Wind Distributions
By C. Fairall, April 13, 2006

The distribution of wind speed is usually well-fit by a Weibull distribution (See Panoksky and Dutton, p 332).

$$p(U) = \frac{b}{a}(\frac{U}{a})^{b-1} \exp[-(\frac{U}{a})^{b}]$$

The mean and standard deviation are given by:

$$\overline{U} = a\Gamma(1+1/b)$$

$$\sigma_u = a\left[\Gamma(1+2/b) - \Gamma(1+1/b)\Gamma(1+1/b)\right]$$

The recent paper [Monahan, J. CLIM vol 19, 497-520, 2006] gives more information than you could possibly want about oceanic wind distributions. He shows that in the Southern Ocean region, b=3; thus a = 1.11*$\overline{U}$ and $\sigma_u = \overline{U}/3$. On an annual average, $\overline{U}$ is about 11 m/s but I guess it might be lower in December-February.

One handy property of the Weibull distribution is the cumulative probability that U exceeds some selected threshold, U', is simply

$$\Pr ob(U > U') = \exp[-\left(\frac{U'}{1.11\overline{U}}\right)^{b}]$$

For example, suppose we select a region where $\overline{U} \approx 10$ m/s. Then there is about a 50% probability U will exceed 10 m/s, a 9.3% U will exceed 15 m/s and a 0.36% probability U will exceed 20 m/s. Thus, if you are in the region 30 days you can expect about 67 hours with U exceeding 15 m/s and 3 hours with U exceeding 20 m/s. I think this would be a good experiment, but it might be nice to have a little higher wind speeds.

The Atlantic wind speed boxes we have now don't quite tell us enough. Perhaps we need average wind speed and std for the entire Dec-Feb ensemble (all years). Or perhaps, instead of mean wind speed, the probability that U exceeds 15 m/s?

Anyway, food for thought.