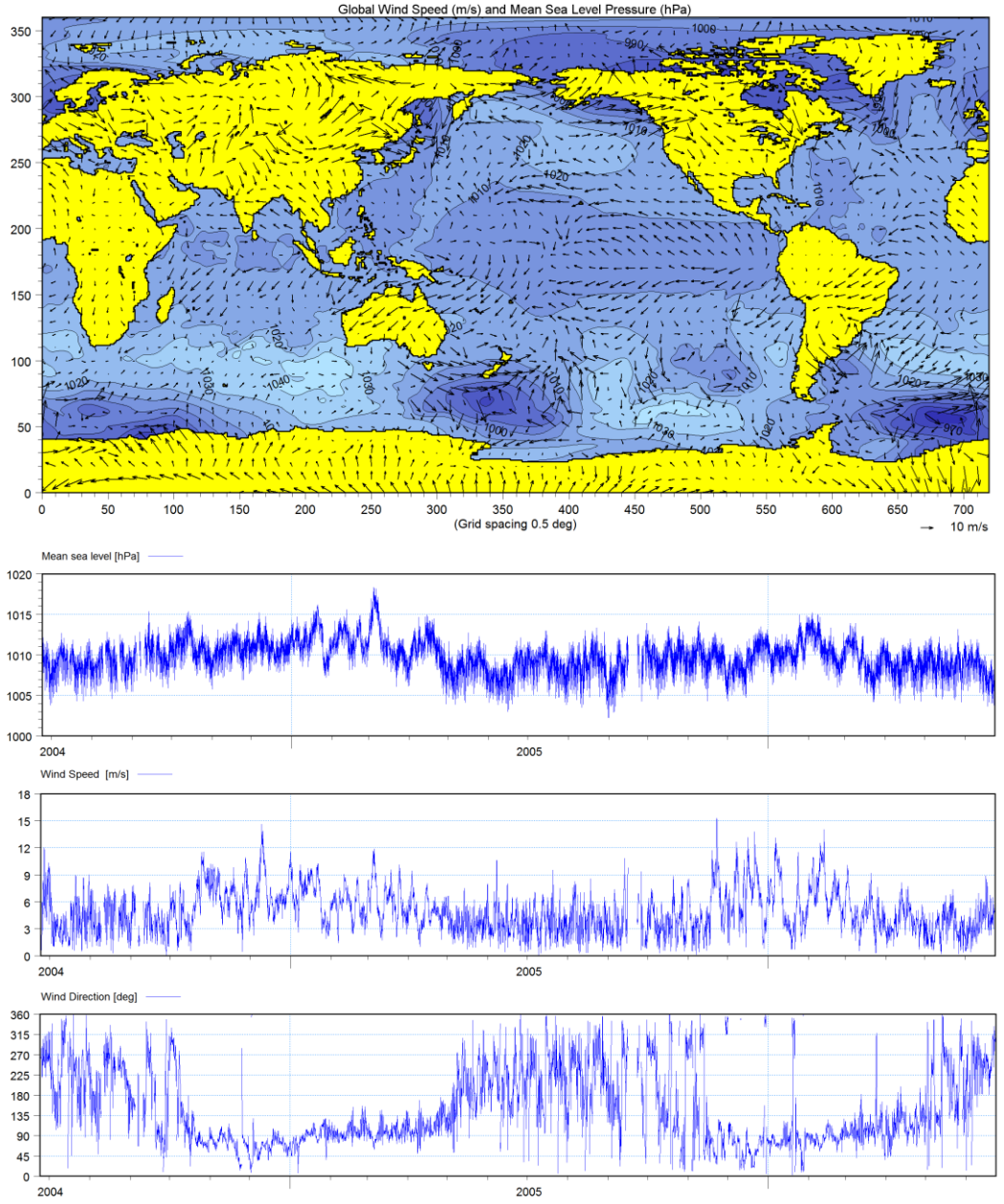

MIKE 21 utilising Global Wind Models

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CONTENTS

MIKE 21 utilising Global Wind Model

1 NOAA-NCEP GFS Model

The Global Forecast System GFS from NOAA-NCEP calculates among other parameters the Air Pressure, Wind Speed and Direction, Ice coverage, Air Temperature, Precipitation and Cloudiness. The forecast is calculated four times per day (00 UTC, 06 UTC, 12 UTC, and 18 UTC) out to 384 hours. The horizontal forecast resolution is approximately 0.5 degree.

All GFS runs get their initial conditions from the Spectral Statistical Interpolation (SSI) global data assimilation system (GDAS), which is updated continuously throughout the day.

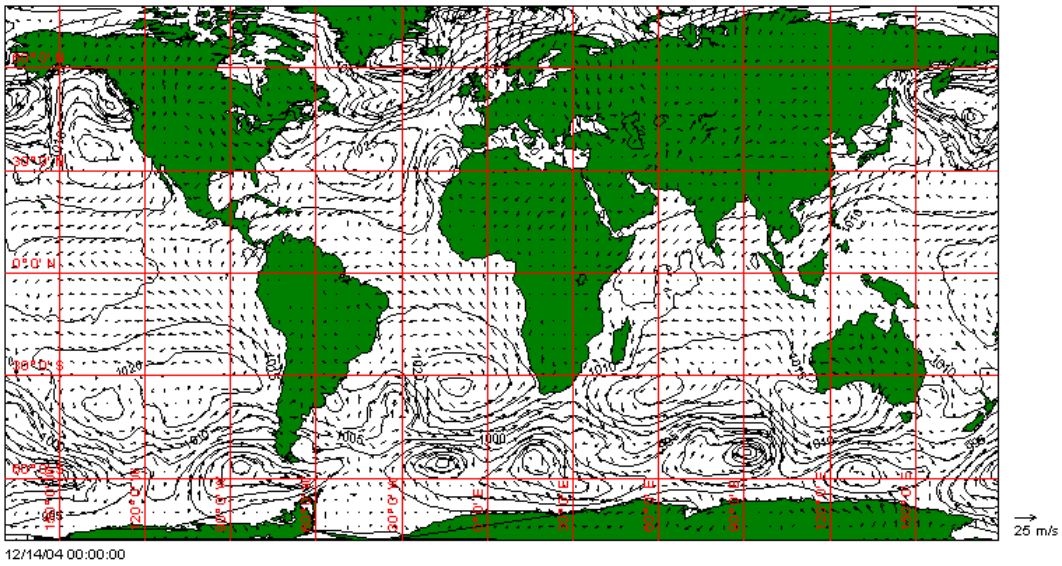

Figure 1.1 Example of Wind field from the NOAA-NCEP GFS model

The MIKE by DHI models developed at DHI can utilise the Global Wind Model in order to forecast Storm Surge, Waves and Hydrodynamics in both regional and local waters. Wind forecast from specific sources, e.g. the NOAA-NCEP GFS model (see Figure 1.1) or a local Weather Forecast can be used to calculate the wind induced force by the hydrodynamic modules and thereby predict the tide and storm surge in a given area.

Likewise, the Global Wind Model can be used to predict the salinity intrusion into estuaries and rivers.

2 Global Wind Model used together with MIKE 21

Based on the Global Wind Model, data can be extracted and utilised in connection with MIKE by DHI models covering global, regional and local areas. An example of the Global Wind Model is show in Figure 2.1, a Regional Model Area is shown in Figure 2.2 covering the Indian Ocean, and finally, Figure 2.3 shows a local area covering the Bay of Bengal.

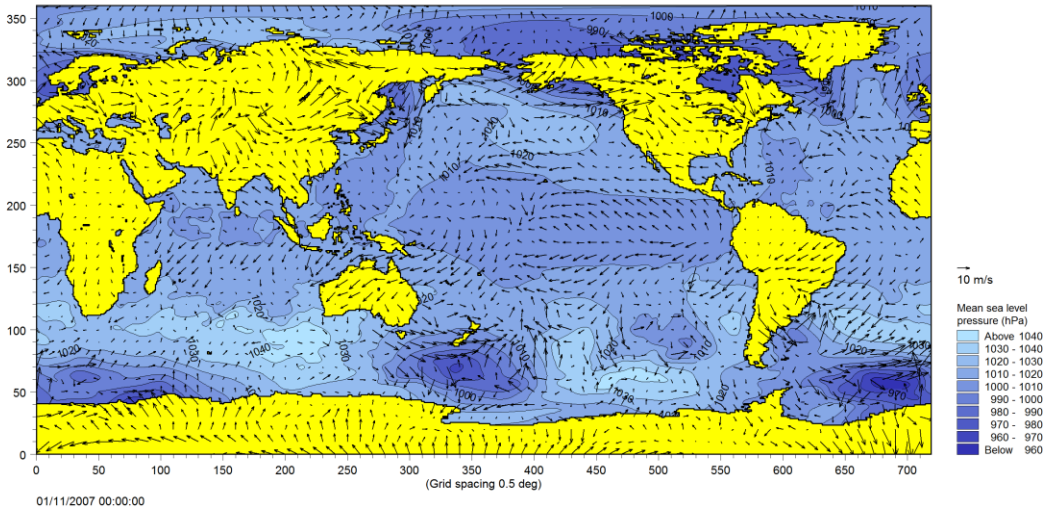

Figure 2.1 Global Wind Model from NOAA-NCEP GFS model

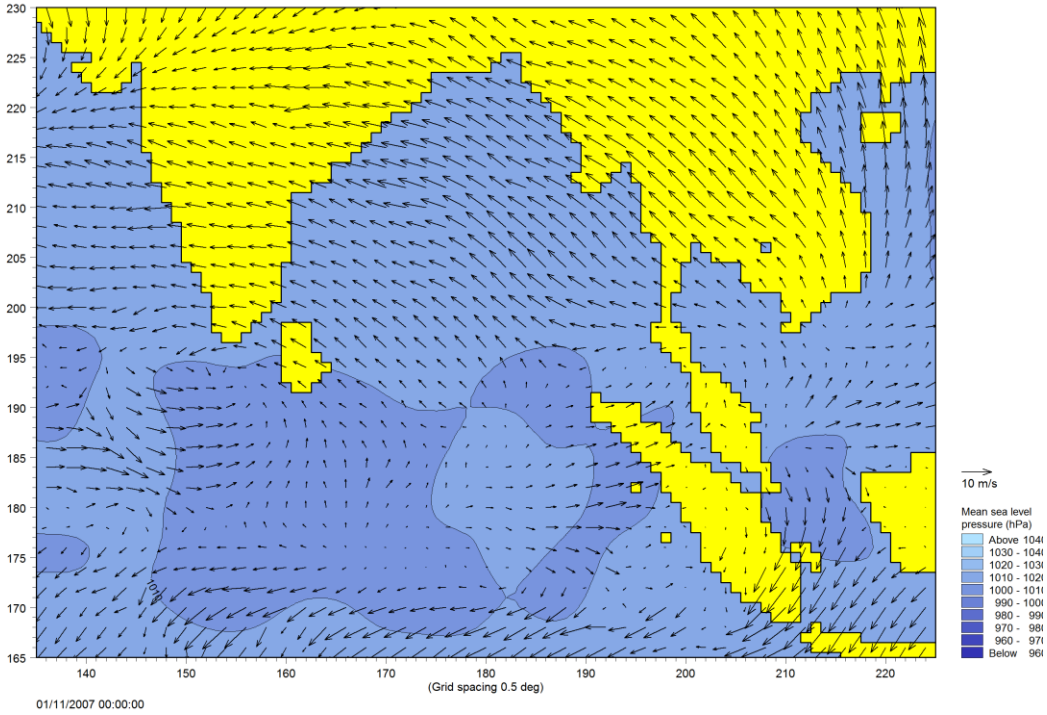

Figure 2.2 Regional Wind Model covering the Indian ocean from NOAA-NCEP GFS model

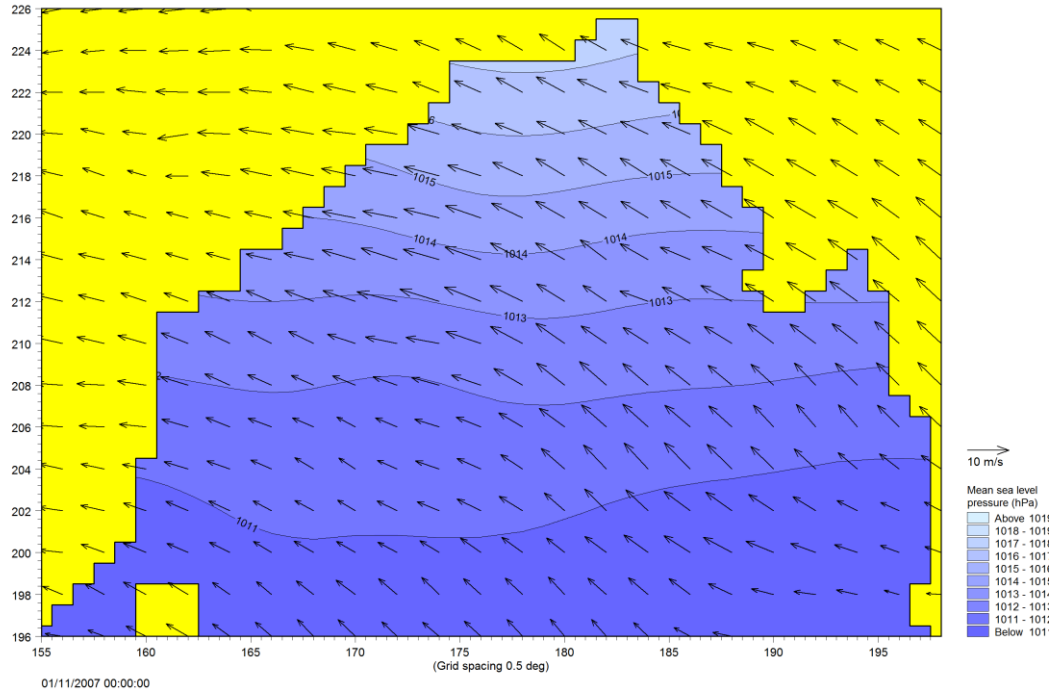

Figure 2.3 Local Wind Model covering the Bay of Bengal from NOAA-NCEP GFS model

2.1 Wind Extraction

Based on the Global Wind Model, time series can be extracted and analysed. This is illustrated in Figure 2.4, which shows some of the important parameters for MIKE 21, namely the Wind Pressure, Wind Speed and Wind Direction.

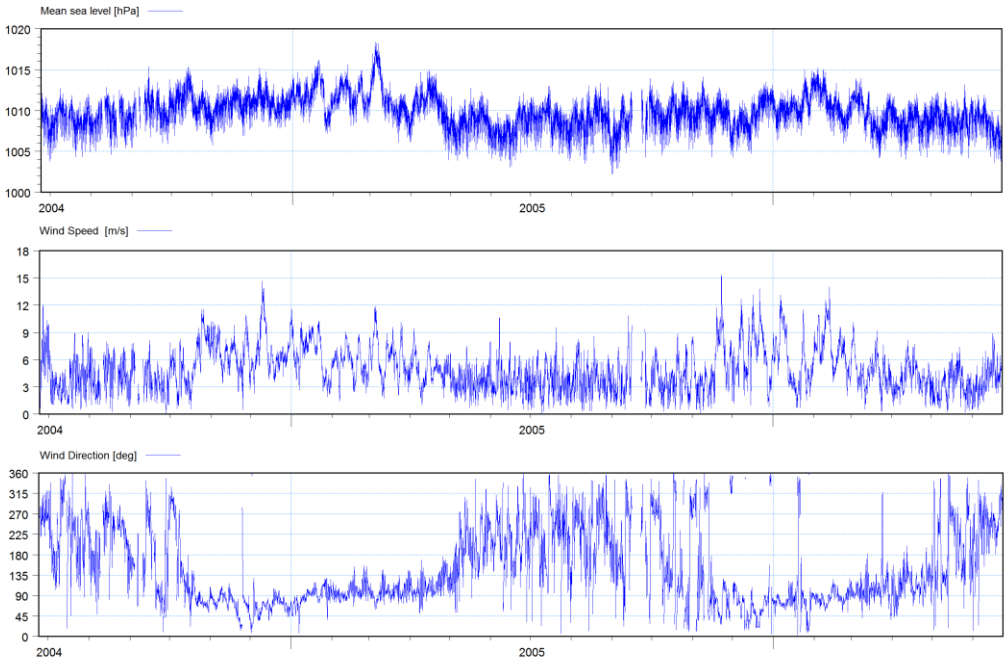

Figure 2.4 Extracted Wind pressure and Wind Speed and Direction from NOAA-NCEP GFS model

The extracted wind speed and wind direction can then be analysed in detail. Figure 2.5 shows a wind speed and wind direction frequency diagram.

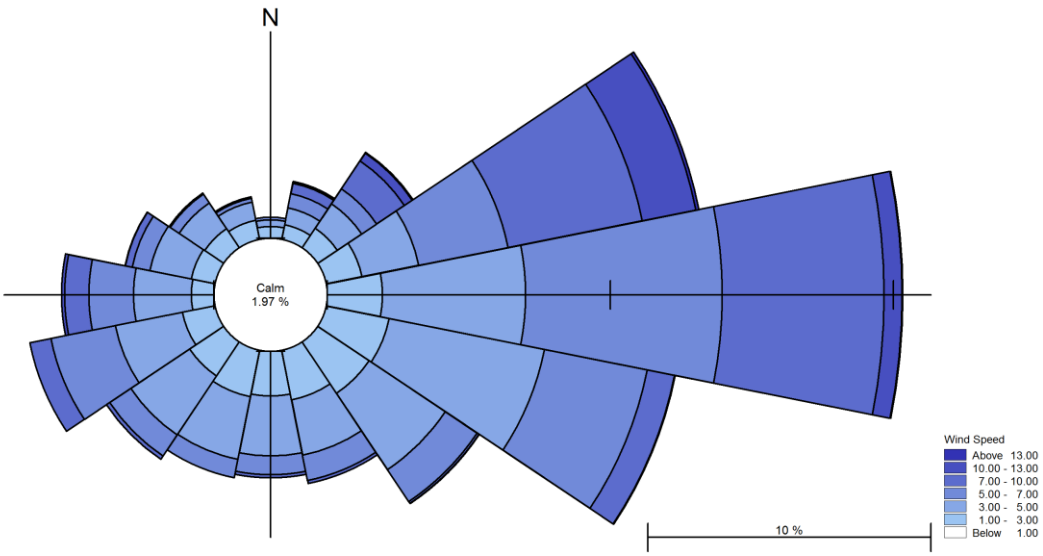

Figure 2.5 Wind rose based on extracted time series from the Global NOAA-NCEP GFS model

3 Global Wind Data (CFSR) 1979-2013

DHI can provide data from Climate Forecast System Reanalysis (CFSR) by the National Centers for Environmental Prediction (NCEP) in DHI format from our WaterData data base:

http://waterdata.dhigroup.com/mantaray/home

Overview of dataset:

The Climate Forecast System Reanalysis (CFSR) by the National Centers for Environmental Prediction (NCEP) in the US includes high accuracy wind data for the time period 1979-2013. Hourly data are available with a spatial resolution of 0.3 deg. x 0.3 deg. (1979-2010) increasing to 0.2 deg. x 0.2 deg. (2011 and onwards).

Expert statement:

Over the years, a number of reanalysis data sets have been made available by NCEP in the US and by ECMWF in Europe. The spatial resolution of these has mostly been 1 degree or more with data being available every 6 hours or more. The CFSR data set, on the other hand, has a resolution of 0.2-0.3 degrees with 1 hour time steps, and is ideal for forcing wave models and hydrodynamic models of regional areas or larger areas. The accuracy of the winds is very good (according to some papers even better than ERA Interim from ECMWF), thus making this global wind data set very valuable for any study, where local wind data are not available.

Recommended use:

MetOcean studies, wave studies, hydrodynamic model studies.

Alternative data set for intended use:

GSF data from NCEP or ERA Interim from EWMCF.

Usage limitations:

- Hurricanes/typhoons/cyclones are likely not to be resolved well.
- The atmospheric pressure provided is the surface pressure not sea level pressure. At sea this is equivalent to sea level pressure used in hydrodynamic models, while the pressure for land point depends on the elevation. When using the pressure for hydrodynamic models care must therefore be taken when interpolating the pressure in nearshore areas adjacent to coastal mountains.

4 References

/1/ NOAA-NCEP Web site: http://www.emc.ncep.noaa.gov/gmb/moorthi/gam.html

/2/ DHI WaterData: http://waterdata.dhigroup.com/mantaray/home