

# Quantifying Random Errors in VOS Meteorological Observations

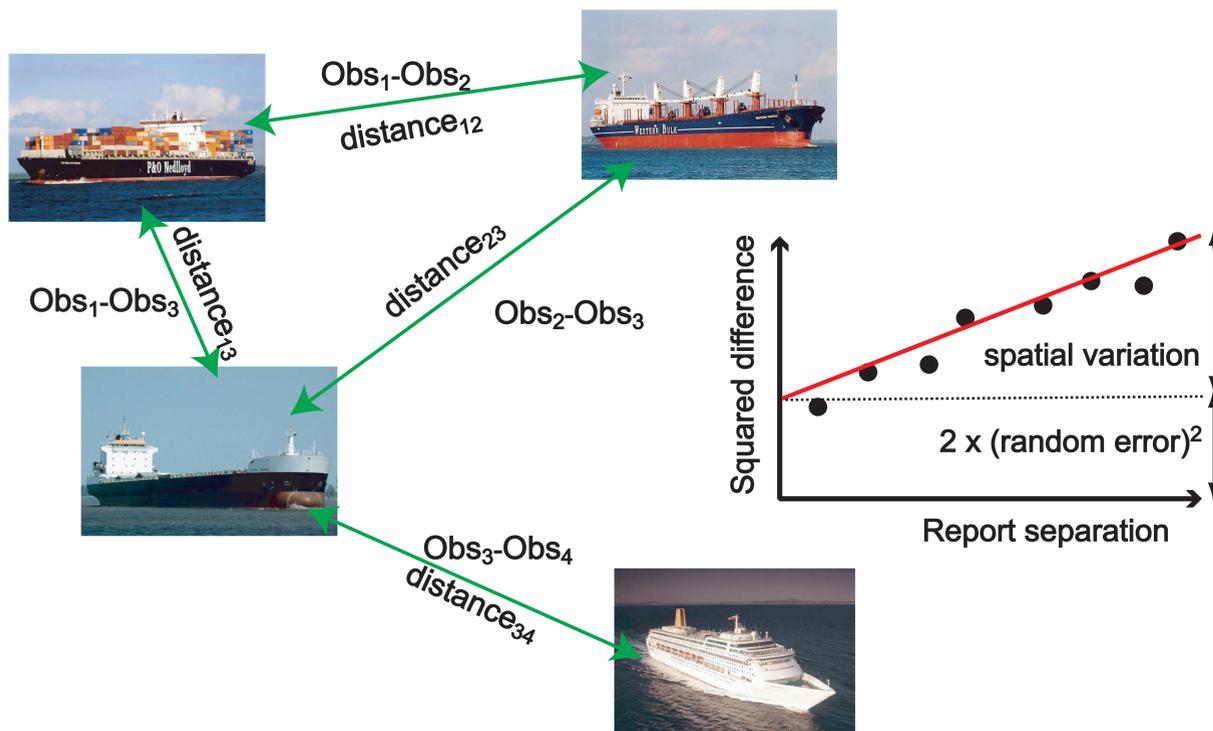
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## Why are we interested in Random Errors?

It is important to know the scatter or random error in marine reports from the I-COADS (International-Comprehensive Ocean Atmosphere Dataset). Without information on the random errors and sampling characteristics of the data then the significance of any results derived from analysis of I-COADS (or climatologies derived from I-COADS) cannot be properly assessed. Estimates of the random errors are important for data assimilation, variability analysis, optimal interpolation and inverse calculations.

## How do we calculate the Random Errors?

We use the semivariogram method Lindau (1995) to estimate the random errors. Ship's observations made at the same time are paired and the mean square differences plotted against the separation of the ships.



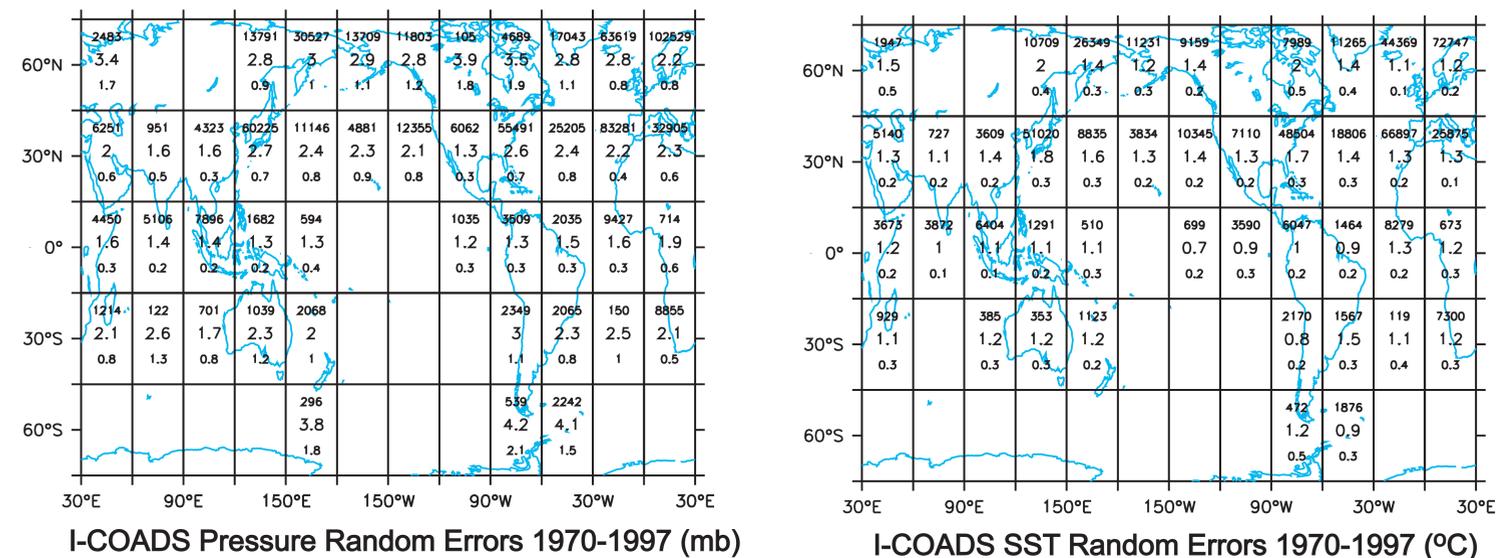
We then perform a linear regression to attempt to isolate the spatial variability from the random observational error. The intercept represents the sum of the errors in the pair at zero distance. Halving this gives us the error in a single ship then taking the square root gives the root-mean-square random error.

## References

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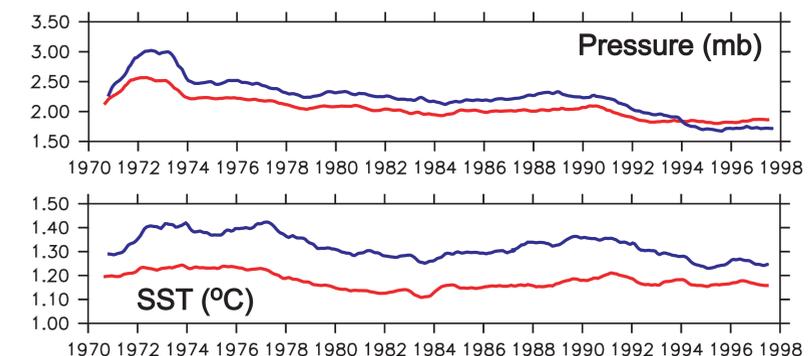
## Results

We have calculated the random errors for pressure, SST, air temperature, wind speed and humidity each month from 1970 to 1997 for 30° ocean areas. The maps show the average of these estimates for pressure and SST (large central number in each square, the lower number is the standard deviation of the monthly estimates and the upper number is the mean number of data pairs). The error estimates are largest in high variability regions, suggesting we may not have fully removed the spatial component of the variability. The time series show the random errors estimates weighted by the number of observations (blue) and the ocean area (red).



I-COADS Pressure Random Errors 1970-1997 (mb)

I-COADS SST Random Errors 1970-1997 (°C)



## More information

Random errors for air temperature, specific humidity and wind speed are presented in Kent et al. (2003). They also show how the error estimates vary with observing method and the quality control applied to the data. Kent and Challenor (2003) demonstrate how data from different sources can vary in quality. The semivariogram was first used in marine climatology by Lindau (1995) and more detail on the method can be found in Kent et al. (1999) and Lindau (2003).

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