Why do we want the VOS-Clim information?

The main purpose of the Voluntary Observing Ship (VOS) Climate Project is to provide a high-quality set of marine meteorological observations - and detailed information on how the data were obtained. Such observations, are of great value to operational marine forecasting. Furthermore, climate studies rely on the increased accuracy of good observations. Improved climate models, better ground truth for checking satellite observations, and a more accurate high-quality marine data set - all will be possible with the cooperation of international ship participants.

For the VOS-Clim project we are asking PMO's to collect extra information about the selected Voluntary Observing Ships. ....Why do we want that information? What will it be used for? Here are answers to some of the questions you may have...

Q As a ship's officer how will it change the way I take observations?"

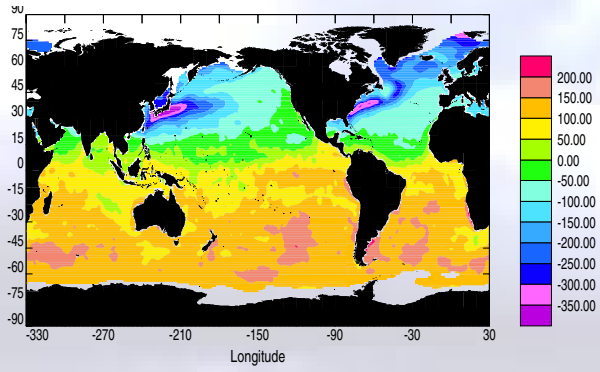
A Hardly at all. If you use an electronic logbook or coding system (e.g. "Turbowin") you will be issued with an upgraded version, if you fill in logbooks you will be asked to report the relative wind speed and direction and ship's speed and head at the time of the observation. In return you will benefit by enhanced support from the Port Meteorological Officers and you will be able to learn more about the various ways in which your observations are used.

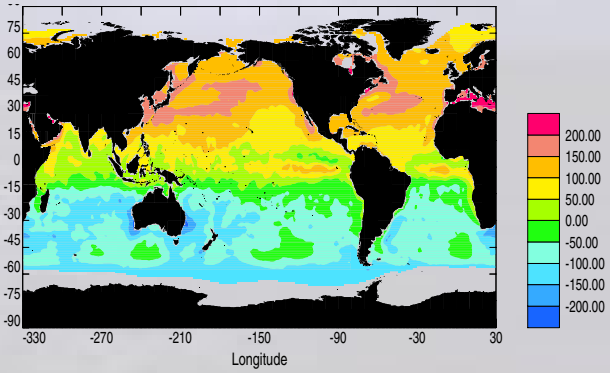
Q What do you mean when you say the ships observations will be used to study the climate?"

A This is a map of the transfer of heat between the ocean and atmosphere for an average January.

In the northern hemisphere it is winter and the blues colours show that the ocean is loosing large amounts of heat to the atmosphere - especially over the Gulf Stream and the Kuroshio.

This map is for July. Now the northern hemisphere oceans are being warmed and the cooling is occurring in the southern oceans where the sea ice has spread out from Antarctica.





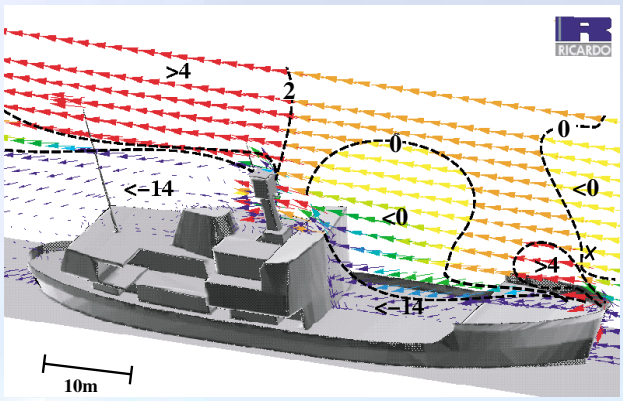
We could only draw these maps because of the millions of observations which have been taken by merchant ships in the past

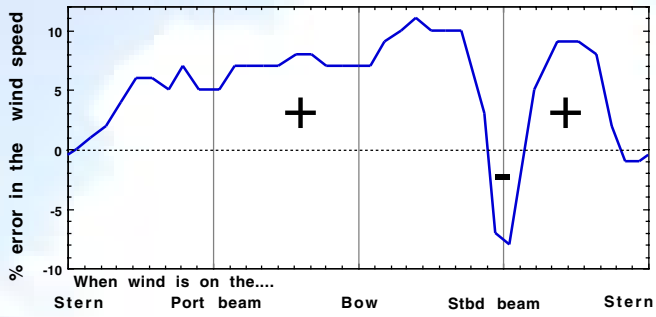
Nowadays we obtain information from satellites and computer models - but the ship data is as important as ever. In fact we need really good ship observations to check the models and calibrate the satellites - that's what the VOS-Clim project is aimed toward. Better observations really will make a difference!

Q "Why do you want to know the dimensions of the ship and the position of the anemometer?"

A The ship disturbs the airflow - the anemometer will not measure the true value that the wind would have if the ship were not there.

Using computer models we can calculate the flow around ships and find out how big this error is.



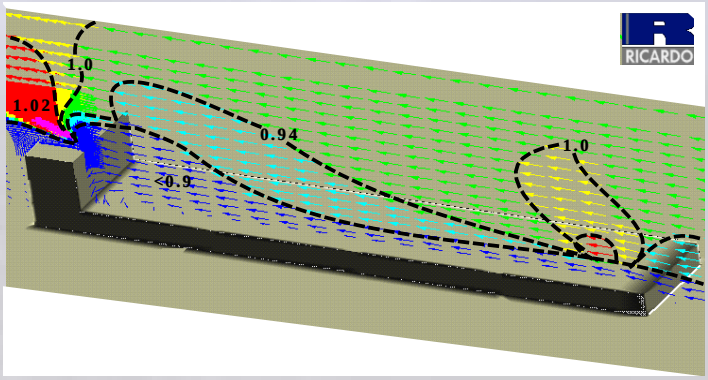


....or we can place a model of the ship in a wind tunnel and measure the error for different wind directions.

This plot is for an anemometer on the port yardarm of the main mast of the ship in the computer model. The winds are speeded up over the wheelhouse except when the wind is from astern (or from the starboard beam when the anemometer is in the wake of the mast).

The example above is a Research Ship which has been used for special experiments. We can't hope to study each VOS-Clim ship in great detail but if we know the main dimensions of the ship we can use simple models, like the "tanker" below, to estimate how much the wind speed is likely to change for a typical anemometer position on a merchant ship.

This is the airflow over a very simplified model of a tanker or bulk ore carrier. It was generated from a computer model. Amongst other factors, the airflow over the wheelhouse depends on the distance between the main deck and the wheelhouse-top... one of the dimensions that you are being asked to specify for the VOS-Clim project.

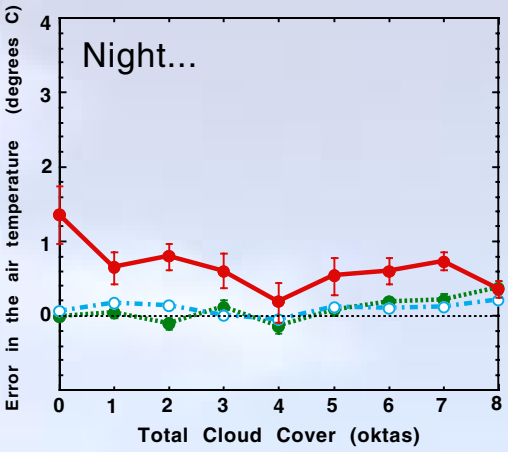


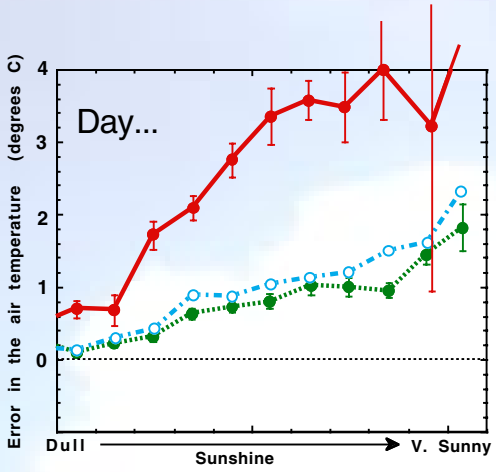
Q "Why do you want to know the type of instrument used for air temperature measurement and where it is situated?"

A For example...

This graph shows the average error in air temperature measurement for thermometer screens on different ships.... the different lines show how well the screen was situated... green = good, blue =moderate, red = bad

At night the badly exposed screens were, on average half to one degree too warm. The other screens gave good readings. Now look what happened during the day...



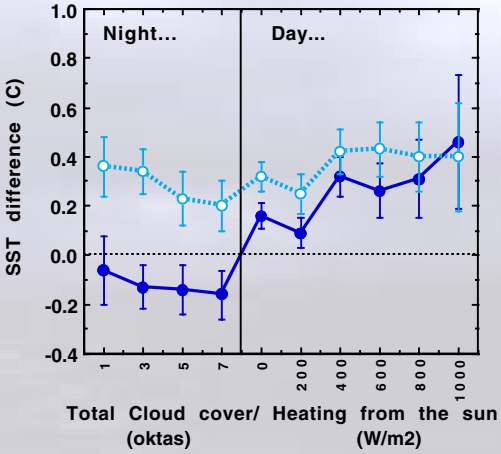


...in sunny conditions all the screens tend to read too warm - but for screens with good or moderate exposure the over-heating is reasonably uniform - we can devise a correction.

...the screens with bad exposure read much too high - several degrees - and there are big differences between different screens - we can't correct these errors but it's important that we know about them.

Q "Why is it important to know the method of sea surface temperature determination?"

A The value of the sea surface temperature ("SST") depends to some extent on how it is measured. An increasing number of ships are being fitted with thermometers that are fastened to the inside skin of the hull ("hull contact sensors"). Provided that they are kept in calibration, we believe that these instruments give the most accurate SST values. The plot shows the average difference between SST values from Engine Room Intake ("ERI") thermometers and those from hull contact sensors (dotted line).

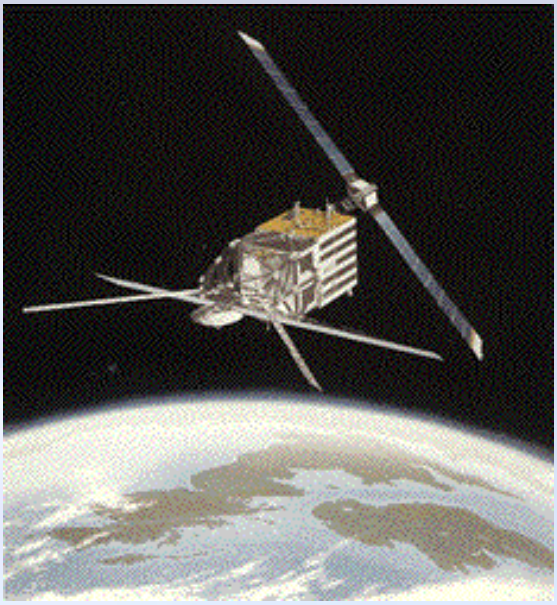


For both day and night the ERI values are warmer by about 0.3 to 0.4˚C. Bucket readings are close to or slightly colder than the hull contact readings at night. However in the daytime the bucket readings tend to become warmer if the sun is shining.

Q "But what about satellites - nowadays don't they tell you everything you need to know?

A NO!

..for example, for about 20 years satellite data have been used to determine the SST over the globe... but when the Mount Pinatubo volcano erupted in June 1991 large quantities of ash were thrown high into the atmosphere...



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..this ash cloud circled the tropics and caused the satellite sensors to report that the tropical SST was suddenly about 1˚C **colder** than usual but the ships and buoys showed that really the SST was about 0.5˚C **warmer** than usual! The graph below shows that it took a whole year for the satellite readings to return to the correct value. So satellite data is always checked against ship & drifting buoy data and corrected as necessary before it is used.

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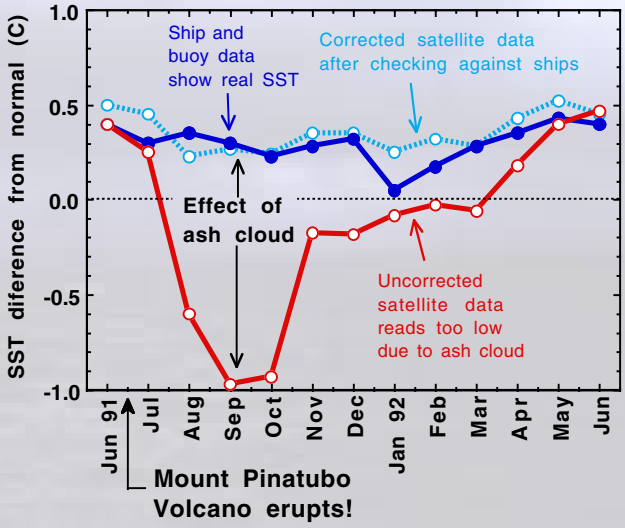
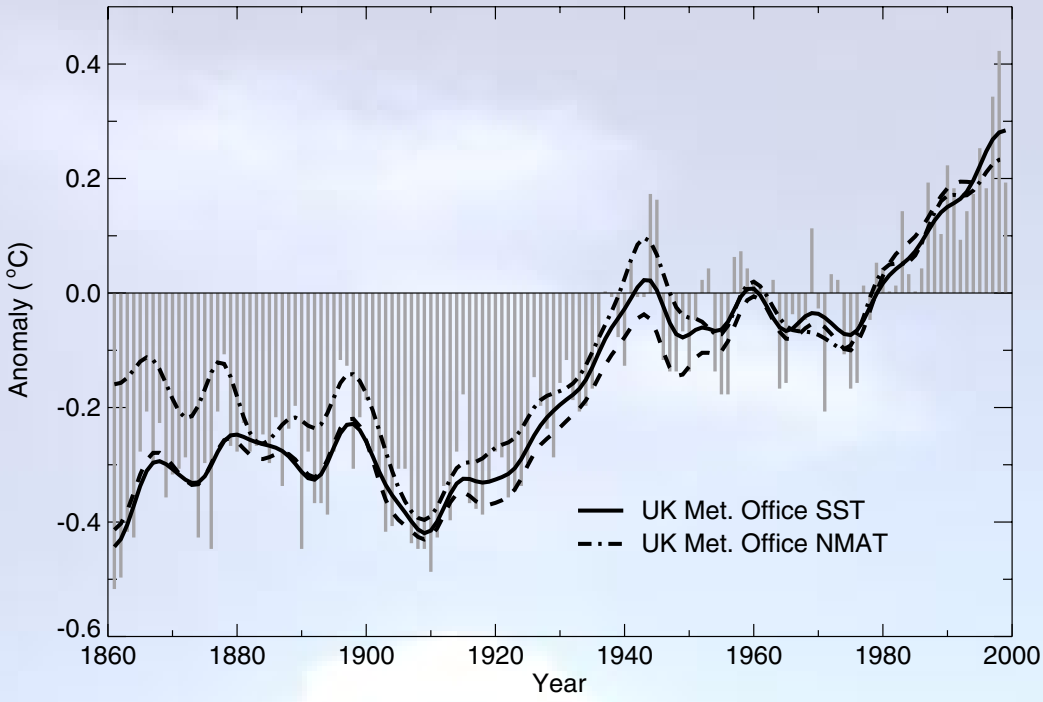
There are other problems with satellite data - satellites may not measure storm force winds correctly, some instruments can not see through clouds or do not provide values close to the sea surface.

Despite all the advances in space technology we still need good data from merchant ships!



Q "But how much does it all really matter?" A Very Much!



As an example, the graph shows the changes in global SST and night-time marine air temperature (NMAT) since 1860. Compared to the period between 1960 to 1990, in earlier years both the air and the sea were colder by a few tenths ˚C. In more recent years warmer air and sea temperatures have been observed. These changes, detected in the weather reports from Voluntary Observing Ships, suggest that rapid global warming, is occurring perhaps due to changes in the atmosphere caused by man. As a result many countries have agreed to limit the release of gases like carbon dioxide into the atmosphere. Some countries have taken measures which have a direct impact on the everyday lives of their citizens - taxes on power consumption for example. In other countries there remain doubts as the degree of warming After all the changes are relatively small and the graph could only be plotted after making significant corrections to the data. To really understand these changes it is important that in future we obtain data of the highest accuracy - the VOS-Clim project will help in this.

Remember, if the predictions are correct rising sea level could be catastrophic for some island states. Storms of increasing frequency and strength would be associated with high winds and more frequent damaging floods. Your observations will help us tell to what extent this is already happening. In fact, we urgently need to understand the climate better - we need high quality data - we are asking you to help!

Q "I've been making marine weather observations for many years... so why are they particularly important now?"

A We have described how the marine weather observations from the past are providing vital information on the world's climate, and have highlighted the present increases in global temperatures. With improving understanding of the weather, more data from satellites, and improved computer models to help in weather forecasting, there is now an emphasis on obtaining ever higher quality measurements over the ocean. The ships in the VOS-Clim project have been chosen as the ships which we believe can provide the high quality reports which we need.

Q "Will the way we make weather observations change in the future?"

A Better instrumentation has already been successfully tested on research ships and prototype systems are being installed on a few Voluntary Observing Ships. But these instruments are very expensive. Once the VOS-Clim project has demonstrated the values of a chosen high quality subset of the VOS the possibility of equipping them with advanced instrumentation will be much higher.

Q "So are there any direct benefits to the shipping industry?"

A The VOS-Clim project will help in the development of future marine meteorological systems which are expected not only to produce better marine weather forecasts, but also to give ships much more comprehensive real-time weather information for operational purposes. In participating in the VOS-Clim project the shipping industry will also be helping mankind face one of its greatest challenges... to face the large scale weather changes associated with a changing climate.

For more information: Please ask your port meteorological officer or visit the VOS-Clim web site at http://www.ncdc.noaa.gov/VOSClim.html .

Credits: All illustrations: Southampton Oceanography Centre except... ERS-1 satellite: European Space Agency; Mount Pinatubo eruption: Rick Hoblitt, USGS/Cascades Volcano Observatory; effect of eruption on SST: adapted from Reynolds & Smith (1994); increase in global temperatures: Hadley Centre; Carson River flood: Rhea Williams, Hydrologist, USGS Nevada; Met Instruments on research ship: Robin Pascal (Southampton Oceanography Centre).