Ocean vector winds are important for ocean-atmosphere interaction and modes of climate variability. Similarly, winds play an important role in spatial patterns of climate change. Maintaining a long, consistent, well-calibrated wind dataset is critical for climate change research.
Surface wind trend based on ship obs.

Increased ship size & anemometer height

Spurious increase in measured wind

Visual observations of wind wave height → correct wind biases

SST
($^\circ$C/60yr)

Uncorrected ICOADS wind (ms$^{-1}$/60yr)
Interannual variability of high-wind occurrence over ocean

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Data & Methods

• QuikSCAT wind velocity on 0.25° grid (Sept 1999 - Nov 2009)
• SSM/I wind speed on 0.25° grid (1988-2009)
• Map high-wind ( >20 m/s) frequency (HWF)


Dec-Jan-Feb high-wind frequency (%)

• frequent in wintertime midlatitudes (storm track region)
North Atlantic

Storm track

South tip of Greenland

- Orography (Greenland, Norway, France—“mistral”)
- SST frontal effects (more frequent over warmer waters)
North Atlantic

- Orography (Greenland, Norway, France—"mistral")
- SST frontal effects (more frequent over warmer waters)
Momentum-mixing mechanism

- low static stability over warm waters $\rightarrow$ enhanced mixing $\rightarrow$ increased surface wind
Interannual variability in high-wind frequency (HWF) DJF 1988-2009

High variance

• A, B & C: Gulf Stream front
• D: Cape Farewell
• E: Open ocean band
North Atlantic Oscillation (NAO) effect

DJF high wind frequency anomaly (color) and wind anomaly (vector) regressed upon the NAO Index, superimposed on correlation between storm-track intensity and NAO index (black contours).
Interannual variations off Cape Farewell

Westerly & easterly HWF; NAO

Winter high-wind occurrence (%) associated with (a) westerly and (b) easterly wind
SST front effect

DJF HWF, SST-SAT, and cross-frontal advection

HWF and 10-m wind b/w positive and negative phases of cross-front advection

Correlation with the Eastern Atlantic pattern = 0.64
Local trend of high-wind frequency (color) and 10-m wind (vector) over 1988-2009, superimposed on climatological seasonal means of AVHRR SST.
Factors for high-wind occurrence

Climatology
• Storm tracks
• Sea surface temperature fronts
• Coastal orography

Interannual variability
• North Atlantic Oscillation
• East Atlantic pattern
• SST fronts and orography
• Tropical cyclones do not emerge in climatology.
Enhanced eddy-kinetic energy $\leftrightarrow$ Increased instability $\leftrightarrow$ Cross-frontal advection

Winter climatology
Interannual variations off Cape Farewell

From Moore and Renfrew, 2005

Westerly & easterly HWF; NAO

Interannual standard deviation of winter HWF (unit: %) associated with (a) westerly and (b) easterly wind