

How we determine solar wind parameters for the past 150 years.

L. Svalgaard

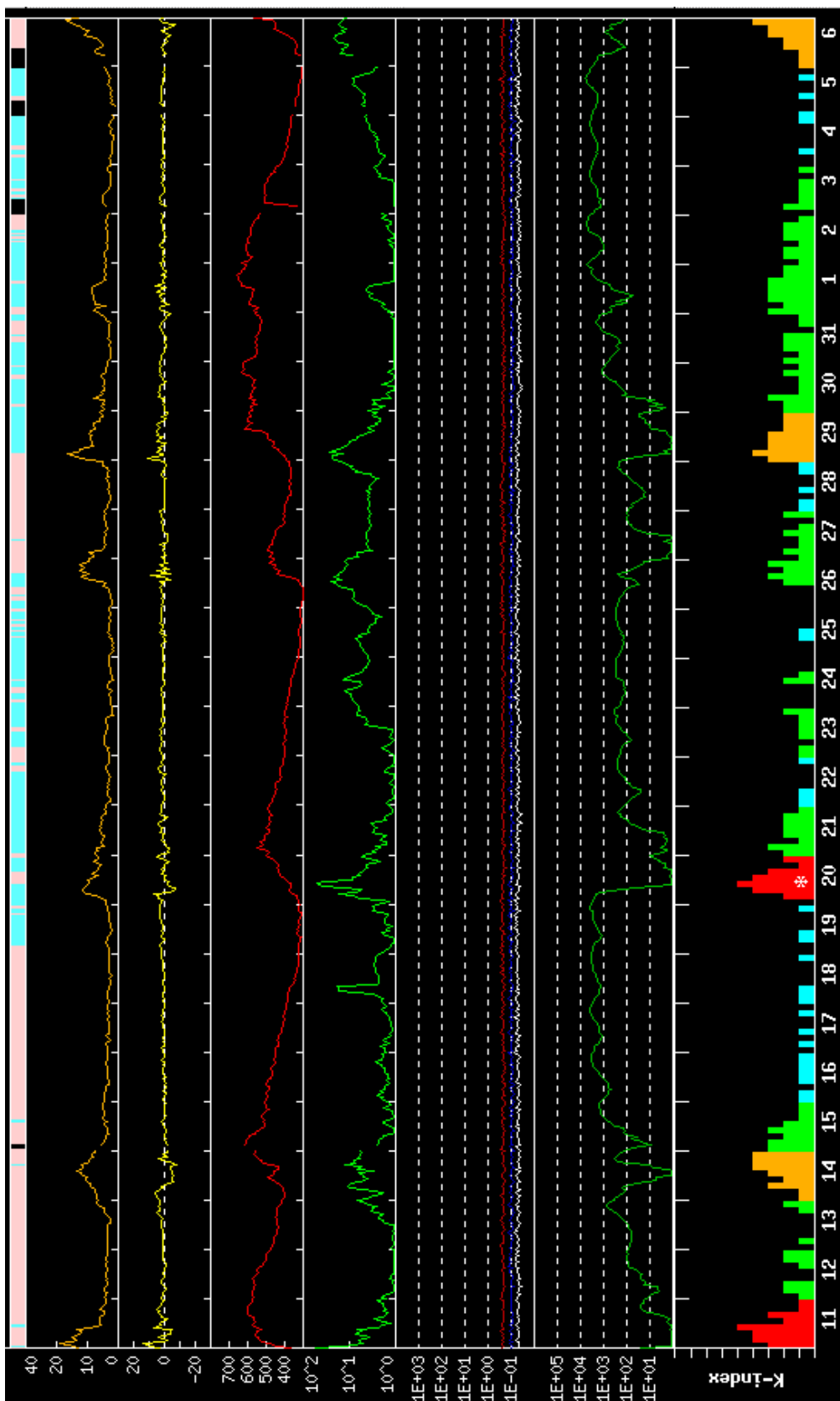
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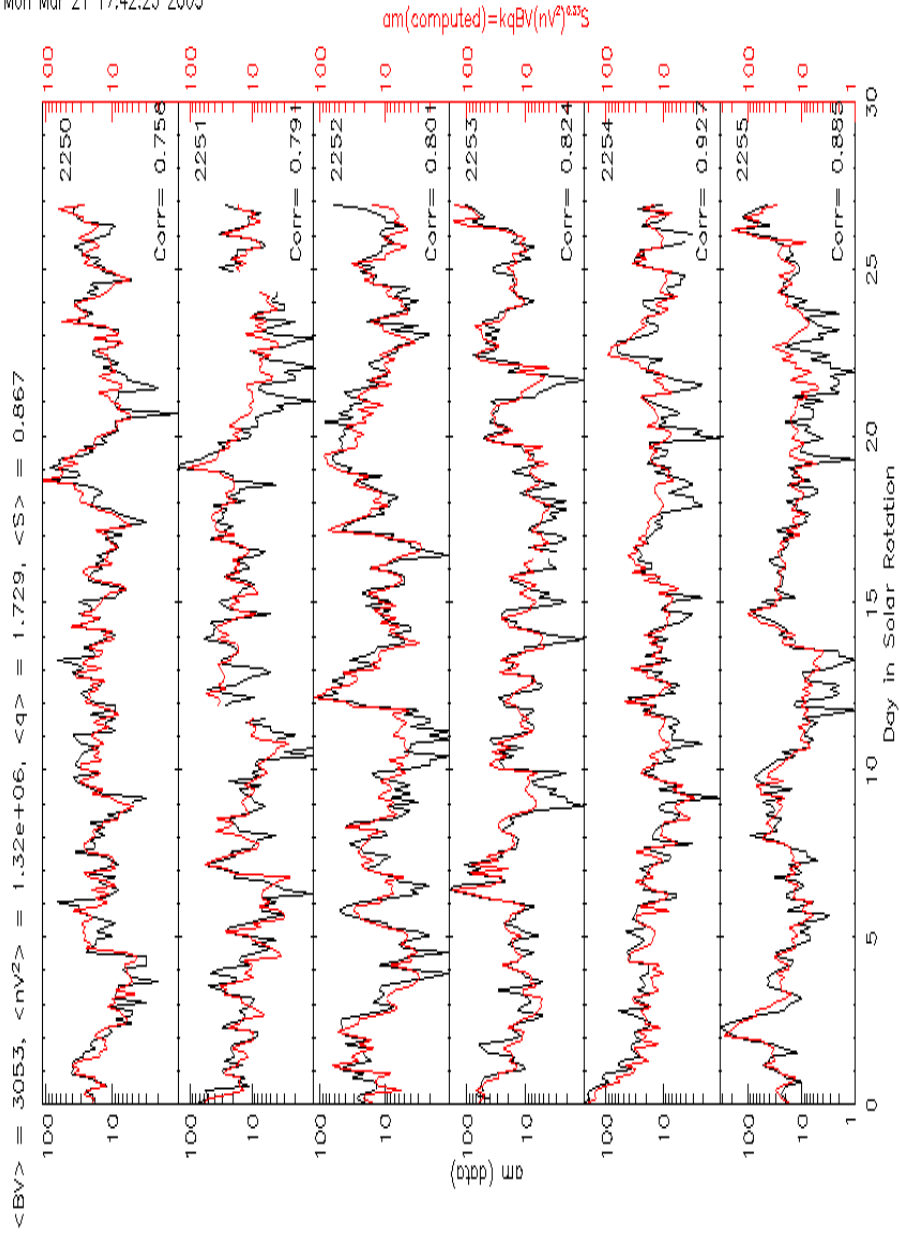
Abstract

The solar wind and its embedded interplanetary magnetic field (IMF) buffet the Earth's magnetosphere resulting in continuous geomagnetic activity, waxing and waning with the changing wind. The very complex phenomenon of geomagnetic activity is described by "geomagnetic indices". Different indices respond with different sensitivities to different parameters of the solar wind; some are most sensitive to changes in the magnetic field, B; some are more sensitive to the solar wind speed, V. By exploiting these different dependencies we can determine both B and V and their possible long-term trends. In particular we find that at each solar minimum B returns to an almost constant "floor" value of ~ 4.5 nT, implying that there is no secular trend in the strength of the IMF.

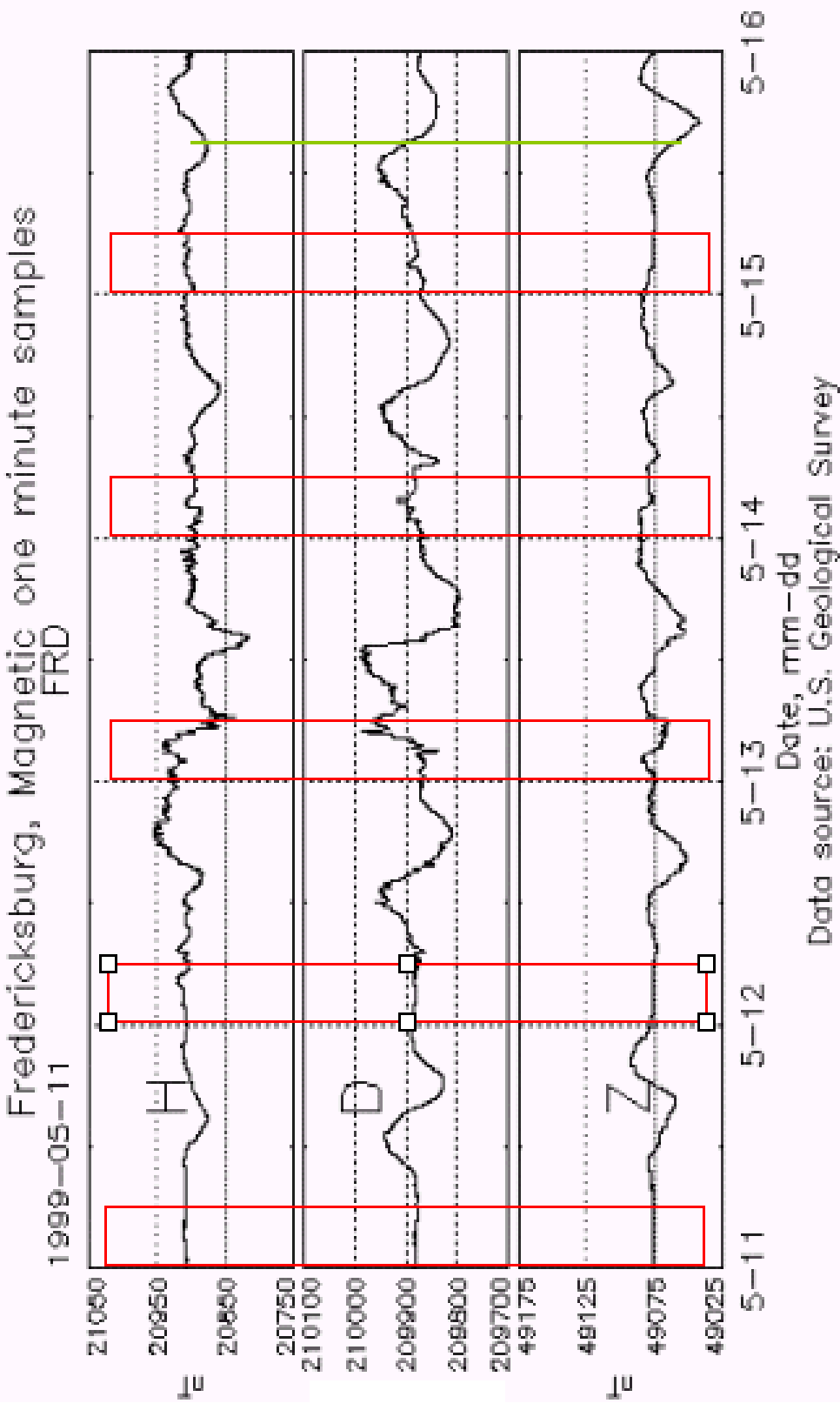


$$A = k q(a,f) (B V) (n V^2)^{1/3} \sim B V^2$$

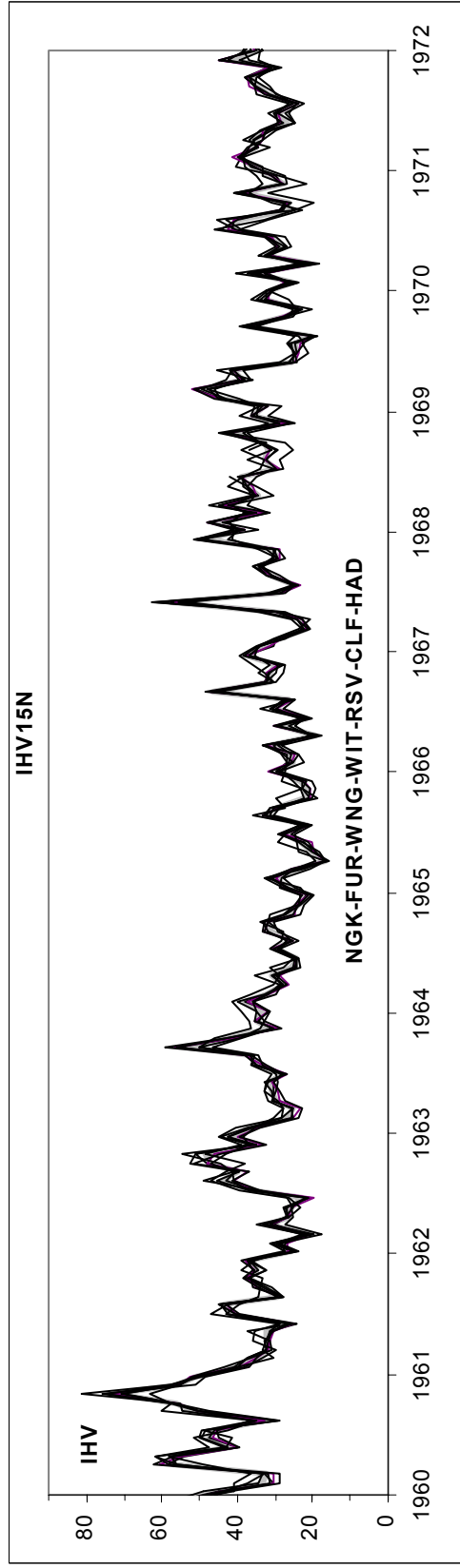
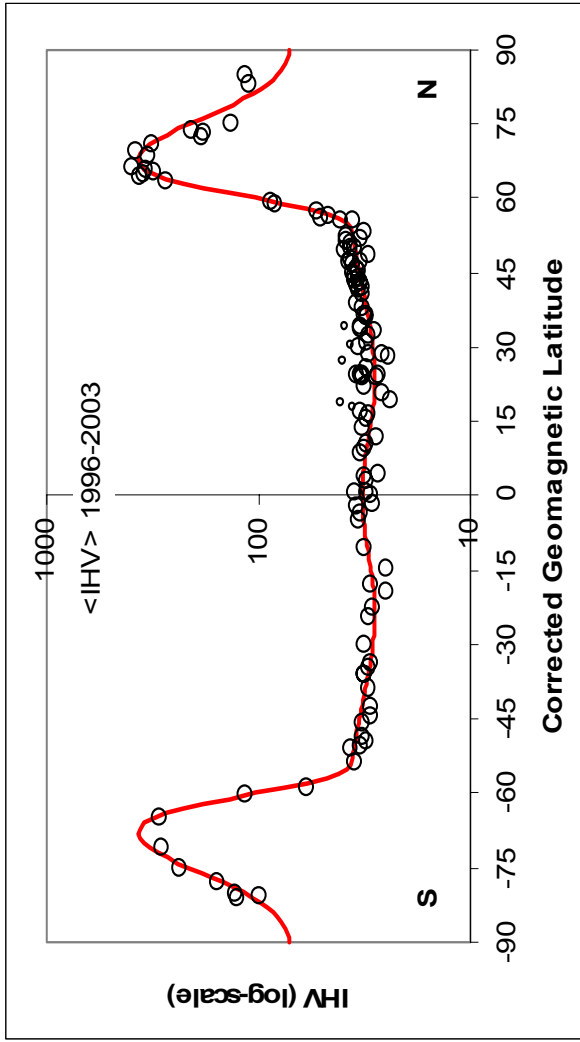
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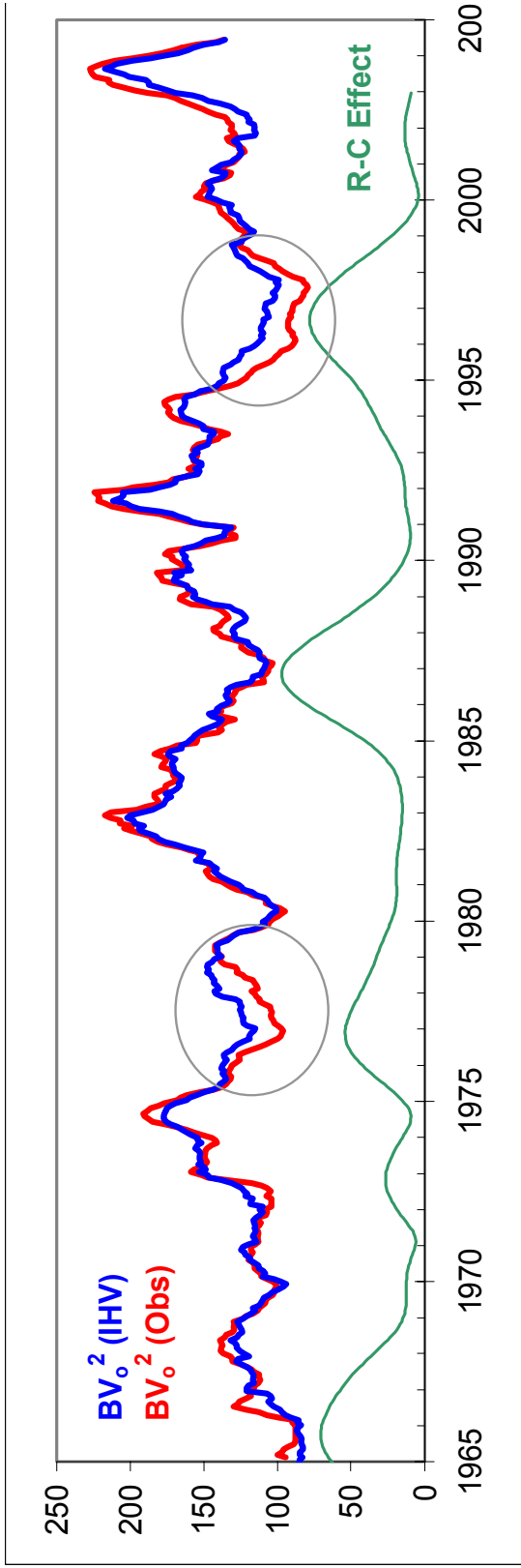
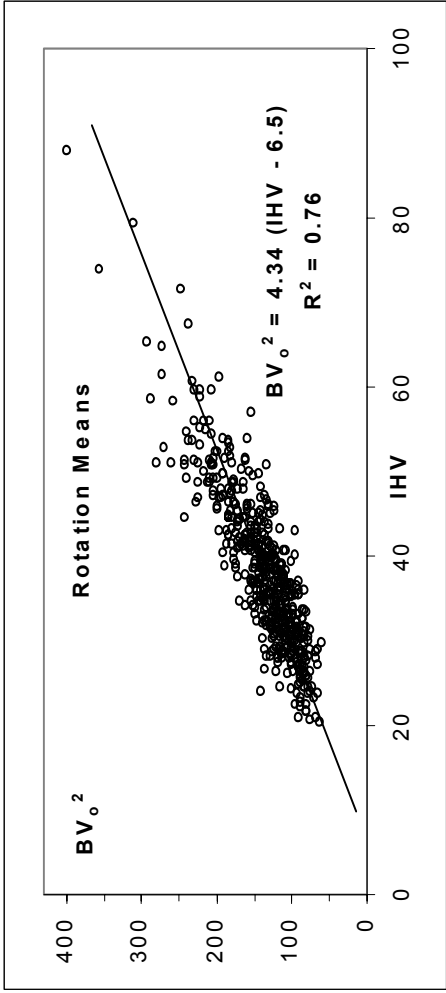


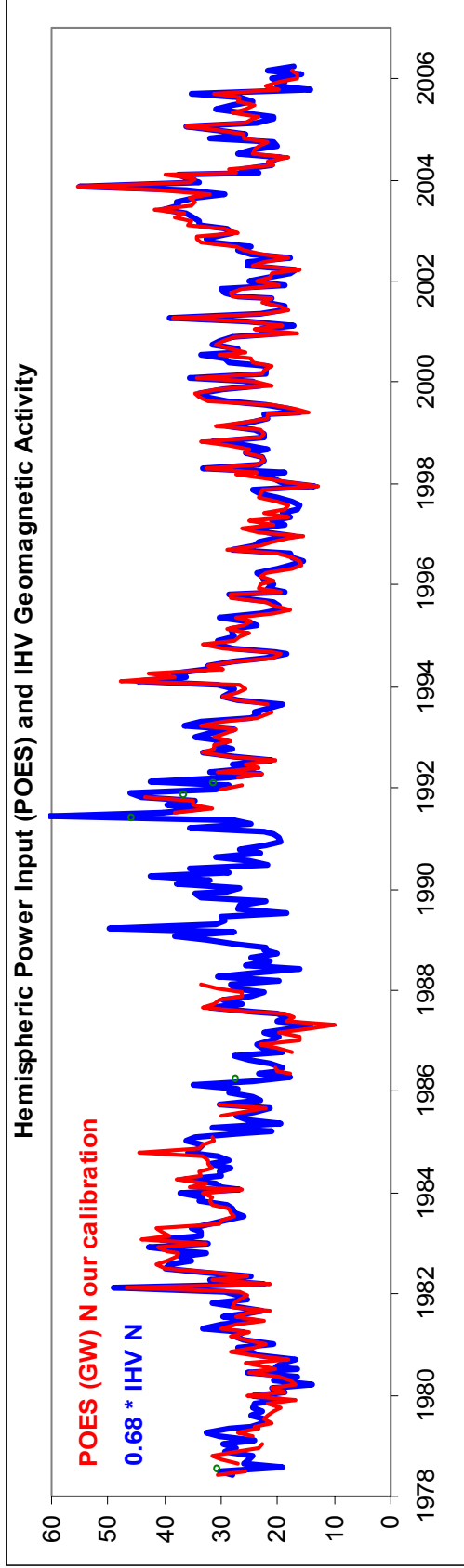
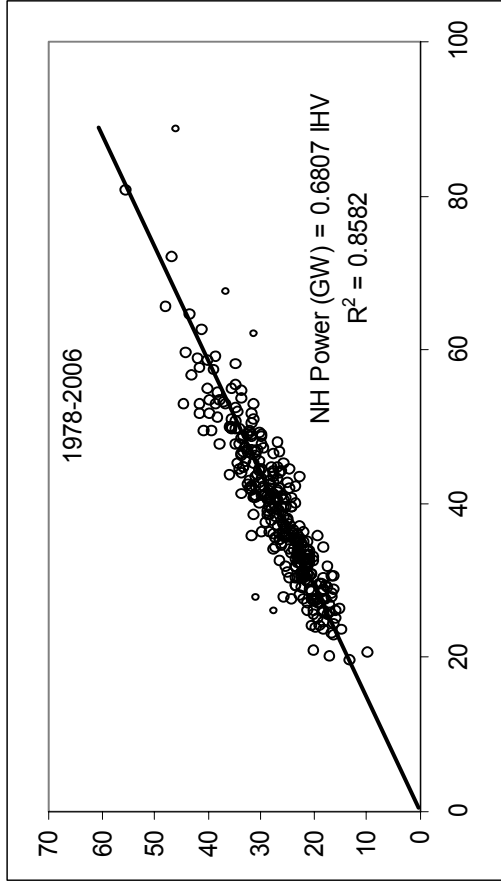
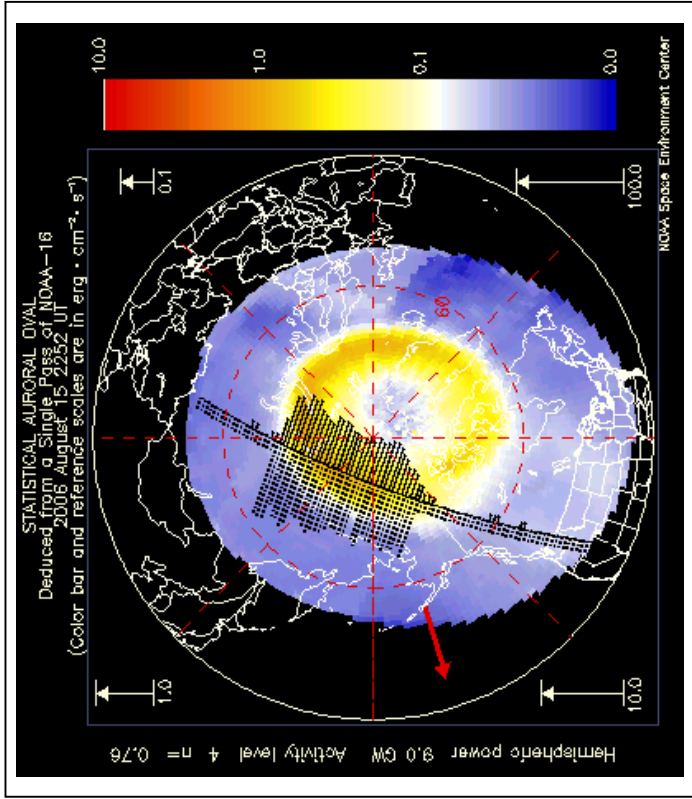
$$Cq = 13.22 \exp(-1.090 \cos \alpha + 1.232f + 0.417 \cos^2 \alpha + 1.733f \cos \alpha + 0.601f^2 + 0.141 \cos^3 \alpha - 1.214f \cos^2 \alpha - 2.033f^2 \cos \alpha - 2.044f^3 + 0.089 \cos^4 \alpha - 0.116 \cos^3 \alpha + 0.801f^2 \cos^2 \alpha + 1.262f^3 \cos \alpha + 1.050f^4)$$



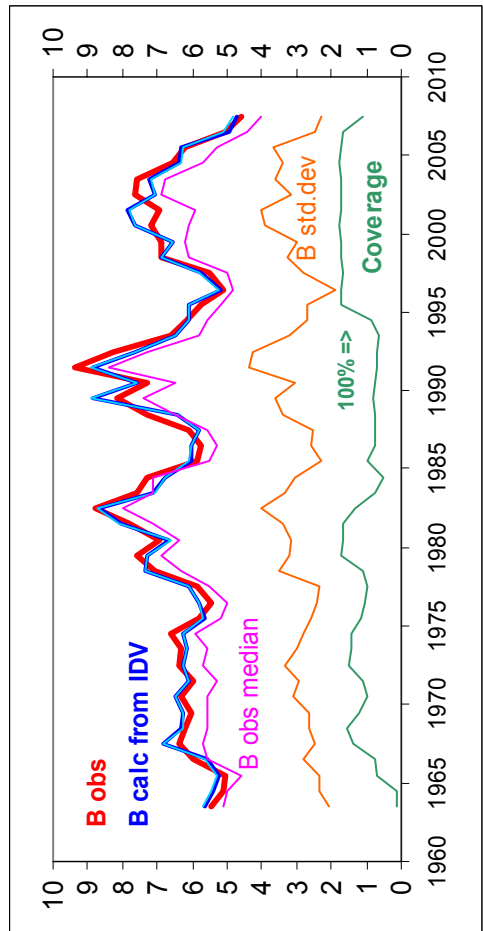
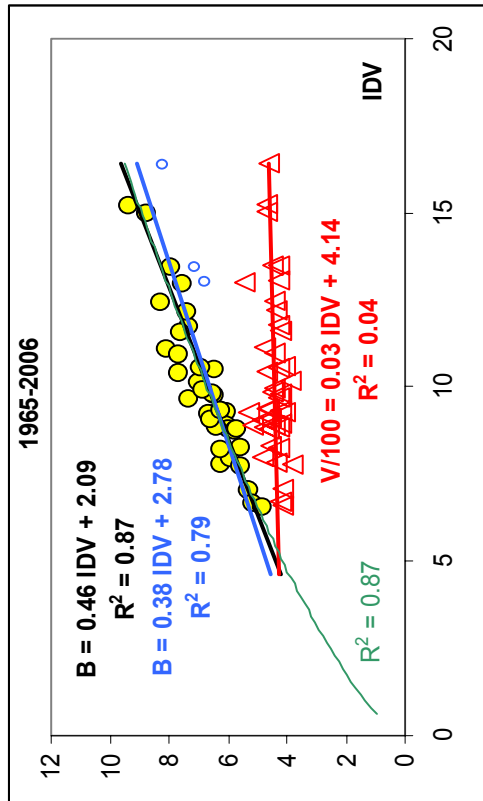
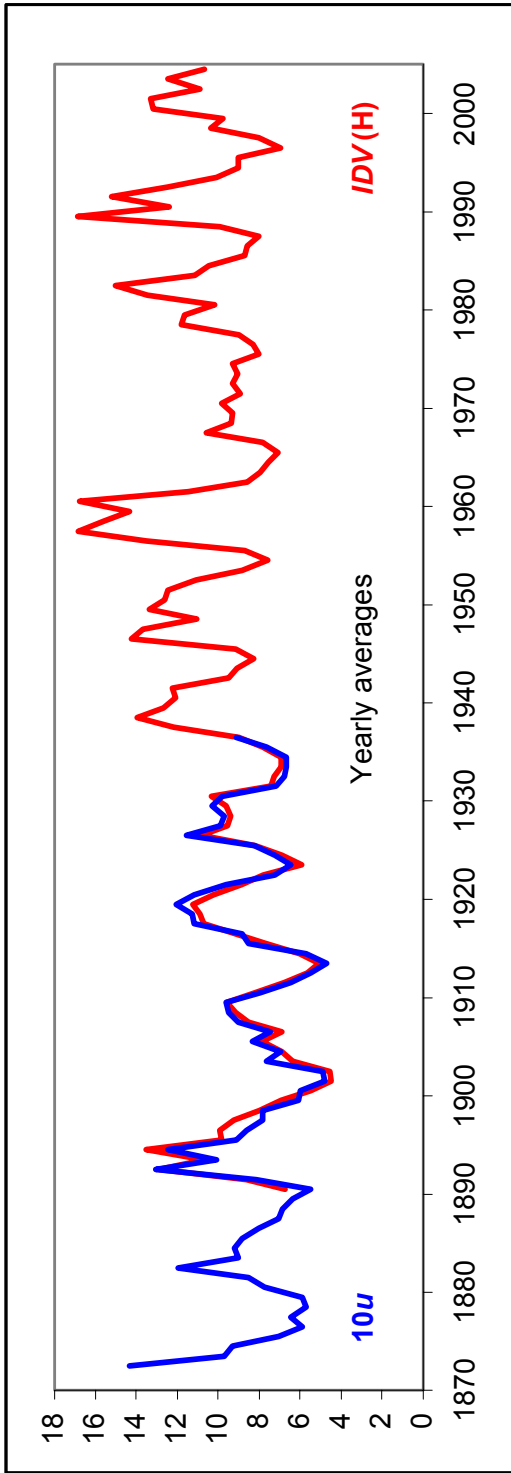
IHV = sum of unsigned differences between 7 hourly means centered at midnight



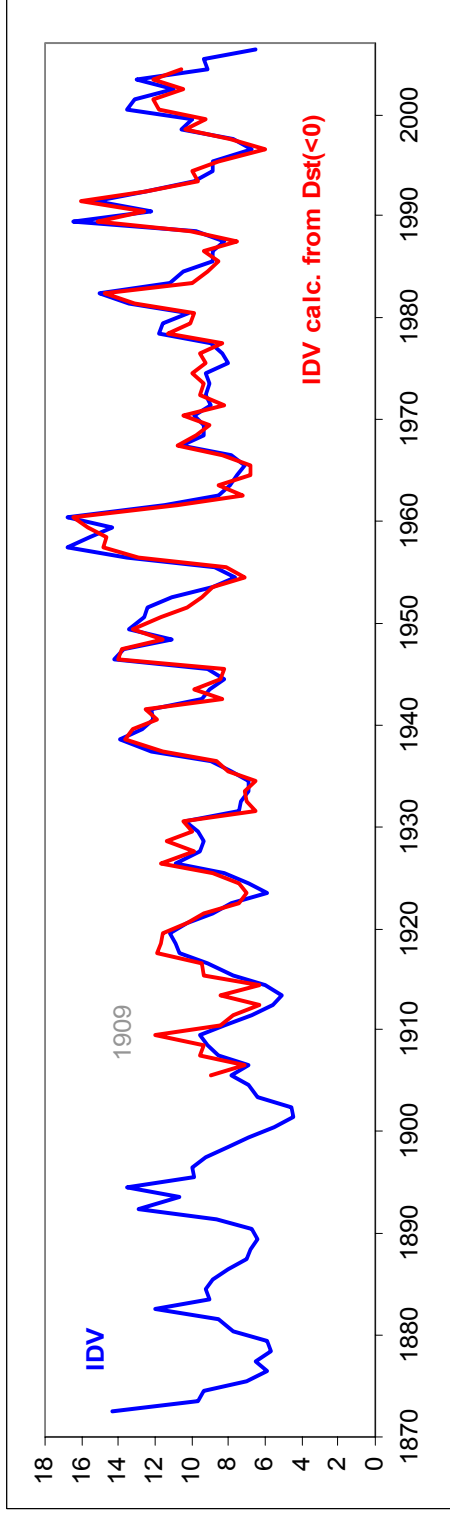
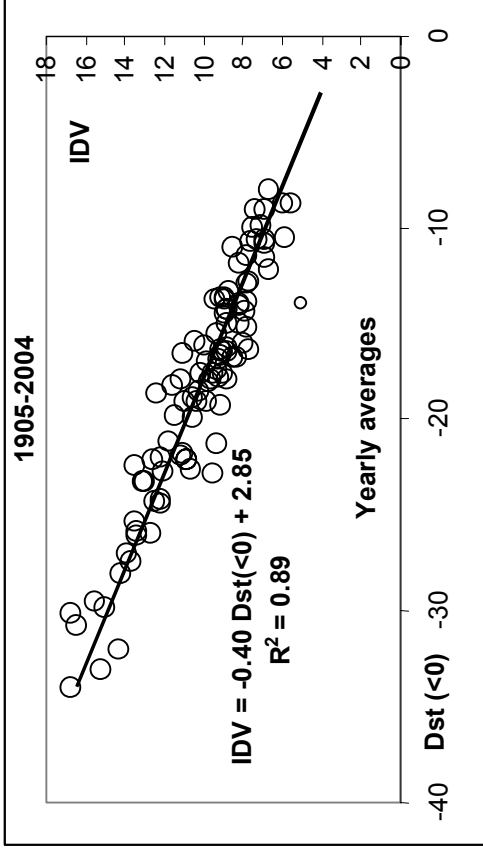




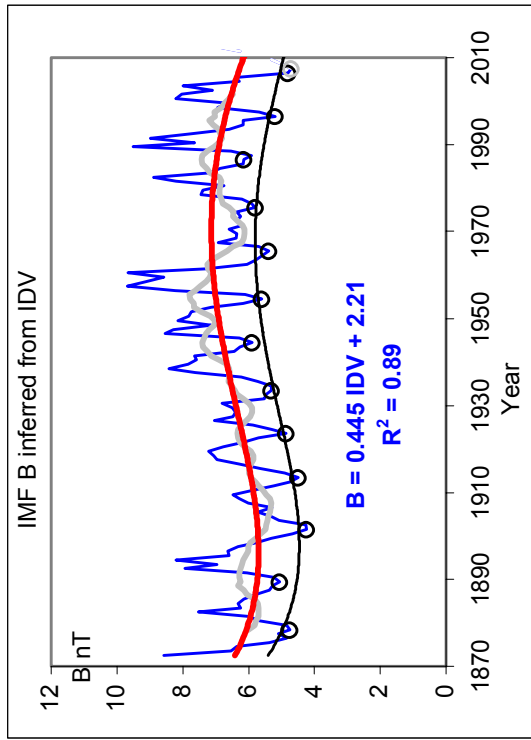
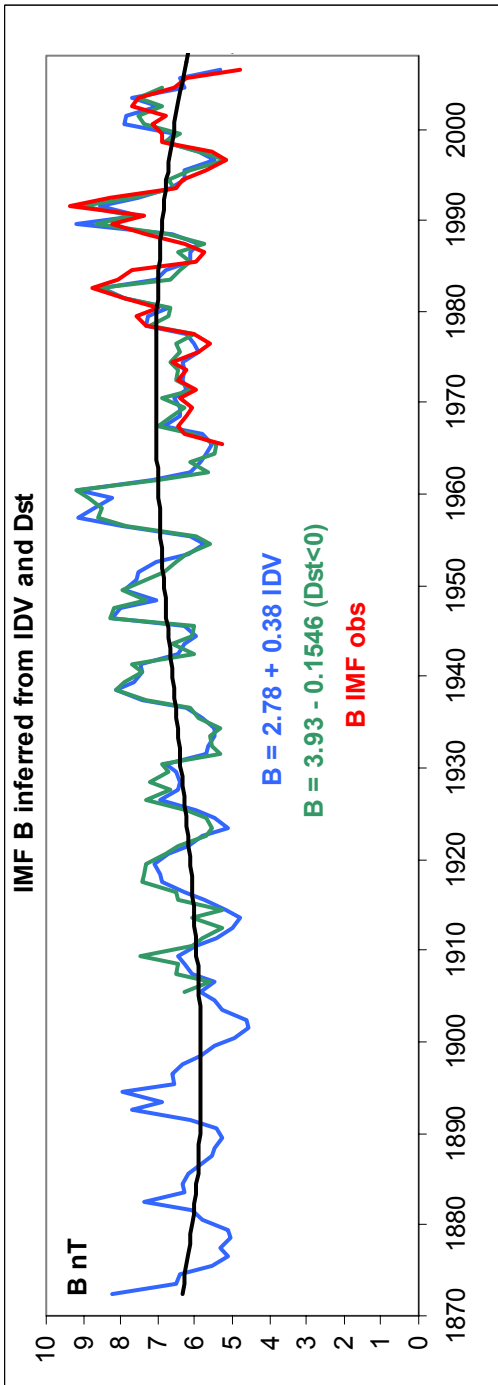
IDV = Average unsigned difference between the midnight hourly means from one day to the next.

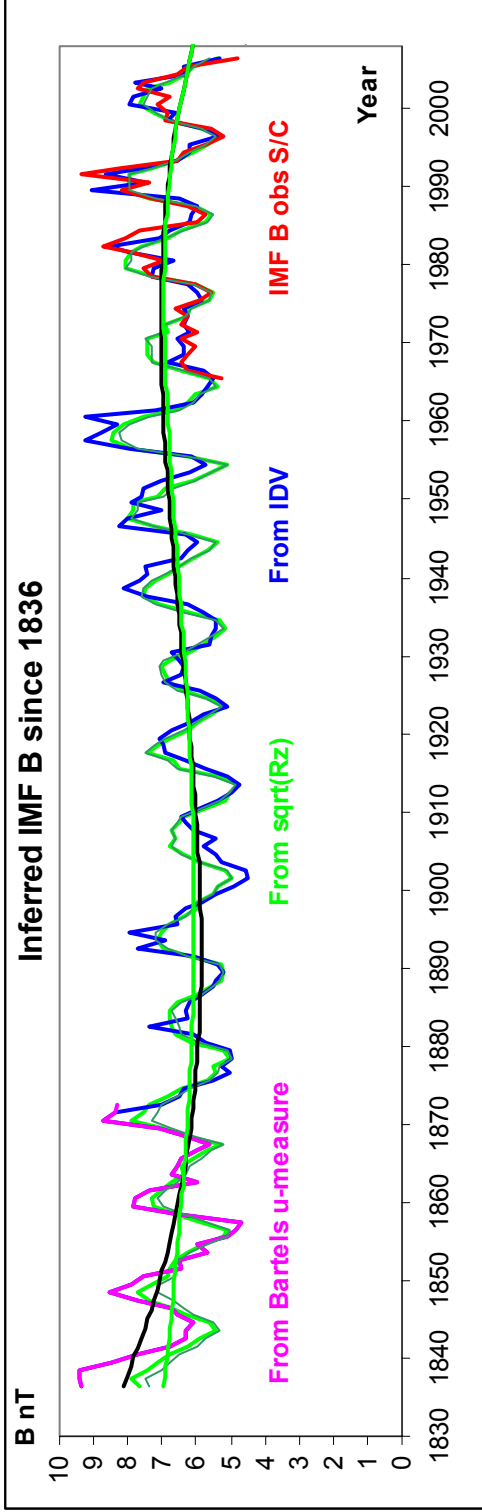
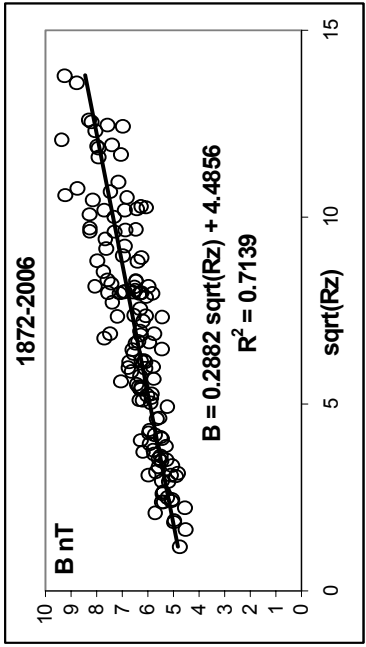


IDV is closely related to negative values of Dst:

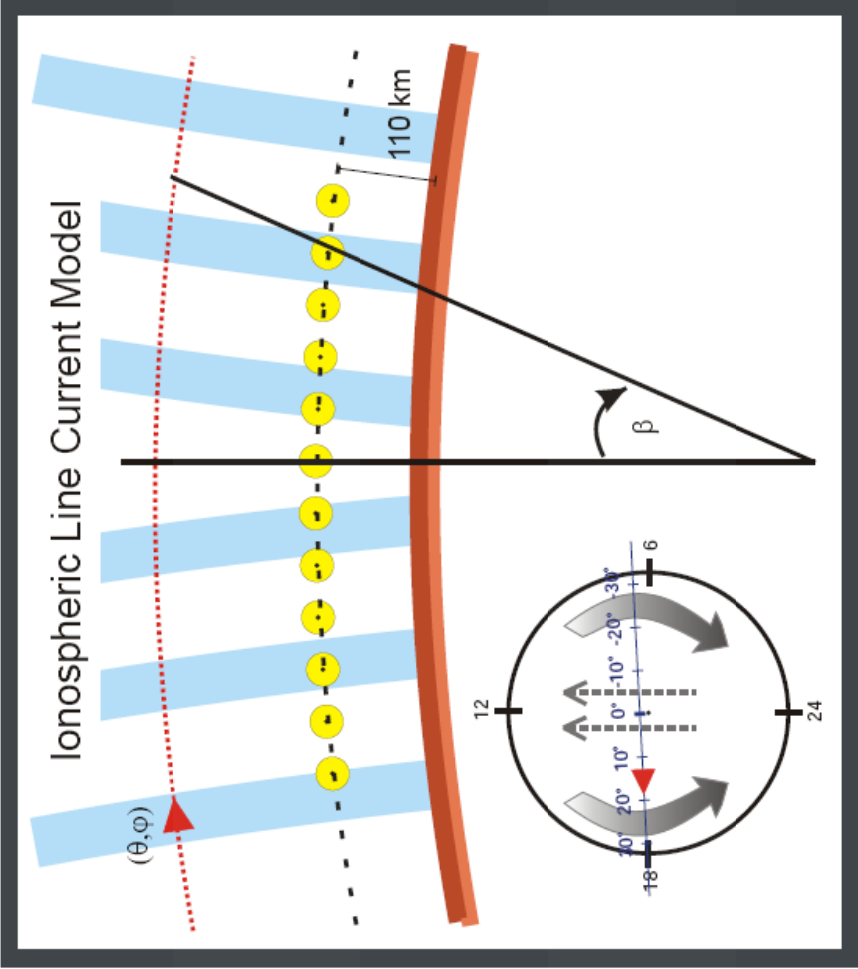


J. Love has calculated Dst back to 1905.

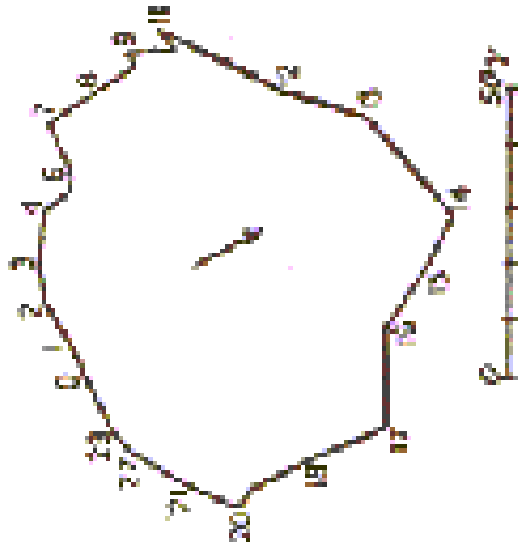




Polar Cap Current Sheet

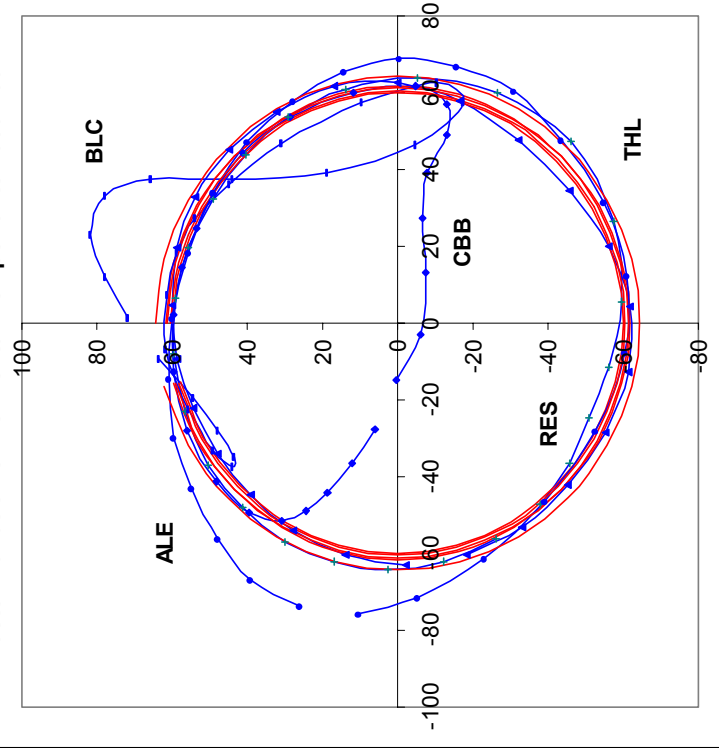


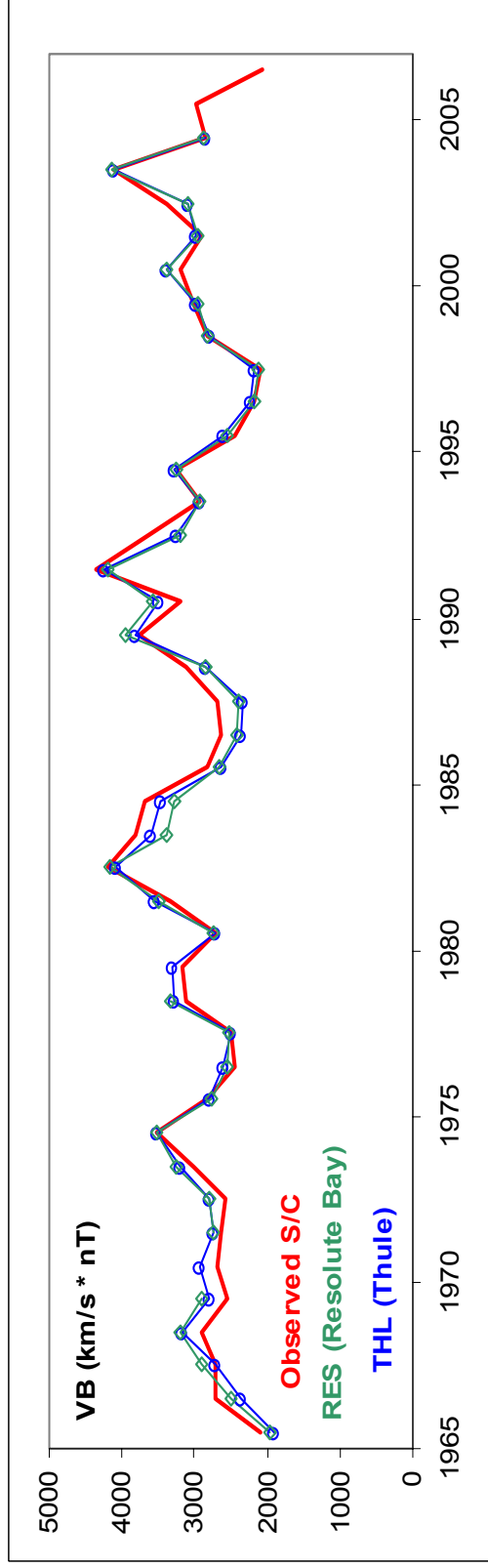
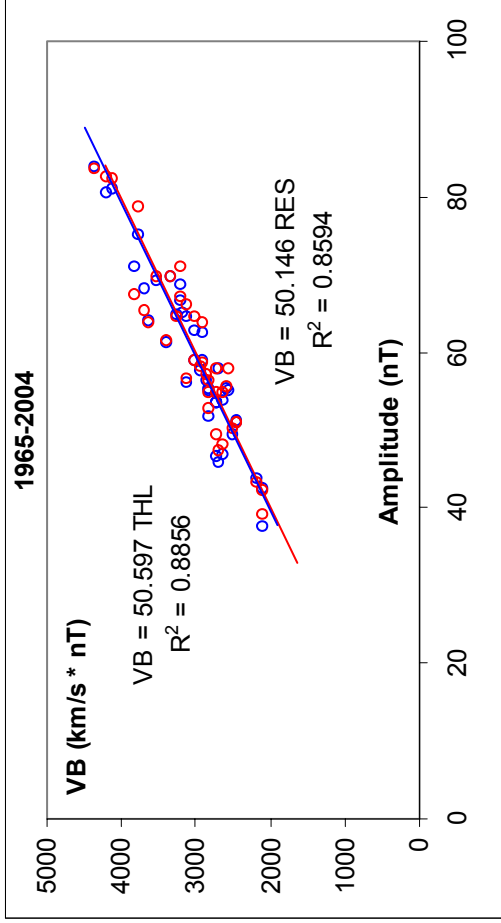
Kingua Fjord 1882-1883

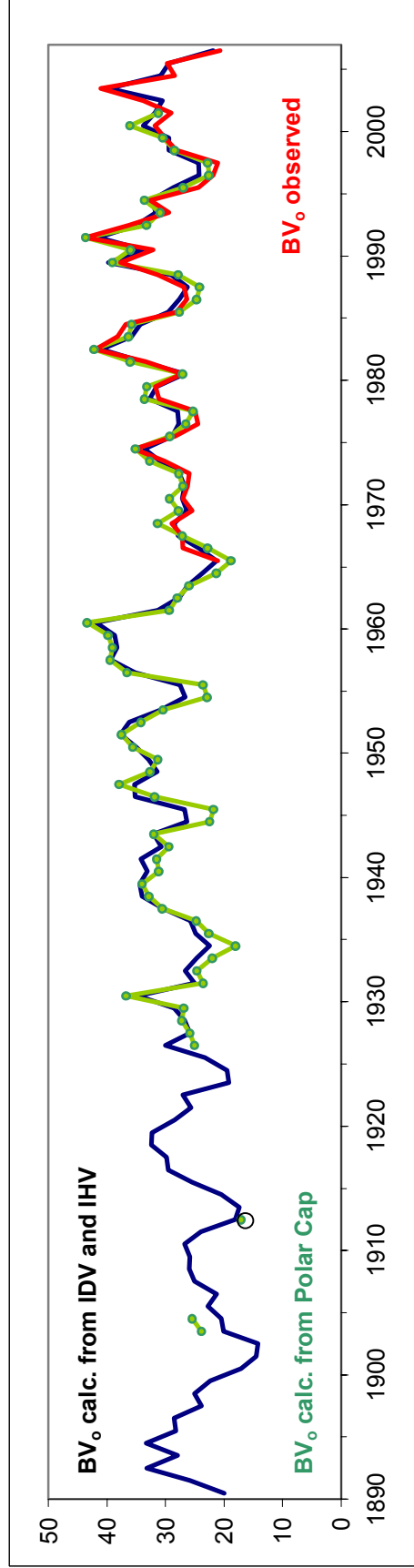
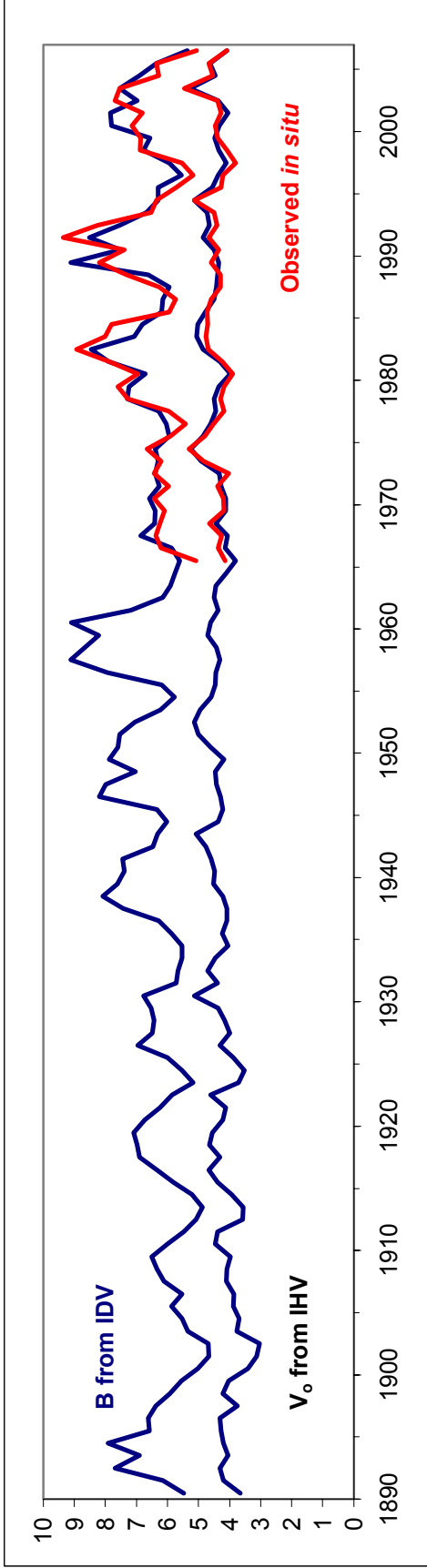


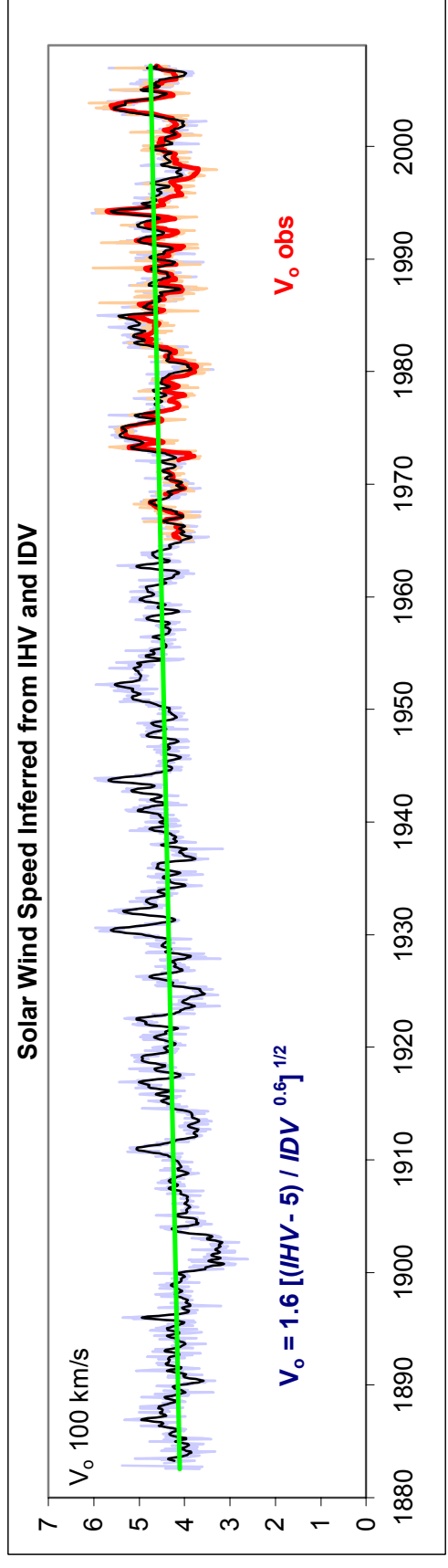
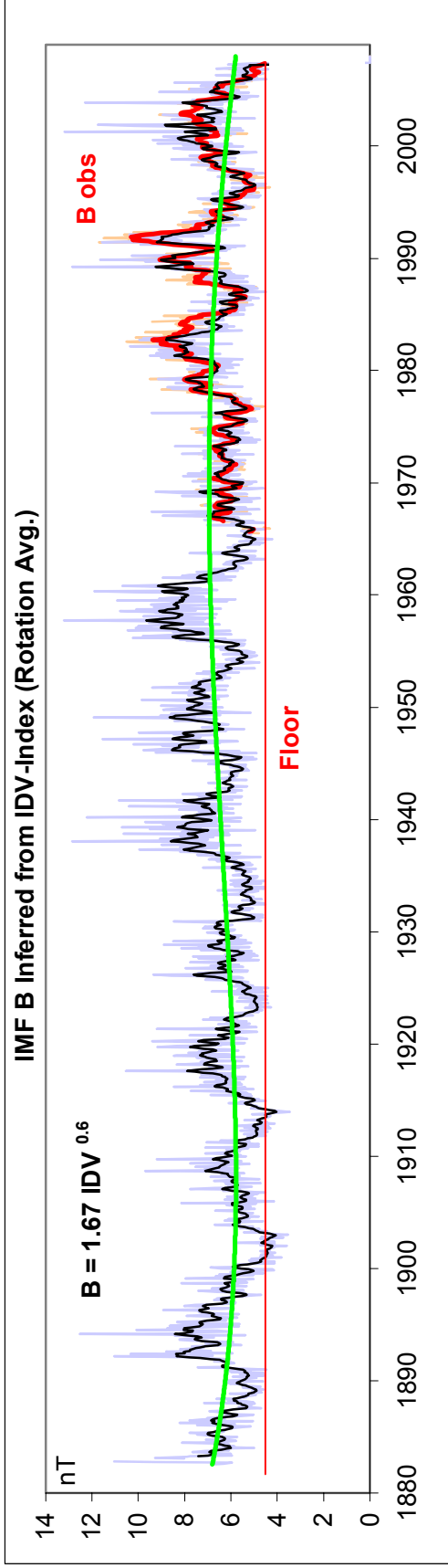
KINGUA-FJORD

Vector Variation of Horizontal Components 1980-2004









The Floor in IMF B