MARPOLSER 98

Maritime Response Operations - Requirements for Metocean Data and Services

by

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MARPOLSER 98 Abstract

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It is often said that the worlds' weather is driven by the oceans, and controlled by complex interactions between the oceans, the land and the atmosphere of which we still only have a limited understanding. The ability to accurately monitor and predict weather, climate and oceanographic conditions can have great benefit for avoiding maritime accidents, pollution events and saving lives in disasters at sea.

Disasters at sea historically have provided a stimulus for many countries to improve the provision of meteorological and oceanographic data services. In 1854 in the Crimean War an unexpected storm in the Black Sea resulted in the sinking of 30 vessels of the French and British fleets and the subsequent failure of the campaign. This disaster provided the major stimulus for the establishment of the first European weather forecast service by the French government.

This first metocean service assembled information about the development and progress of storms, and utilising the newly invented telegraph, could transmit such information quickly enough to be used for forecasting purposes. Over the next few decades many countries established meteorological services, some as a result of further maritime tragedies. From these early beginnings the World Meteorological Organisation was born, coordinating the exchange of weather information worldwide.

Today the observation of the weather and sea conditions, the rapid transmission of the data and the ability of meteorologists to predict future weather conditions is still a vital component of the safe operation of vessels throughout the world, for the safety of mariners, and for the protection of the marine environment from oil pollution. Ships and mariners at sea not only benefit from these developments but are an essential source of metocean observations for meteorological organisations.

Maritime casualties such as ships sinking or being lost at sea, vessel groundings, fires and collisions, oil/gas platform blow outs or fires, or vessels being disabled due to severe weather events like cyclones unfortunately do happen in Australian waters. The Australian Maritime Safety Authority (AMSA) coordinates Australia's international responsibilities in the area of ship safety, marine environment protection, oil spill response, search and rescue planning and coordination. At the heart of AMSA's decision support systems is the need for accurate, reliable and rapid metocean data and predictions from a variety of organisations and agencies, primarily the Bureau of Meteorology.

Effective incident response requires the rapid access by responders to a vast array of meteorological and oceanographic data and sophisticated computer modelling information. This paper highlights the vital role of accurate and reliable metocean data and predictive models in the response to maritime incidents involving oil and chemical spills, foreshore clean up and ship salvage operations, as well as in maritime search and rescue planning.

The paper will also detail examples of the use of metocean data in decision support during various maritime incident responses in Australian waters and suggests potential methods for improving the provision of metocean services to incident responders.

Contents

Introduction

It is often said that the worlds' weather is driven by the oceans, and controlled by complex interactions between the oceans, the land and the atmosphere of which we still only have a limited understanding. The ability to accurately monitor and predict weather, climate and oceanographic conditions can have great benefit for avoiding maritime accidents, pollution events and saving lives in disasters at sea.

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In a previous paper in this workshop we reviewed a selection of local maritime pollution events and maritime casualties in Australian waters, which could have been avoided if a better understanding of meteorological and oceanographic conditions by vessel crews had occurred.(1) This paper highlights the vital role of accurate and reliable metocean data and predictive models in the response to maritime incidents involving oil and chemical spills, foreshore clean up and ship salvage operations, as well as in maritime search and rescue planning.

The paper will also detail examples of the use of metocean data in decision support during various maritime incident responses in Australian waters and suggests potential methods for improving the provision of metocean services to incident responders.

Metocean Data and Ships - Historical Perspective

Disasters at sea historically have provided a major stimulus for many countries to improve the provision of meteorological and oceanographic data services.

The Spanish Armada of 1588 was destroyed, not by the British Fleet, but by gales and accompanying seas along the coast of Scotland and Ireland. In 1854 in the Crimean War an unexpected storm in the Black Sea resulted in the sinking of 30 vessels of the French and British fleets and the subsequent failure of the campaign. This disaster provided the major stimulus for the establishment of the first European weather forecast service by the French government. (2)

This first metocean service assembled information about the development and progress of storms, and utilising the newly invented telegraph, could transmit such information quickly enough to be used for forecasting purposes. Over the next few decades many countries established meteorological services, some as a result of further maritime tragedies. From these early beginnings the World Meteorological Organisation was born, coordinating the exchange of weather information worldwide. (2)

Today the detailed observation of the weather and sea conditions, the rapid transmission of the data and the ability of meteorologists to predict future weather conditions is still a vital component of the safe operation of vessels throughout the world, for the safety of mariners, and for the protection of the marine environment from oil pollution. Ships and mariners at sea not only benefit from these developments but are an essential source of metocean observations for meteorological organisations.

Maritime Incidents

Maritime incidents involving commercial vessels can involve a range of different emergency situations. Ship emergencies and accidents can include:

- near misses
- construction and electrical failures
- fires
- collisions
- groundings
- cargo reaction
- swamping or flooding of vessels
- roll overs and loss of stability eg. cargo shifting etc.
- and "not under control" ie loss of power or steerage.

Disabled vessels around the Australian coast is not uncommon with a number of reports being received by AMSA each week. In deep water vessels cannot anchor so this leaves them often at the mercy of the water currents and prevailing winds. In severe weather events the problems for disabled vessels are increased.

Effective incident response requires the rapid access by responders to a vast array of meteorological and oceanographic data and sophisticated computer modelling information, it is an essential management tool.

Photo 1. Oil Supertanker

An old seaman's saying goes, *"There is only one way to beat the weather - stay one step ahead of it"*. Technology now provides us with the means to keep one step ahead of the weather.

Australian Oceans and Maritime Search and Rescue (SAR)

Australian coastal and maritime regions have extraordinary environmental, aesthetic, economic and cultural value.

The oceans around Australia are dynamic environmental systems subject to great variability and rapid change. Our oceans encompass all five of the world's ocean temperature zones from tropical at temperatures 25°C to 31°C through subtropical, temperate, subpolar and polar (-2 °C to 5°C). Therefore Australian weather conditions at sea can range from summer tropical cyclones to dead calm seas, from massive winters storms, to icebergs and fog. The Southern ocean in particular experiences severe storms and the largest seas in the world driven by the large surface area of exposed sea through the 'roaring forties' and 'furious fifties'.

In our north, during the summer months, cyclones can form within one to three days causing extremely high winds and seas and their movement is erratic and unpredictable presenting forecasters with a major challenge

The extent of shipping movements around Australia is extensive with over 12,000 ship visits to Australian Ports per annum.(1) Over a twelve month period commercial vessel routes can be visualised by the geographic location of reports received under the AMSA AusRep Ship Reporting system. (Figure 1.)

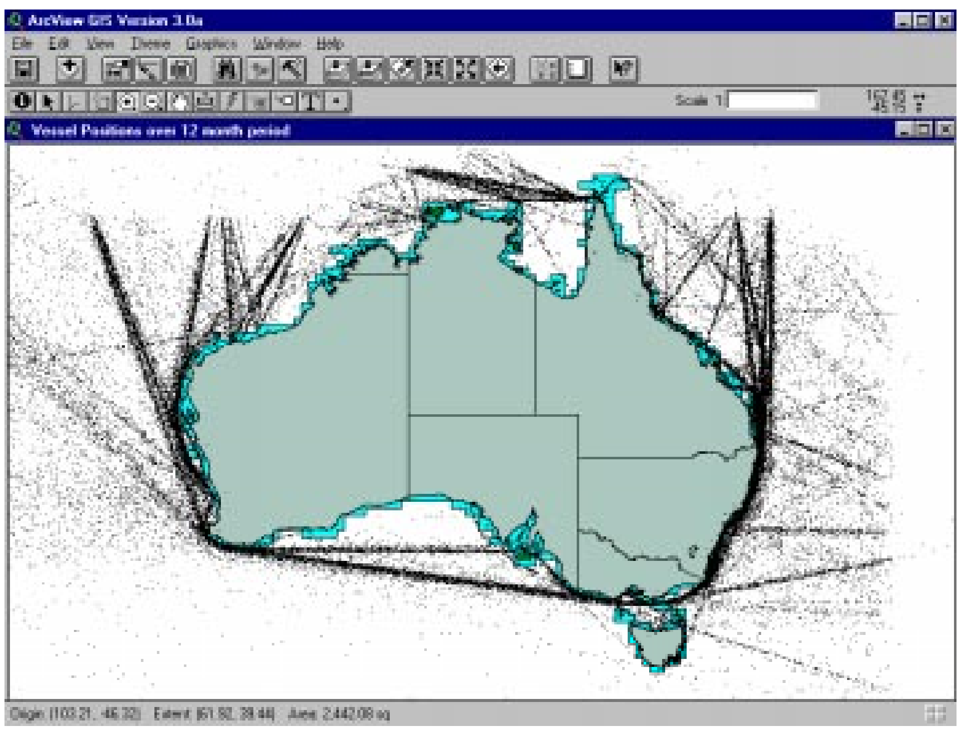

Figure 1. Location of ships reporting to AMSA over a 12 month period.

Considering there are over 500,000 recreational watercraft registered in Australia the likelihood of lost vessels, sailors and mariners in Australian waters is quite substantial.

Watercraft that lose main engines or steerage in deep water are unable to anchor and are at the mercy of the wind and ocean currents. It has been found that drifting objects will move primarily in the direction of the water currents but because of different windage factors (area and shape of the vessel exposed to the wind) drifting vessels will also be influenced by wind direction. The same situation relates to life rafts or people in the water.

A detailed understanding of ocean currents is fundamental to the determination by SAR planners of the location of drifting vessels, water craft or other objects in the water that are not fitted with satellite beacons or radio communication.

AMSA's search and rescue coordination unit AusSAR in conjunction with Marine Environment Protection Services has been negotiating a contract with the Australian Bureau of Meteorology to provide a Net Water Movement metocean model for all Australian waters. Further details will be provided at this conference by the Bureau.(3) This project involves both a floating object/life raft/vessel drift modelling (SARMAP) and an oil spill trajectory model capability (OILTRAK/OILMAP)

Whether it is a SAR or oil spill trajectory modelling task there are three main user requirements:

- Now-casting (situation analysis/what is happening now)
- Fore-casting (planning and implications for the future)
- Hind-casting (recreation of events for investigations/prosecutions)

In SAR planning the smaller and more precise the designated geographic area for a search pattern at sea the greater the likelihood of reaching survivors in time. The use of more accurate computer drift models will result in more defined search and rescue areas and the saving of lives at sea.

Photo 2. Helicopter winching of personnel from a vessel

Pernas Arang Incident - Solitary Islands

An ability to establish the speed and direction of ocean currents and eddies around Australia is information invaluable to spill response authorities such as AMSA, in predicting the path of oil spills or the drift of disabled vessels.

The timely availability of metocean conditions close to shore, or well out to sea, can be vital in situations when response decisions need to be made quickly in regard to a vessel in distress or an oil spill threatening a shoreline.

In January 1996, the Malaysian coal carrier, Pernas Arang, with a crew of 33 on her way to Newcastle for loading, was disabled near Coffs Harbour by engine failure and was attempting engine repairs. Because of the heavy seas and winds the vessel began drifting at anchor towards the environmentally sensitive Solitary Islands Marine Reserve.

The Solitary Islands are an important marine park and reserve for many protected marine species and a habitat for migratory birds as well as important dive and tourist attraction.

Aboard the ship was 830 tonnes of heavy bunker fuel and another 150 tonnes of marine diesel. Floundering in heavy seas and drifting towards the coast a potential for major spill from the vessel was apparent.

Confronted with the potential of an environmental emergency from oil spillage into the sensitive Solitary Island Marine Reserve, AMSA activated the National Plan response arrangements. National Plan oil spill response equipment and personnel from Queensland and New South Wales was mobilised to protect the coastline but the planning decisions needed information ie where would the vessel come aground and where and what would the oil impact.

To provide this AMSA needed to ascertain the likely velocity and locations of prevailing currents and eddies in the region to deal both with the rescue of the vessel, and formulate an environmental protection and operational oil spill response plan for the region.

Oceanographers at the CSIRO Division of Marine Research, Hobart had undertaken significant research into the dynamics of the East Australian Current which proved especially relevant to the likely trajectory of any oil spill from the vessel.

CSIRO responded immediately to AMSA's request and in conjunction with the Bureau of Meteorology established accurate wind speed/direction in the region where the ship was floundering, (about eight nautical miles of the coast). They also determined there was also an ocean eddy that could send the ship northward and together with CSIRO satellite images of the sea surface temperature, oceanographers determined that the current acting on the ship would be about one knot.

Unless it could be secured, the Pernas Arang would drift about 24 nautical mile northwards each day and impact the Solitary Islands within one day. A rescue tug was dispatched from Brisbane to secure the vessel. The tug Austral Salvor took the Pernas Arang under tow to Newcastle and no grounding or pollution event occurred. (photo 3)

Photo 3. Pernas Arang at anchor.

A similar situation occurred in the UK with the oil tanker the Braer which had floundered on the coast and was drifting in bad seas towards the coast. Apparently the master of the vessel had refused tug assistance until it was too late resulting in the ship being pounded onto the rocky coastline of the Shetland Islands discharging 25 million gallons of oil into the sea. (photo 4)

Photo 4. Vessel Braer on the rocks of the Shetland Islands UK.

Incident Response

There is a saying that.. *" Poor information makes bad decisions - Good information makes better decisions"* in spill response this saying holds true. Search and rescue planners and spill responders are demanding users of metocean information with decisions being made that will affect life, the environment and property.

Accuracy and reliability of the metocean information is paramount but it must be delivered in a timely fashion. High quality data that arrives too late is useless to decision makers.

Requirements for metocean data include:

- actual weather at incident site
- predicted short/medium term
- oceanographic conditions
- determine regions of atmospheric instability
- plan what if/scenario planning
- determine "window of opportunity" for vessel salvage, cargo removal, crew evacuation etc.

Wind and sea state information required may include:

- wave height and period
- wave direction and slope
- swell and storm surges
- wind speed, direction and consistency
- tide height and timing
- water circulation
- currents and eddies

- water temperature
- and possible stratification of the water with fresh water.

Other information required may include:
- visibility
- sun up/sun down
- rain
- cloud cover
- air temperatures etc.

Spill response planners and salvage teams depend upon metocean information to provide essential guidance for the salvage of the vessel. This may involve a deep understanding of the tide height and timing as well as currents in the vicinity of the casualty to determine the optimum time to free the vessel from a grounding or off load cargo to another vessel. Sudden shifts of wind can cause problems with the vessel salvage and safety of the crews.

Much of the marine pollution containment and recovery equipment for oil spills is restricted in its application in heavy weather conditions. Currents over a few knots can rip apart booms and drags anchors or leak oil over/under boom curtains. Oil recovery equipment like skimmers and oil recovery vessels, like Marcos, can be ineffective or even swamped under moderate wave and sea conditions.

Foreshore clean up crews only have a small window of opportunity to tackle oil spill clean up on intertidal areas of the coast. Knowledge of the tide height and timing is important to ensure that foreshore crews are not stranded or put at risk by rising tides.

Photo 5. Foreshore Clean up crews on Ninth Island Bass Strait During the Iron Baron Oil Spill 1995

Different sections of the intertidal region of foreshore environments are impacted by coastal oil spills. Depending upon the tide range and any storm surge event that may be superimposed upon the tide different oil impact zones will occur. Mangrove and salt marsh environments are also inundated to a different extent depending upon the tidal cycle. Remobilisation of oil from foreshores is a major consideration for spill responders with the next tide cycle.

Oil spill dispersant spraying operations by boat and by helicopter is also restricted by the prevailing weather and sea state. (Photo 6)

Photo 6. Dispersant Spraying at Sea affected by Weather Conditions

Exxon Valdez Oil Spill - Impact of Storm Event.

When the 300 metre supertanker Exxon Valdez grounded on Bligh Reef in Prince William Sound, Alaska, on 24 March 1989 around 11 million gallons of oil was spilt. A large spill in any terms but only number 53 in the list of world oil spills. (4)

Photo 7. Exxon Valdez, Alaska Oil Spill Public Information Centre (OSPIC).

The major issue for this well documented spill was the very sensitive ecology and wildlife of the area and pristine nature of the Islands and foreshores along Prince William Sound.

In the first 3 days of the spill, because of the extremely mild weather and sea conditions, the slicks remained in a relatively small geographic area near the site of the grounding. But before sufficient response personnel could be deployed with enough booms, skimmers and recovery vessels mobilised, a winter storm hit with high seas and winds of 50 knots.

The 6km slick on the third day spread into a 64km slick within hours. When the winds subsided 2 days later the spill had spread over hundreds of square kilometres of the Sound and associated Islands. (5)

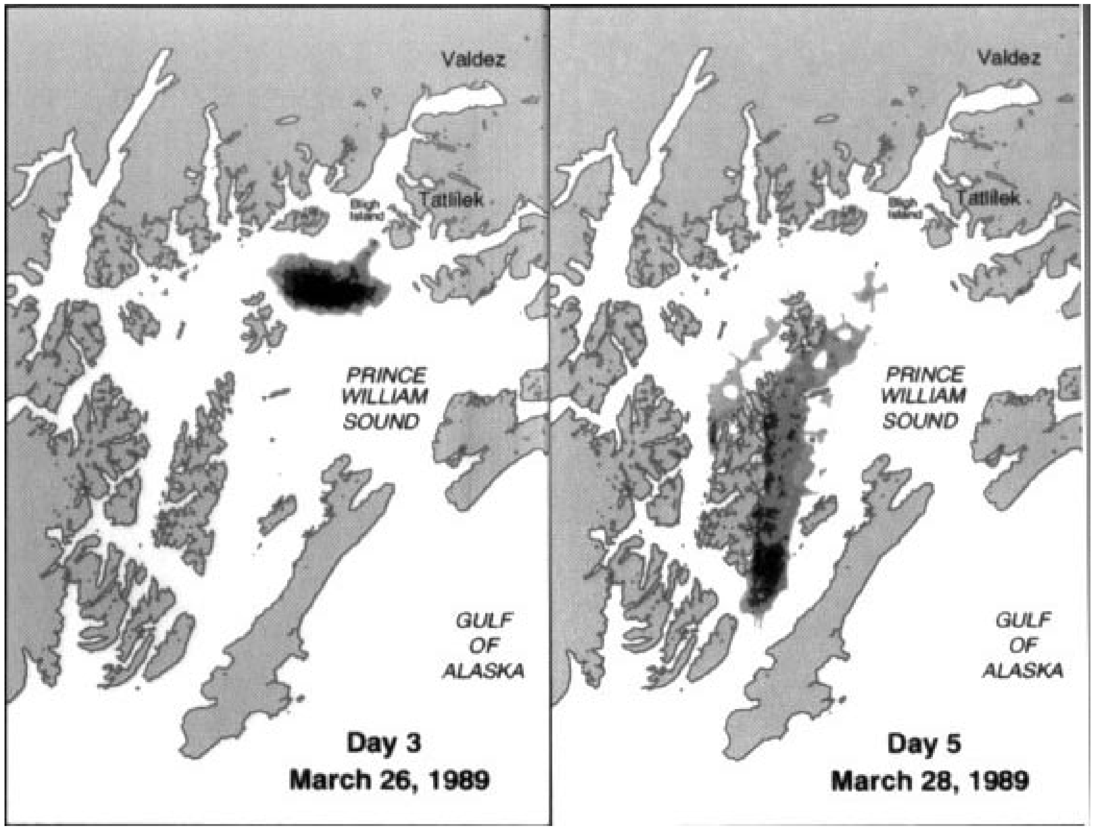

Figure 2. NOAA Hindcast Spill Model for Exxon Valdez Oil Spill before and after Storm event (ref. ADNR Technical Report No3. Sept 24, 1993)

Due to the storm the responders had lost the battle to contain the spill at sea and reduce the impact on the environment. After the first three days the option to disperse the oil at sea, to contain and recover the oil was effectively lost, the "window of opportunity had closed".

Spill trajectory modelling

When an oil spill occurs in the marine environment the first concerns of emergency response planners are:

1 - where will the oil go ?
(ie the slick direction, speed of movement and spreading characteristics)

2. - what environmental impact will the oil have ?
(ie what coastal and marine environmental resources may be at risk)

Oil spill computer models, linked to coastal resource atlases, provide this valuable decision support information. Spill computer models are used for a variety of purposes in Australia:

- For operational use in oil spill events in Australian waters, to determine the spill trajectory, spreading and fate of the oil on water. This information has been vital for the effective and efficient deployment of response equipment and personnel and to determine the coastal and marine resources under risk.

- For the training of operational staff, State/Territory, Federal, and industry in the movement of spilled oil and the processes that may affect decisions made in the field.

- Contingency planning in the case of oil spills in an area of interest and the running of "what-if" hypothetical scenarios of different weather and sea conditions.

- For risk analysis associated with oil spills from oil exploration, drilling and production installations.

- For the identification and possible prosecution of vessels and oil platforms discharging oil at sea.

At the heart of this computer modelling is accurate metocean data, reliable and scientific sound computer modelling.

The new AMSA Search and Rescue Planning/ Oil Spill Trajectory Modelling project called Net Water Movement will be discussed by the Bureau of Meteorology in a separate paper at this conference. (3) The data requirements for calibration and validation of the specialised oil spill modelling software OILMAP will be discussed at MARPOLSER 98 by Dr King et al. (6)

Underlying this spill modelling software is a three dimensional coastal hydrodynamic modelling software called OILTRAK. This software developed by Global Environmental Modelling Services (GEMS) provides vectors of tide and wind driven currents for a designated area. In fig (3) an example of a model output from OILTRAK for a portion of Bass Strait Victoria.

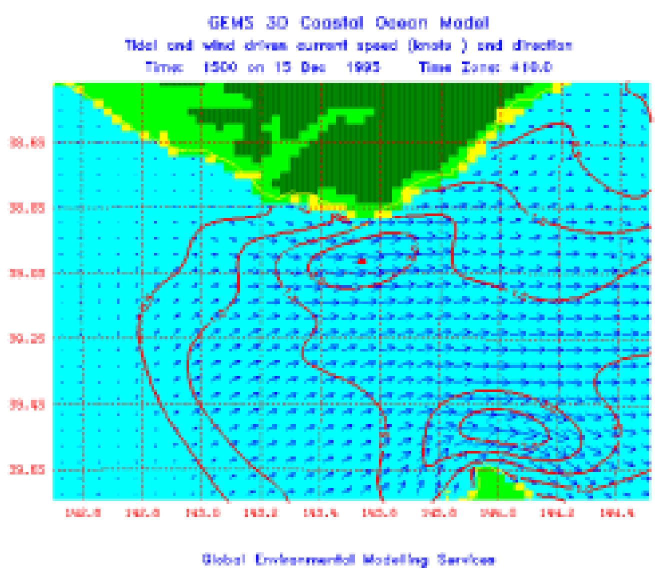

Fig 3. Example of the output from OILTRAK - Bass Strait, Victoria.

Metocean Data Collection

Predicting weather and sea conditions relies on sound metocean data. Automated buoys and satellites are transforming our knowledge of the interactions between the oceans and the atmosphere.

The collection of metocean data is achieved through many sources and means including:

- satellite (orbiting/geostationary)
- automatic coastal/land stations
- drifting buoys
- moored buoys
- vessel reports/observations and automatic stations
- oil platforms
- aircraft
- weather radar
- weather balloons.

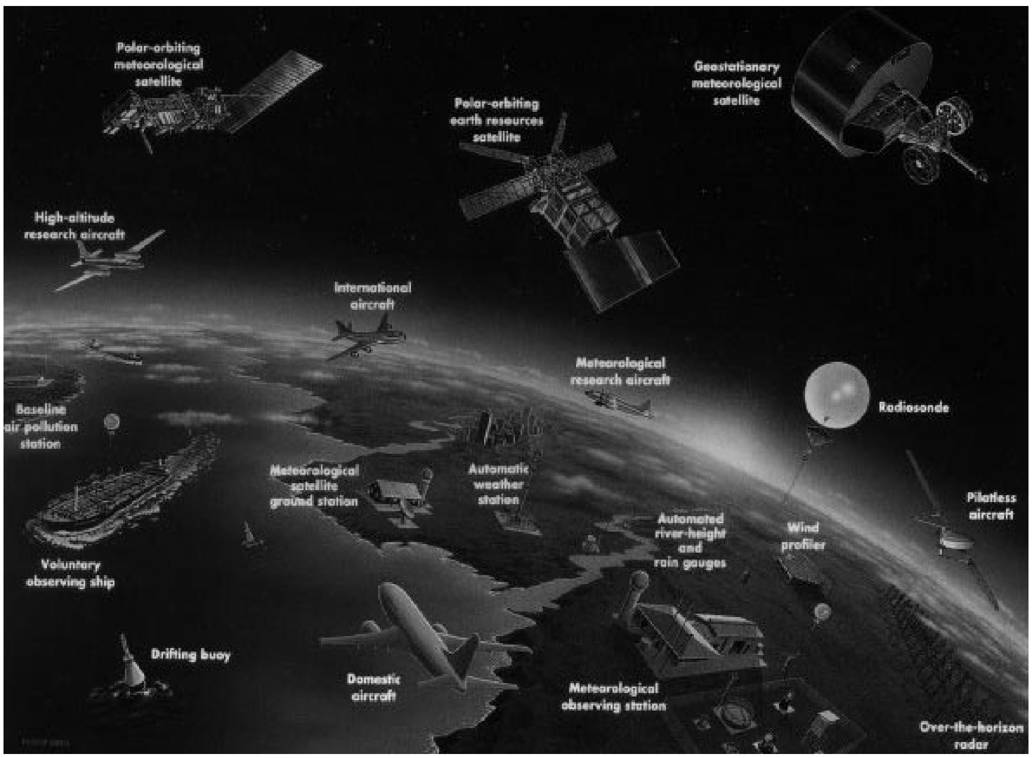

Photo 8. Metocean data sources,
Bureau of Meteorology, Observing the Weather and Climate

The World Meteorological Organisation (WMO) reports that up to 7000 commercial vessels are enrolled in the Voluntary Observing Ships program.

Many organisations are collecting and processing metocean data, some of which, is rarely released or known to outside users. It should be a national priority to ensure the unrestricted exchange of metocean data and information between organisations private, academic, military, state, territory and federal agencies. Improved data exchange and accessibility avoids duplication and would provide the most effective decision base for the protection of life, the environment and property.

A scarcity of metocean data exists in Australia due to the vast extent of the continent, low population and remoteness of much of the coastline. More permanent automatic weather and oceanographic monitoring stations would result in greater data acquisition spatially and of course, better data sources for computer numerical modelling and increased predictive capacity.

We encourage the establishment and maintenance of further metocean monitoring stations in Australia especially the oil spill high risk regions of the coastline.

Metocean information presentation

Metocean information is the derived product from the:

- monitoring
- collection
- processing
- distribution
- and numerical modelling of atmospheric and oceanographic data.

For metocean information to be valuable to the untrained user it must be in a form that can be easily understood, timely and suits user needs.

We support the strengthening of the established relationship between the Bureau of Meteorology and AMSA by regular interchange of ideas, needs, services and technology.

Access to real time observations and met. stations around the Australian coastline is an important requirement. The Bureau of Meteorology provides users with on line access to text files of data from Australian met. stations. It is my recommendation that a point/click map be devised, similar to the climate reference station map below (figure 4) for direct access to real time observations from coastal monitoring stations. This would allow responders to monitor met. information specific and relevant to the incident region only.

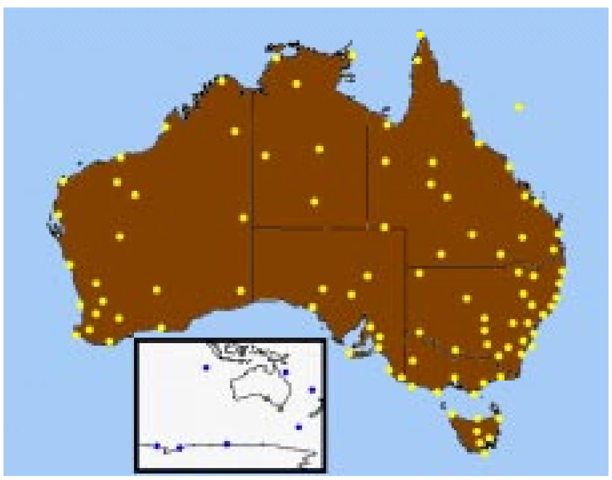

Figure 4. Climate Reference Stations - Bureau of Meteorology

AMSA encourages the use of direct access to metocean information and supports the Bureau of Meteorology initiative in providing users with raw data and derived products via the Internet.

It should also be a national priority to encourage greater research into the application of metocean data and computer models for maritime incident response. Also greater awareness should be promoted of the importance of metocean information to the safety of vessels at sea.

Georeferencing of Weather & Oceanographic Information

The success of a spill response operation depends upon effective information flow. In most response operations planners are faced with information overload coming from a variety of sources maps/ imagery/ text/ graphics/computer model predictions/ weather information etc. Integrating this information into one system provides one solution to this information overload.

AMSA as well as many other regulatory, emergency, disaster and response organisations have established or are in the process of establishing Geographic Information System (GIS) based decision support systems. A GIS based system allows the overlay of spatial and temporal data and information concerning the geographic area of interest and allows the user to query the system, import data and imagery, pan, zoom in/out etc.

Much of the wind, sea state, weather modelling outputs and satellite imagery available to users is in a form of standard graphic files such as gifs, tiffs, jpg etc. To make value of this information and to simplify the interpretation of the metocean information this requires the graphics to be georeferenced.

AMSA encourages organisations to consider the use of georeferencing of weather and oceanographic maps, satellite imagery, radar images and derived graphics from computer models to enable users to simplify and rapidly access this information using PC based low cost Geographic Information Systems (GIS) eg ArcView or MapInfo.

Below is a typical radar image (figure 5) of a storm event on the Northwest coast of West Australia during April 1998. Without georeferencing the ability to utilise the image to focus on a localised event makes it difficult for users. With the use of lat/long grids and preferably georeferenced the image would be able to be directly overlayed with the incident location and the ability to zoom/pan annotate etc.

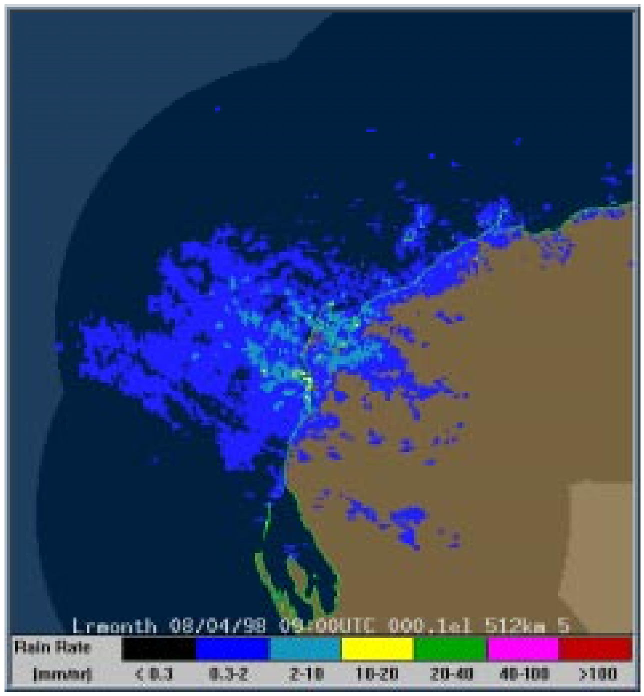

Fig 5. Radar Image WA Bureau of Met. 8 April 1998

The output from the new Net Water Project the AMSA Maritime Search and Rescue Planning and Oil Spill Trajectory Modelling system will be georeferenced to allow trajectories to be easily imported and overlayed by SAR planners and spill responders.

Vessel Routing

Knowledge of sea and weather conditions for at least a few days ahead is vital for an effective, cost and time efficient shipping operations. As most sailors know making use of natural ocean circulation and wind patterns improves travel times and reduces costs.

Vessel-routing is simply the technique of planning and guiding vessels at sea to optimise transocean journeys fuel efficiently, cost effectively and in a timely manner by:

- planning journeys prior to sailing and recommending modification on route
- provision of metocean information and advice directly to the vessel master
- avoiding unfavourable currents & winds
- avoiding bad weather and high seas.

For example if wave heights exceed 7 metres most commercial vessels need to reduce speed to limit damage to cargo or structure.

Vessel stability and severe weather incidents

In heavy weather ship movement may cause a vessels cargo to shift and cause instability of the vessel. A heavily listing vessel can take on water and possibly roll over from loss of stability.

(Photo 9. - Ro Ro Ferry that had rolled over from loss of stability)

Vessel Movement and Docking

Large vessels approaching/departing or manoeuvring in difficult harbours and ports often require an understanding of tidal conditions, winds direction/speed, currents velocity/locations, and outflows from estuaries to ensure safe passage and docking at jetties. Even with the assistance of tugs the extent of windage of vessels and effects of tides/currents can cause problems in ship movements.

Many bulk commodity vessels pull significant under water draft and suffer from limited under keel clearance is some ports. Under keel clearance is an important consideration as wave/swell conditions affect heave, pitch, roll motions of the vessel as well as water temperature/salinity will affect vessel buoyancy, tide timing will affect height of water available in the channel and at the jetty. Many large vessels have a limited time window to enter or leave ports because of this keel clearance problem.

The use of on board weather stations as well as wave rider buoys, tide gauges, current meters etc in a port can provide vessel masters and port pilots with a better understanding of the likely metocean conditions the vessel will be subjected to so that correct pilotage actions can take place. A better understanding of under keel clearance will optimise the port operations and will improve vessel and crew safety.

An example of this was the grounding of the TNT Carpentaria in Torres Strait in October 1991. In certain parts of the Prince of Wales Channel there is insufficient water to allow deep draught vessels safe passage during certain cycles of the tide. Tidal gauges have been installed in the area that transmit information so ships can determine when it is safe to enter.

The master of the vessel was found by the MIIU investigation to *'have made an error of judgement in his vessel manoeuvrers'* and '*not appraise and appreciate the significance of the transmissions from tidal stations'*. (7)

Grounding of the Karin B, Victoria

Of prime importance for sailors is the strength and direction of the winds and also the possible onset of storms, gales or other strong winds and rough water.

On the morning of 19 October 1996, the cargo vessel Karin B entered Corner Basin, Victoria, bound for Esso Australia Ltd. terminal at Barry Beach. Outside the bar, off Corner Inlet, the wind was very fresh from the north-west, but it eased to about 15 knots as the vessel passed through the inlet. Although the sky was threatening and a frontal change forecast, those on the bridge considered they had time to berth the vessel before the front arrived.

While making the turn from Toora Channel into the dredged Barry Beach Channel, Karin B was caught by a sudden increase in wind and was blown on to the mud bank to the starboard side of the dredged channel. Fortunately no injury to crew occurred, nor damage was sustained by the vessel and no pollution occurred. (8)

The MIIU investigation in the cause of the incident concluded that *'Karin B was caught by a sudden strong wind associated with the passing of a cold front during the manoeuvre into the confined approach channel to Barry Beach Terminal.' (8)*

Also the investigation concluded *'readily available, up to date information on the approaching front <u>was not obtained</u> from the Bureau of Meteorology*.' (8)

This incident demonstrates the need to obtain timely weather support to vessels especially in changing weather situations and implications it has for vessel movements in restricted waters.

Bogasari Dua / Midas Collision, WA

Even at anchor vessels can be put at risk by the changing conditions of the weather and sea conditions.

On the morning of 5 March 1996, the Indonesian 33,747 tonnes deadweight geared bulk carrier Bogasari Dua and the Panamanian 38,313 tonnes deadweight bulk carrier Midas were both lying at anchor in Geraldton Roads, Western Australia. Midas was anchored about 1½ miles to the north of Bogasari Dua.

At about 0400, Bogasari Dua, lying to a single starboard anchor in 30 m of water, began to drag anchor in gale force southerly winds and was driven towards the Midas. Those on the bridge of Bogasari Dua did not realise that the vessel was dragging anchor until after 0430, when they were alerted by the whistle signals of Midas. Bogasari Dua came into contact with Midas at about 0445, before either the anchor could be weighed, or the engine made ready. As soon as the two vessels moved apart, at about 0450, the Master of Bogasari Dua manoeuvred his vessel clear. (9)

Damage to both vessels occurred but no there was no injuries to crew or nor any pollution of the marine environment.

In the investigation report the MIIU found a main contributing cause was. *'The Master of Bogasari Dua had switched off the weather facsimile machine, denying the vessel access to local weather forecasts and the strong wind warnings.'*

Also the report stated *'The watch keeping officers aboard Bogasari Dua did not properly monitor the weather conditions and so did not inform the Master of the increasing wind strength'*.

It was also found the master of the Boagasari Dua had not ballasted down the vessel to reduce windage of the ship thereby reducing strain on the anchor.

Tropical Cyclones and Offshore Petroleum Exploration and Production

Massive waves and high winds generated by a tropical cyclone constitute the major hazards to shipping. Previously in the conference we presented various examples of vessels caught in cyclones around Australia which could result in significant marine pollution or possible loss of life.

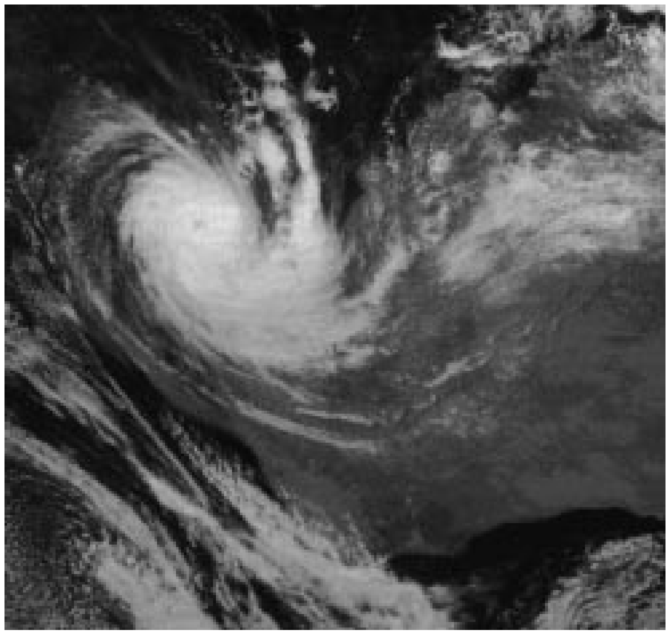

Photo 10. Cyclone Olivia Western Australian 10 April 1996
(Bureau of Meteorology imagery from the Japanese Meteorology Satellite)

Cyclones also pose a significant threat to offshore oil and gas exploration and production facilities like fixed platforms and floating production and storage operation (FPSO)

Many of the offshore rigs and FPSO installations on the North West of Australia are in what's called cyclone alley. (1,10,11)

Photo 11. Griffin Venturer Floating Production and Storage Operation (BHP Petroleum)

Tropical cyclones can form in less than 24 hours but on average they take 2-3 days to form. Cyclone movement and trajectories are very unpredictable and sometimes erratic therefore predicting the cyclone path is one of the major challenges for forecasters.

Cyclones that affect Australia usually start close to the equator during November/December and gradually over the following months can be generated further south closer to the Australian mainland. During the mid summer period cyclones begin closer to the Australian coast (10) The Timor Sea and Arafura Sea are the main cyclone generating regions for cyclones that impact the North West of Australia (10)

Cyclones are characterised by:

- a deep depression and low barometric pressures
- clockwise whirlpool of winds
- extremely high winds
- massive seas
- can appear to reduce and intensify over time
- wind shifts constant
- eye is calm
- large geographic area affected
- sometimes fast, sometimes slow moving
- intense fast moving cyclones often mean higher winds and storm tides
- erratic and unpredictable trajectory
- a category 5 cyclone has the equivalent energy of around 10,000 atomic bombs of the size used on Nagasaki.

During cyclone Orson in 1989 the North Rankin A platform was subjected wind gusts of up to 274 km/hr and West Australia's lowest ever air pressure of 905 hPa. It was calculated that waves in excess of 20m had battered the base of the rig during the cyclone.(11)

The Aust BoM have cyclone warning centres in Perth, Brisbane and Darwin which not only alerts vessels and off shore facilities but receives data from them to support the monitoring and prediction of these severe weather events.(11)

Offshore facilities have a staged preparation for the on set of a cyclone which involves:

- tanker offloading is suspended and FPSO decoupling occurs from mooring and vessels are directed away from the threatened area until the threat has abated.
- unessential crews are evacuated and equipment is battened down and if required the remaining crew is also evacuated.

The safety of crew and structure is always of paramount importance in all the contingency planning for tropical cyclones. Evacuation of rigs and facilities must be carried out in sufficient time to allow helicopters and boats to arrive ashore before the cyclone.

Information about the historical wind, wave and current forces experienced during tropical cyclones is essential for the effective design and construction of offshore platforms and FPSOs.

Photo 12. Petroleum Exploration rig During a Storm at Sea

Conclusion

The shipping industry is for the most part safe and environmentally sound, but it can be made safer and cleaner with a better metocean monitoring advice and services to the maritime industry and response organisations.

Initiatives that improve our knowledge of ocean behaviour and circulation patterns are significant in formulating response plans to marine pollution.

- Promote the establishment and maintenance of metocean monitoring stations in the high risk oil spill regions of Australia.

- Strengthen the established relationship between the Bureau of Meteorology and AMSA by regular visits or interchange of officers to exchange ideas and technologies.

- Establish more effective and unrestricted sharing, exchange and rapid access to metocean data sources of agencies from State, Federal, Harbour/Port and private organisations.

- Encourage the use of georeferencing of weather and oceanographic maps, satellite imagery and derived pictures/graphics from computer models to enable users to access using PC based low cost Geographic Information Systems (GIS).

- Promote the use of the Internet to deliver and exchange metocean data between organisations and users.

- Encourage greater research into the application of metocean data and models for maritime incident response.

- Promote the awareness of the importance of metocean information to the safety of vessels at sea.

References Cited.

(1) Baird D and Gilbert T.D Review and Morphology of Maritime Pollution Emergencies, MARPOLSER 98.

(2) Chapter 9.6 Military, Applications of Meteorology, p273.

(3) Wright RB, AMSA Net Water Movement Project, MARPOLSER 98.

(4) Oil Spill Intelligence Report, International Oil Spill Statistics : 1996, OSIR, web site. http://www.cutter.com/osir/biglist.htm

(5) Morris BF and Loughlin TR Overview of the Exxon Valdez Oil Spill 1989-92 in Marine Mammals and the Exxon Valdez 1994, Academic Press p8.

(6) King B, McAllister F and Hubbert G Data requirements for Calibration and Validation of the OILMAP Oil Spill Model, MARPOLSER 98.

(7) MIIU report No.37, Investigation into the grounding of the TNT Carpentaria, October 1991.

(8) MIIU report No. 100, Investigation into the Grounding of Karin B. October, 1996.

(9) MIIU report No 91, Investigation into the Collision of Bogasari Dua and Midas March 1996.

(10) Met. Specialists Aid Petroleum Operators with Seasonal Vigil in Australia's Cyclone Alley. Petroleum Gazette 2, 1996, p28-35.

(11) It's Cyclone Season, Oil & Gas News, January 1996 18-22.