Remote Sensing Systems
www.remss.com

How Precisely Can One Infer Decadal Wind Trends from Satellites?

Frank J. Wentz

Remote Sensing Systems, Santa Rosa CA

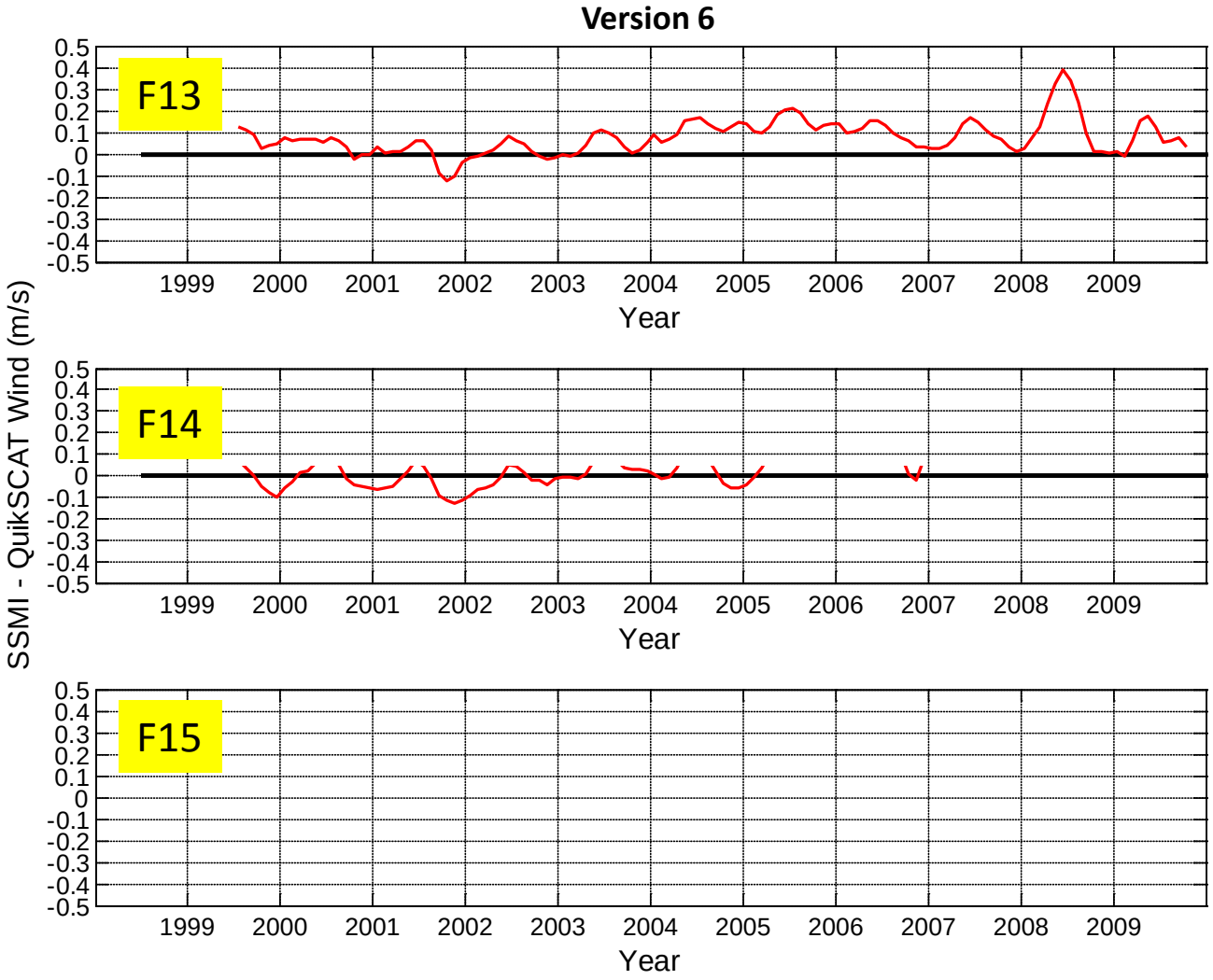
Supported by: NASA Oceans Program

Presented at 2012 International OVWST Meeting
Utrecht, Netherlands
June 14, 2012

Remote Sensing Systems
www.remss.com

SSM/I Minus QuikScat Wind Speed Difference

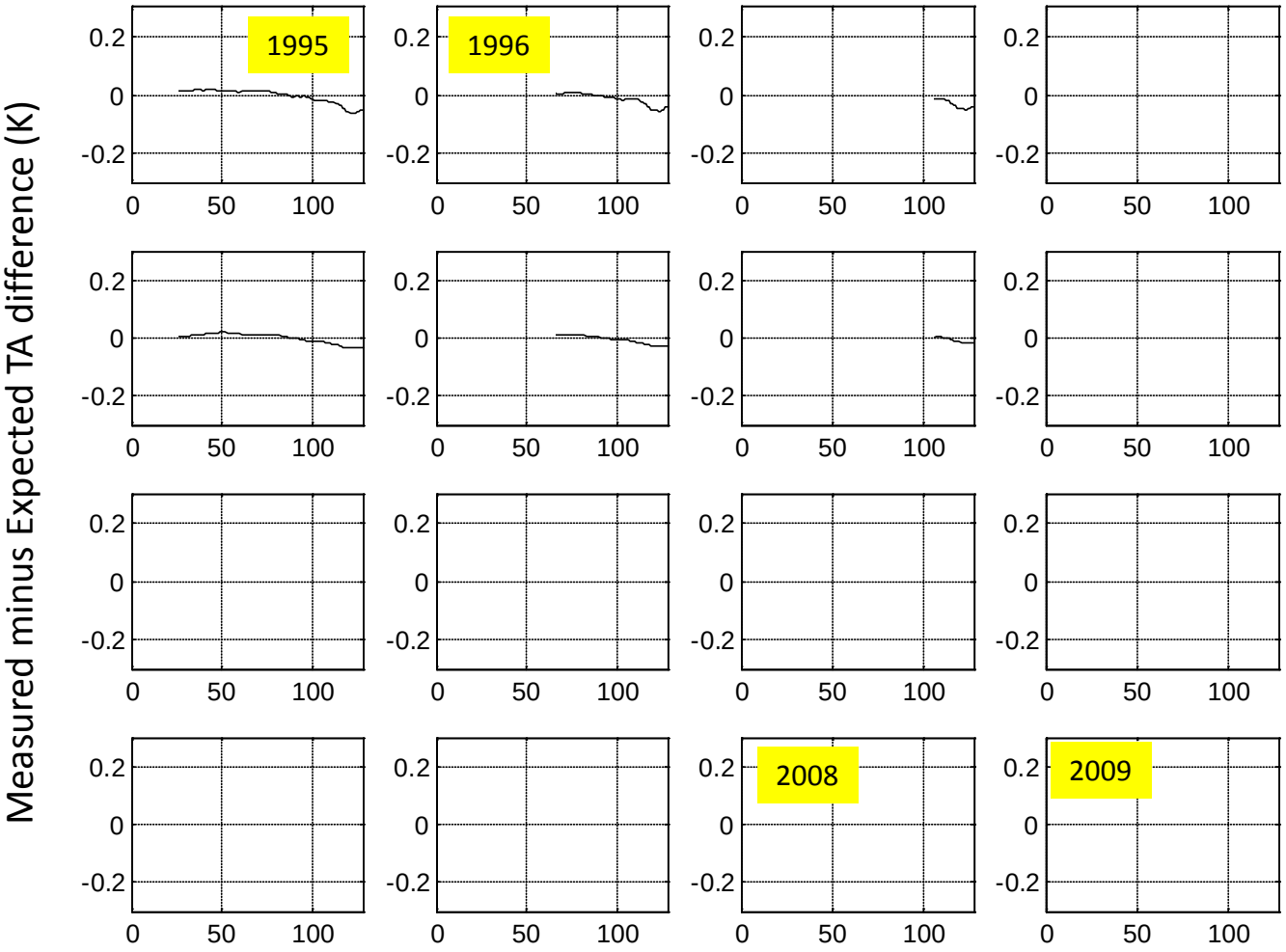
SSM/I and QuikScat first collocated using a 2-hour, 25-km window.
Plots show 3-month running mean window



Remote Sensing Systems
www.remss.com

F13 SSM/I Along-Scan Biases

Plots show difference between the measured antenna temperature (Tax) and a simulated Tax coming from a Radiative Transfer Model. Tax = Ta_vpol – 0.5*Ta_hpol (reduces atmospheric noise). Tax differences are plotted versus SSM/I scan position (1 to 128). Results are for F13 SSM/I

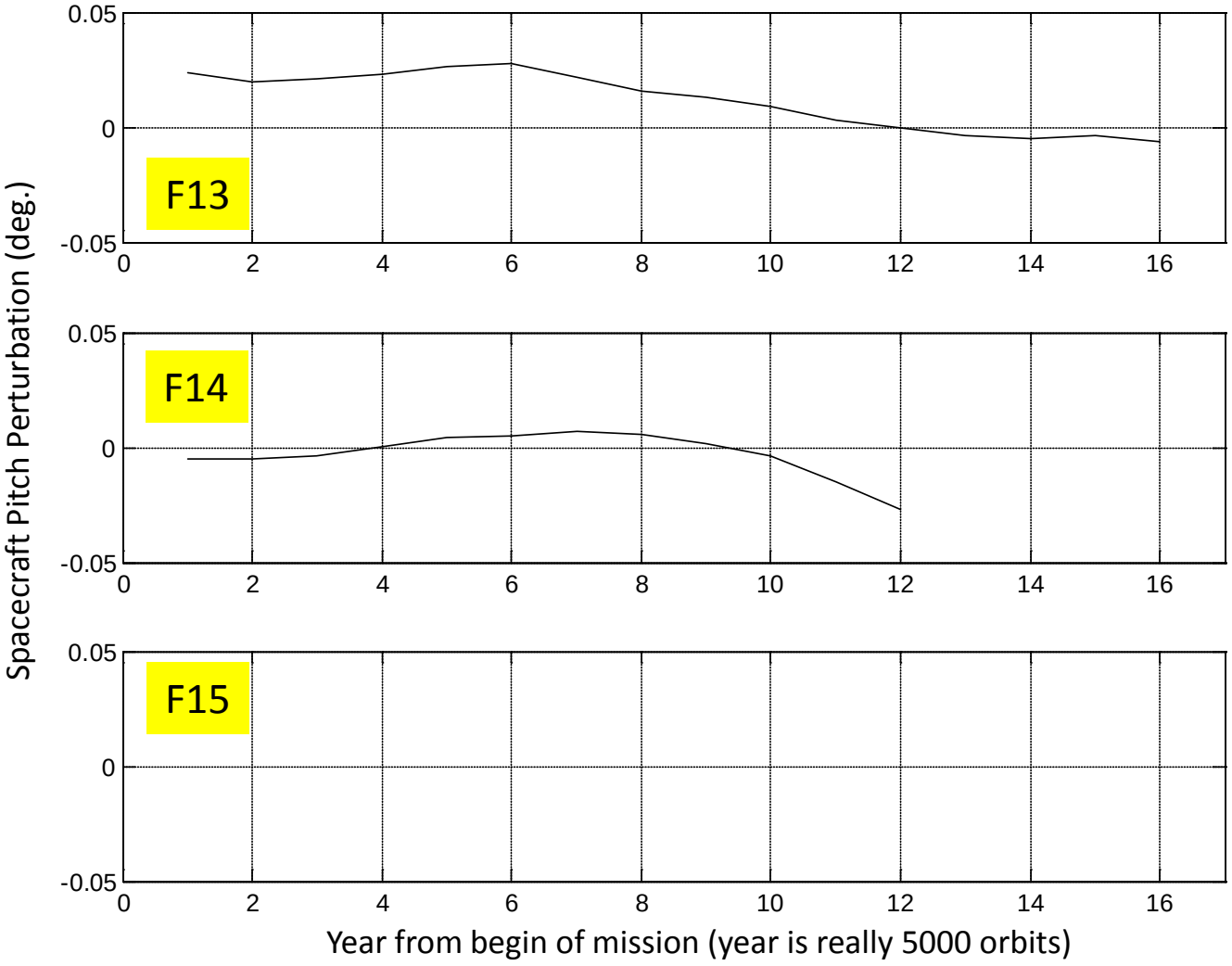


Each plot is actually 5000 orbits, not one year.
Hence there are 16 plots rather than 15

Remote Sensing Systems
www.remss.com

Spacecraft Pitch Perturbations

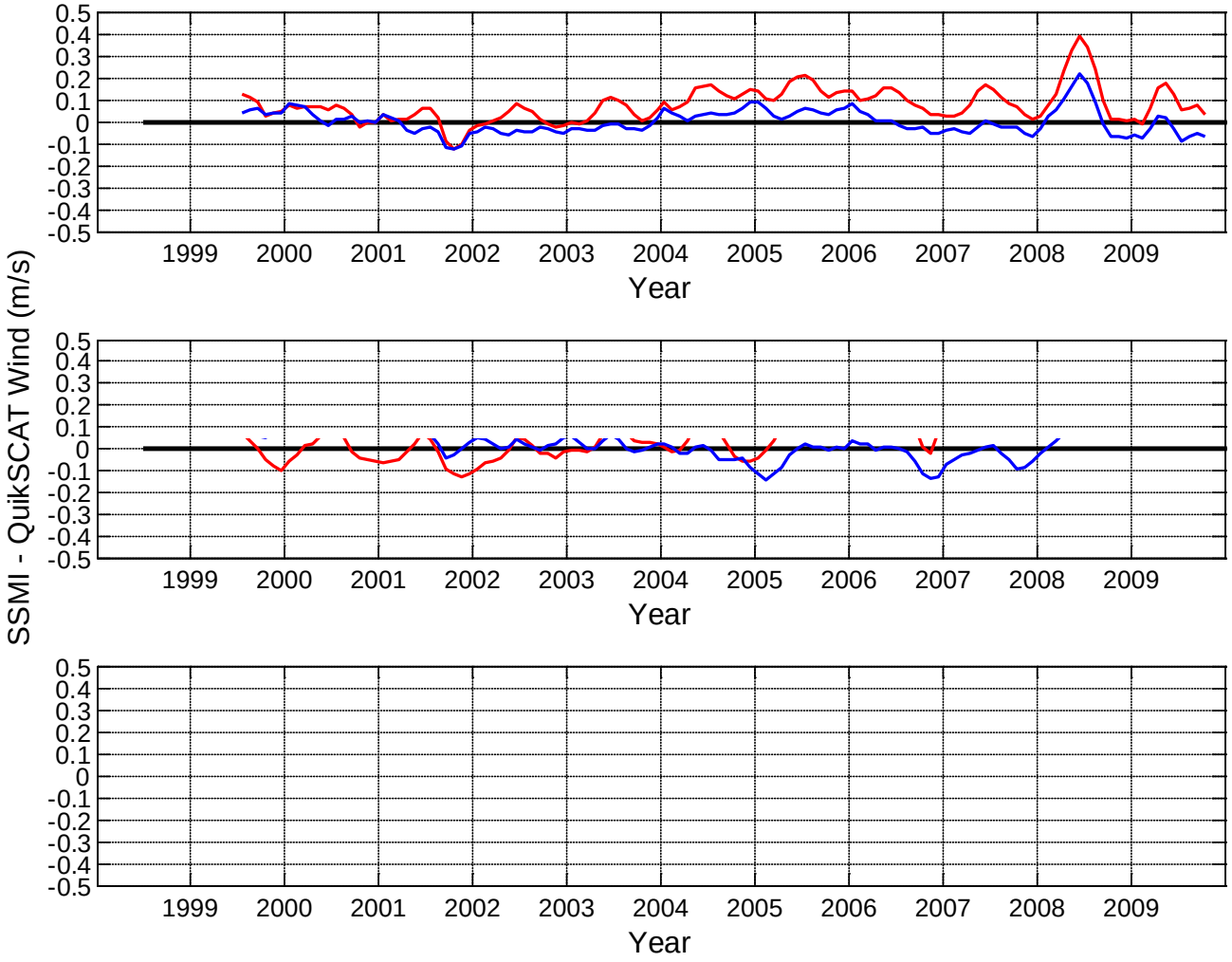
Wind retrieval increases by 3.2 m/s when Earth Incidence Angle is increased by 1 deg.
An increase of 1 deg. in pitch increases Earth Incidence Angle by 1.1 deg.
F13 change in pitch corresponds to a 0.1 m/s change in the wind retrieval



Remote Sensing Systems
www.remss.com

SSM/I Minus QuikScat Wind Speed Difference

Red is Version 6 Blue is Version 7



Remote Sensing Systems
www.remss.com

Comparison of Wind Trends

Wind Trends in units of m/s per decade

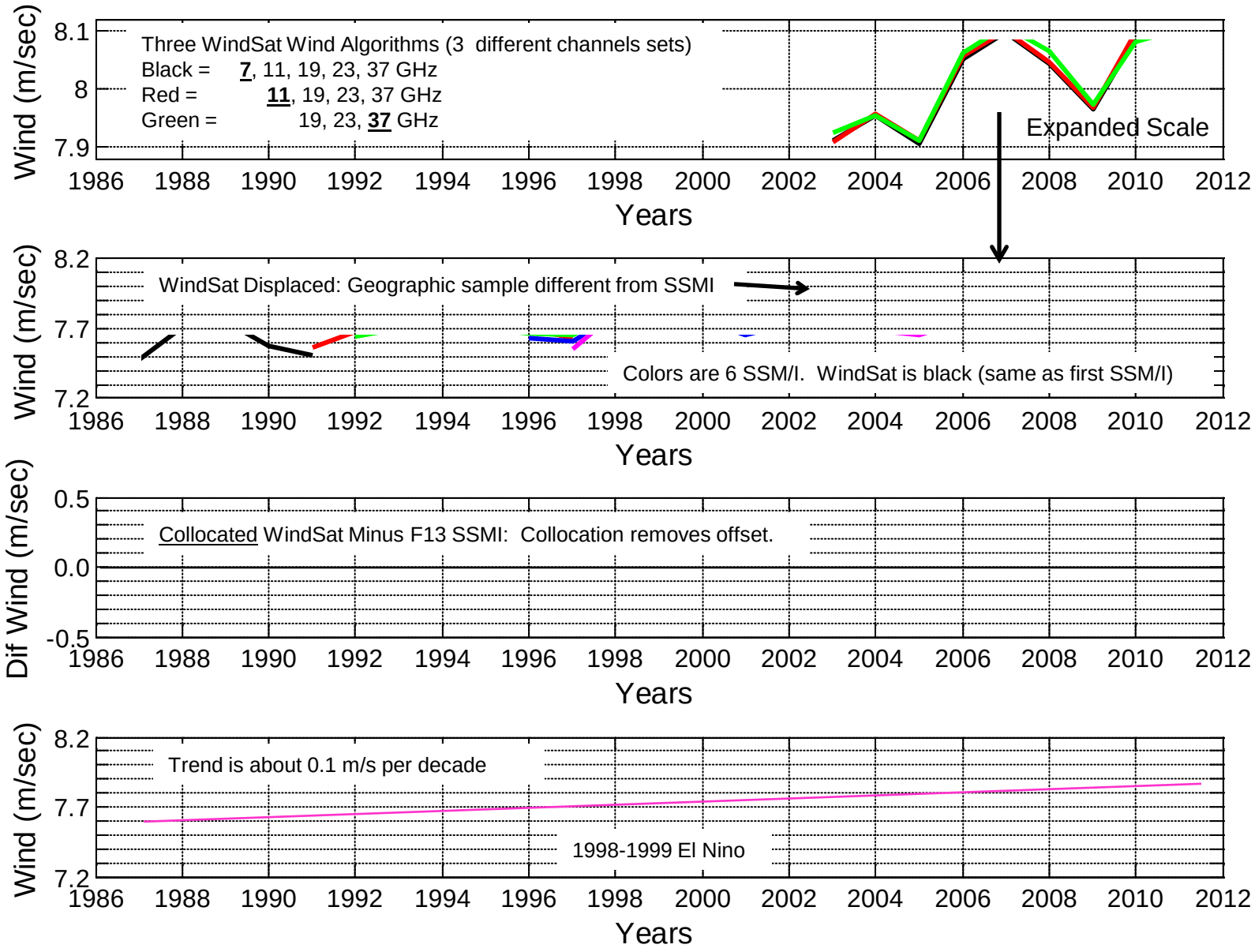
Note: These trends are NOT global trends.
They are computed at SSM/I and QuikScat collocation points.
Average latitude of collocation points slowly change in time for F14 and F15.
This is why trends for F14 and F15 have large negative values.

SSM/I	QuikScat Trend	SSM/I V6 Trend	SSM/I V7 Trend
F13	0.01	0.11	0.00
F14	-1.51	-1.12	-1.62
F15	-1.57	-1.49	-1.53

Remote Sensing Systems
www.remss.com

Wind Speed Time Series

Note: 0.1 m/s Scale



Error in Estimating Global Wind Trend

Standard Least-Squares Estimation

Error in estimating slope = measurement_error * sqrt(12/numobs^3)

numobs = 25 years
measurement_error = 0.1 m/s

Error in slope = 0.03 m/s per decade

Conclusion
An observed 0.1 m/s per decade trend is significant