Analysis of meteorological observations from Station 'M' (MIKE) 1949-2002

K. A. Iden, knut.iden@met.no
Norwegian Meteorological Institute, P.O. Box 43 Blindern, No-0313 Oslo, Norway

W/S Polarfront in calm environmental conditions

Norwegian Meteorological Institute
met.no

Background,
The international collaboration regarding Ocean Weather Stations.

The strongest weather systems are most often generated over the oceans. Weather observations from the oceans and up in the atmosphere are important for weather forecasting purposes in coastal areas and also for the weather inland. In areas with little or no traffic at all, it is even in our days difficult to get satisfactory data coverage. In the years after the second world war, the civil air traffic over the North-Atlantic became very important. The traffic needed regular weather observations from the part of the atmosphere where the airplanes moved. The new observing system, the radiosondes, made it possible to measure temperature, humidity and wind from different levels in the atmosphere. The air traffic needed also fixed navigation and communication stations. The most important was probably the need for rescue if an air disaster happened in The North-Atlantic. The answers to these needs were the Weather ships. The international organisation for civil aviation (ICAO) took the responsibility to operate an international network of Ocean Weather Stations in The North-Atlantic. The network was established in 1948 and consisted of 13 stations. Station 'M' (Mike) was one of these. The need for weather ships from civil aviation decreased gradually while the Meteorological society still needed the observations from the oceans. In 1974 the World Meteorological Organization (WMO) took the responsibility for the four remaining stations. The international agreement about weather ships was ended in 1990. Great Britain and Norway continued the operation of one station each, Lima West of Scotland and Mike in the Norwegian Sea. Lima was ended in the middle of the 90ties. Thus Mike is the only one still remaining.

The history of the weather ship station 'M'.

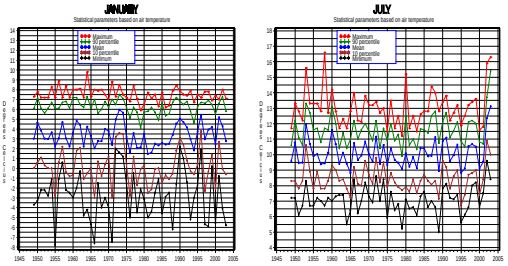
The first two weather ships to man station "M" were Polarfront I and Polarfront II. The Norwegian authorities was ship owner. The ships were rebuild English corvettes.They were on duty until 1974 and 1976. In 1974 the Norwegian state made an agreement with the shipping company Misje Offshore Marine AS in Bergen to hire a new and modern ship given the name Polarfront. For several years the ship alternated with the Dutch weather ship Cumulus to man station 'M'. In 1986 and onward Polarfront has manned station 'M' alone.. Each month Polarfront is leaving the station for 1-2 days to have a new crew and new supplies. Once in the year, usually in the beginning of October, the ship will stay in home port for a week due to needed maintenance. Data coverage are therefore never 100% after 1986.

Some other Measurements performed at station 'M'.

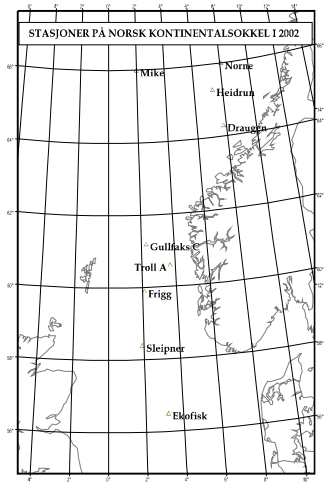
Since the beginning in 1948 monthly measurement of temperature, salinity and oxygen has been performed down to 2000 m. This is one of the longest, if not the longest series of this kind on a global scale. In a period before1977 a sample of the sea water was collected the third in each month. The water was sent to IAEA in Vienna in the beginning. Later it was sent to Germany. Since March 1981 samples of the air are taken twice a weekend sent to NOAA's Climate Monitoring and Diagnostics Laboratory. Station 'M' is thus a point in a net of stations worldwide established to study the pollution in desolate areas. These measurements has become important in the survey of the CO_2 and other green house gases in recent years.

Meteorological Measurements performed at Station 'M'.

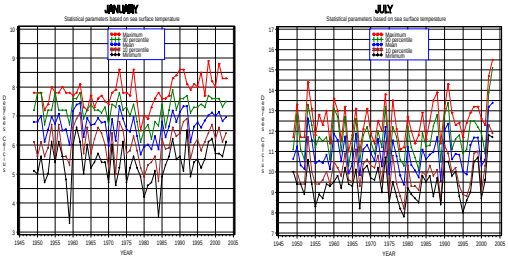
Standard meteorological observations have been performed on a hourly basis since the beginning of the sixties, however in the analysis performed below on the Synop-Ship data only the 3hourly data are used. Station M is also an important radiosonde station of great value for the weather forecasting. Here we will concentrate on the data measured at or near the sea surface. As can be seen from the detailed time series plot, both 2002 and 2003 has experienced the highest mean values for several months. This applies both for air - and sea surface temperature. The mean for the summer months (June, July and August) was higher in 2002 than in 2003, however both are higher than the others in the series.



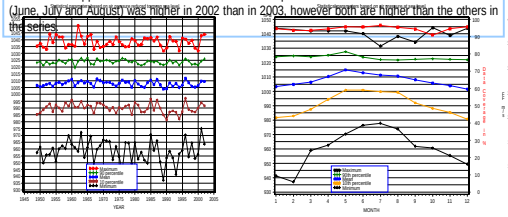
The figures show some statistical parameters based on 3hourly temperature measurements in January and July. The mean temperature in January show year to year variations but no systematic trend. In the curves for July the 2003 and 2002 means are the highest in the whole series. In 2003 (not shown) February and August also have the highest mean values and in 2002 April, May and June (not shown) have their highest mean values in the record.



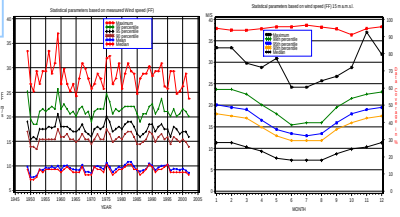
Positions where meteorological data has been collected on the Norwegian Continental Shelf in 2002. At Ekofisk, Frigg and Gullfaks (Statfjord) the measurements started around 1980 while measurements in the Haltenbank area (Draugen and Heidrun) started in 1995 and 1996. At Norne the measurements started in 1998.



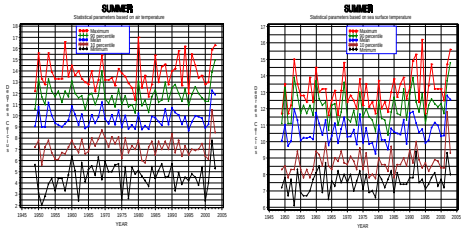
The figures show some statistical parameters based on 3hourly sea surface temperature measurements in January and July. The January curve of the mean shows no systematic trend but the curve for the monthly maximum seems to have an increase in the later years. The July curve for the mean shows that 2002 and 2003 have the two highest monthly mean values in the series. The mean for August 2003 (not shown) is also the highest August value in the record. The highest values for May and June (not shown) was measured in 2002.



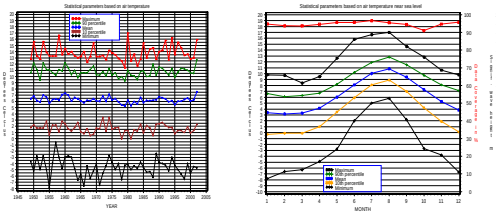
The figures show some statistical parameters based on 3hourly air pressure data at sea level. In the left one the parameters are based on measurements for a year. In the right one the parameters are computed on a monthly bases. Noteworthy is the very low value in 1989 when an intense low pressure passed on the 15 of February. The barograph was not able to register the lowest value in this situation which must have been close to 935 hPa.This is the lowest air pressure at sea level ever measured in the Norwegian station network.



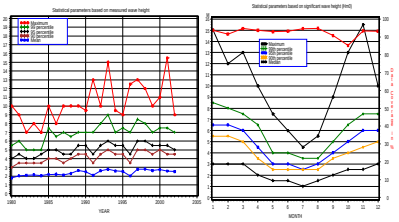
The figures show some statistical parameters based on 10 min mean of wind speed 15 m above sea level (3hourly data) In the left one the parameters are based on measurements for a year. In the right one the parameters are computed on a monthly bases. The highest value is 37.0 m/s measured in November 1959. The highest values seem to have occurred in the early part of the series.There is a slight tendency towards lower values towards the end of the period analysed.



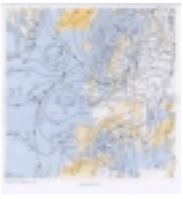
The figures show some statistical parameters based on the 3hourly measurements of air temperature (left) and the sea surface temperature (right) for the summer months June, July and August. Both 2002 and 2003 have mean values that are marked higher than the other values in the series.



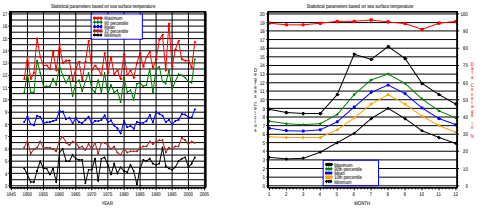
The figures show some statistical parameters based on 3hourly air temperature data near sea level. In the left one the parameters are based on measurements for a year. In the right one the parameters are computed on a monthly bases. The mean shows some variation from year to year but no systematic trend in the actual period . 2002 however was the warmest year in the series.



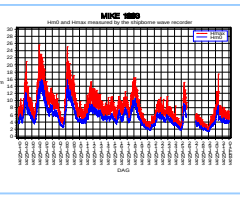
The figures show some statistical parameters based on 3hourly values of significant wave heights. In the left one the parameters are based on measurements for a year. In the right one the parameters are computed on a monthly bases. Since 1978 Polarfront has been equipped with sea born wave recorders. The present one was installed in October 1996. The yearly plot shows very high values in 1993 and 2001. In January 1993 two different storm situations resulted in periods with significant wave heights around 15 m. The 99 percentile for this year is the highest in the series. The highest value, however, (15.5 m) was measured 11 of November 2001. The extreme wave conditions must most probably have been created by strong wind (not extreme) with a near constant direction for a duration of more than twelve hours. All the platforms in the Haltenbank area experienced very high significant wave heights. Heidrun and Draugen are equipped with Miros wave radars. At Norne a wave rider buoy was just installed in addition to the WaMoS radar already on the ship. The wave rider data at Norne is in good agreement with the wave data measured by Polarfront in this extreme situation. The Draugen data are also in good agreement while the wave radar at Heidrun give some unreliable data in parts of this situation. The WaMoS radar data are in good agreement in the beginning of the situation but seems to give to low maximum values. The values from Polarfront was also in good agreement with the prognoses given by the numerical wave model in this situation.



The map (produced by the Deutscher Wetterdienst) shows the weather situation 12 UTC the 11 November 2001. This situation resulted in the extreme wave heights measured in the Norwegian Sea. For nearly 12 hours the wind direction was around 270 degrees and the wind speed in the interval 50-55 knots. The significant wave height (15.5 m) measured in this situation is among the highest measured in Norwegian Waters since instrumental wave measurements started in the late 70ties.



The figures show some statistical parameters based on 3hourly sea surface temperatures. In the left one the parameters are based on measurements for a year. As for the air temperature there seems to be no systematic trend in the yearly mean. 2002 is also for the sea surface temperature the warmest in the series. In the right one the parameters are computed on a monthly bases for the period 1949-2002..



The map shows another situation, 12 UTC the 8 January 1993, that results in the extreme wave conditions in the Norwegian sea shown in the time series plot for January 1993 above.The weather situation has much in common with the one from November 2001 above. January 1993 happened to be a succession of days with extreme wave conditions and it is difficult to imagine the day to day life for the crew under such conditions. The weather situation on the 4 of January 1993 differ in details from the one of the 8 as the wind field was more from SW in the Haltenbank area on this particular day.