

Supplementary Material

Results of hyperbolic-logarithmic and logarithmic approximation of spiral signatures on SAR images

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Supplemental file 1_Alma

SAR image index: 20020530014925

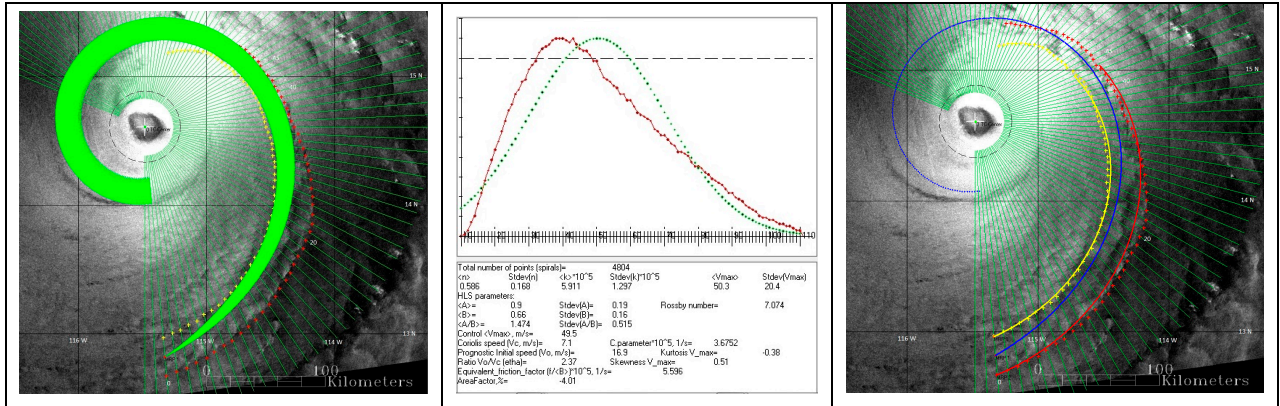


Fig. 1S1. HLS-approximation of the spiral band on SAR image of TC Alma at $R_m=30$ km; left panel: family of signature spirals; center panel: histogram of distribution of maximum speeds; right panel: mean HLS of the spiral band (blue curve), trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral; approximated interval 0-43 points

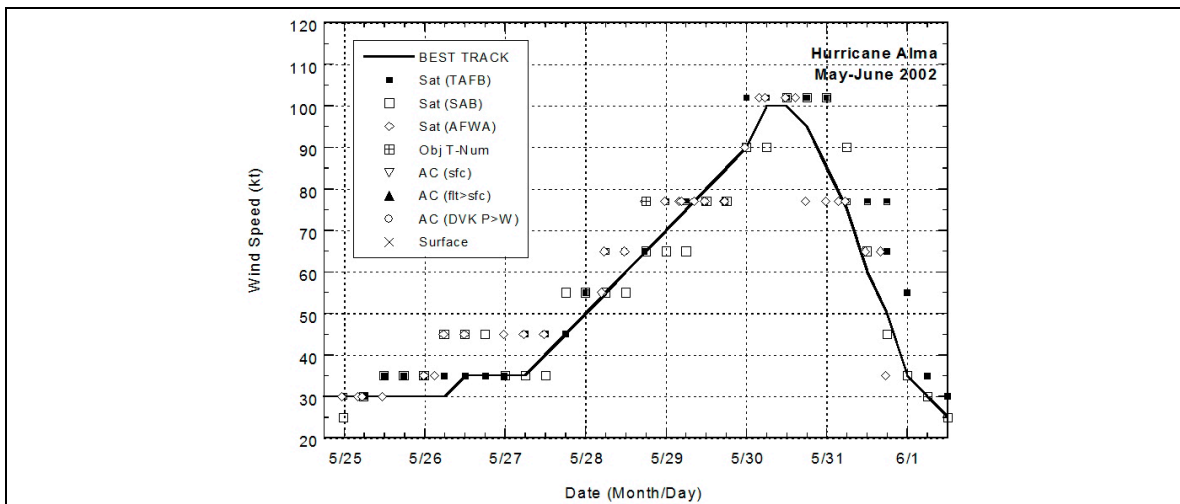


Fig. 2S1. Best Track data for TC Alma

Source: Stewart S.R. Tropical Cyclone Report Hurricane Alma 24 May-1 June 2002.

National Hurricane Center, 24 July 2002.

https://www.nhc.noaa/data/tcr/EP012002_Alma.pdf.

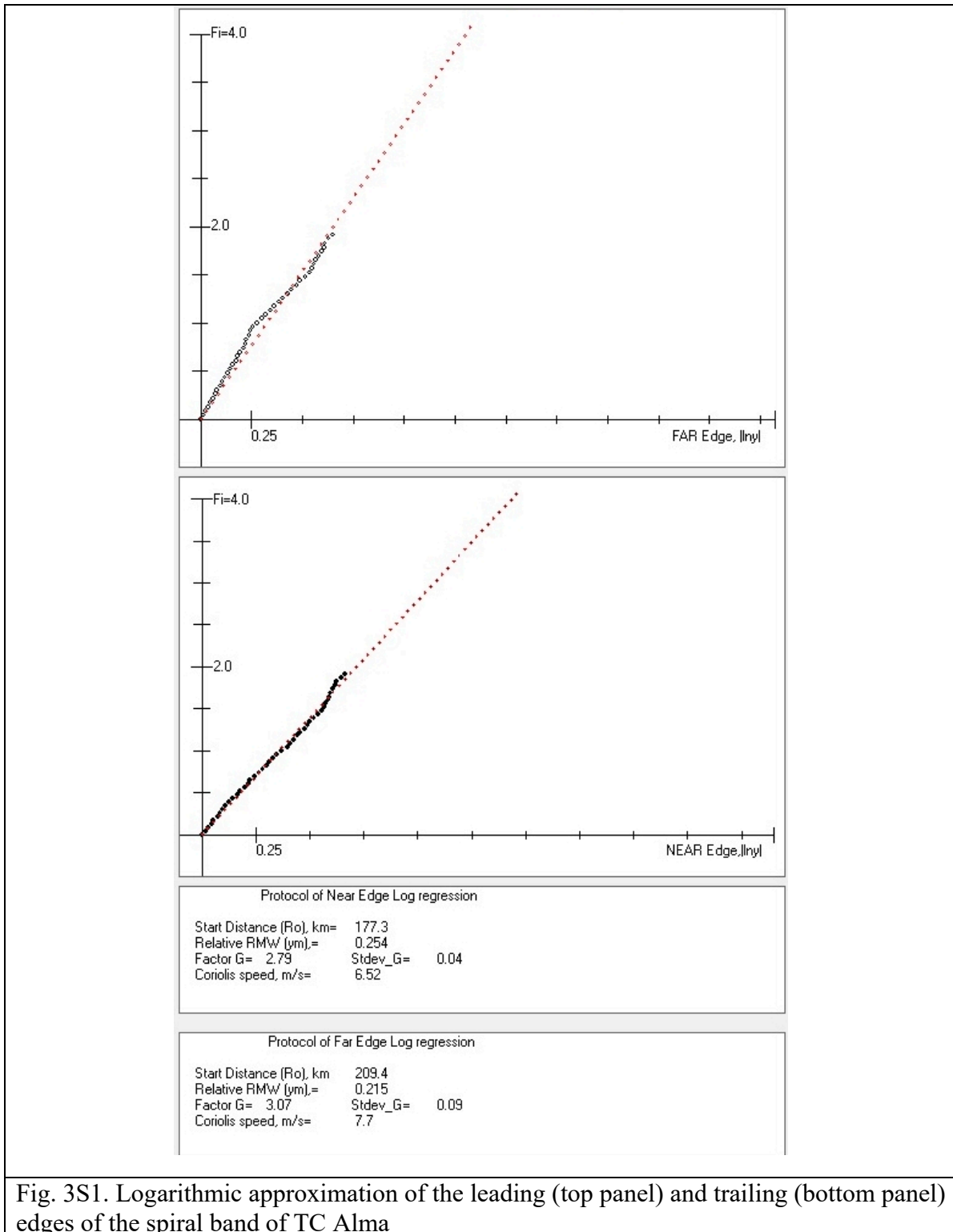


Fig. 3S1. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Alma

Supplemental file 2_Dean

SAR Image index: 20070819231634

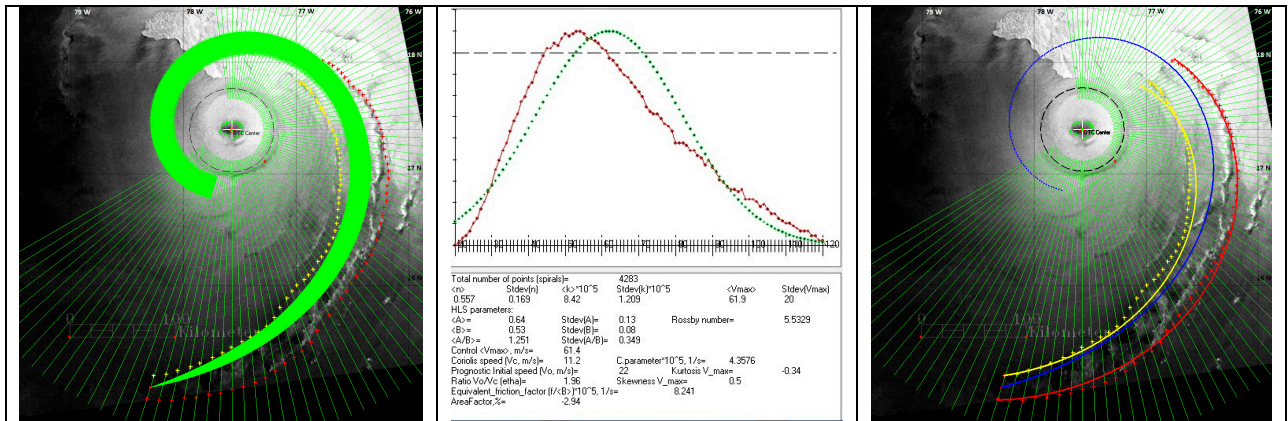


Fig. 1S2. HLS-approximation of spiral band of TC Dean at $R_m=50$ km and V_m range=20-120 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

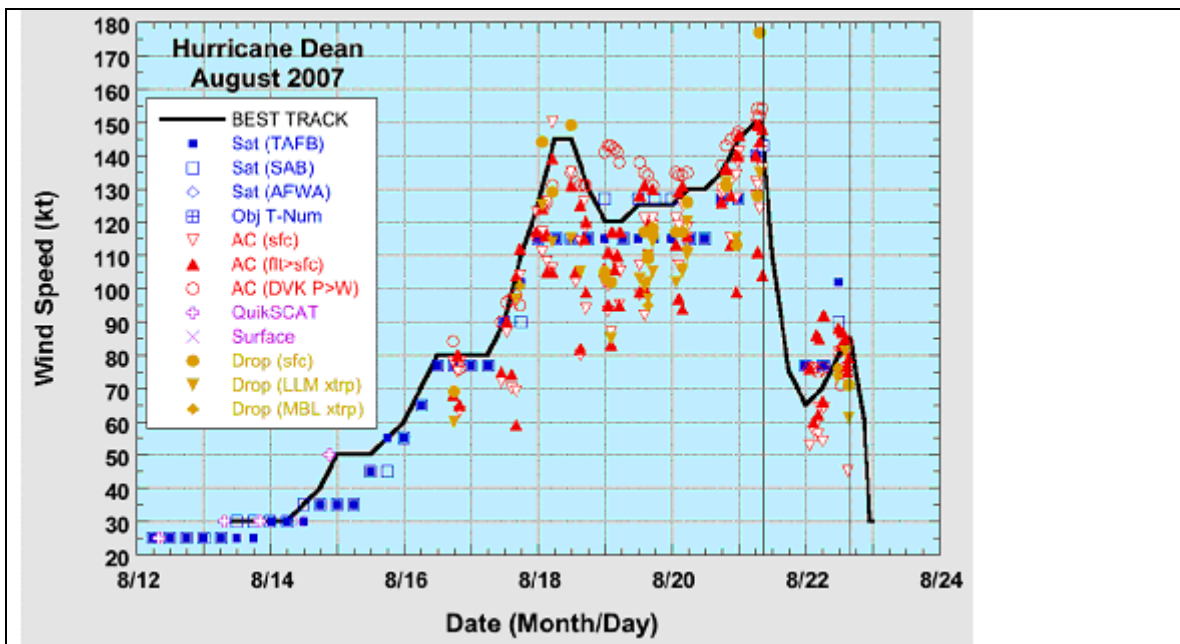


Fig. 2S2. Best track data for TC Dean

Source: Franklin J.L. Tropical Cyclone Report Hurricane Dean (AL042007) 13-23 August 2007. National Hurricane Center, 31 January 2008.
https://www.nhc.noaa.gov/data/tcr/AL042007_Dean.pdf

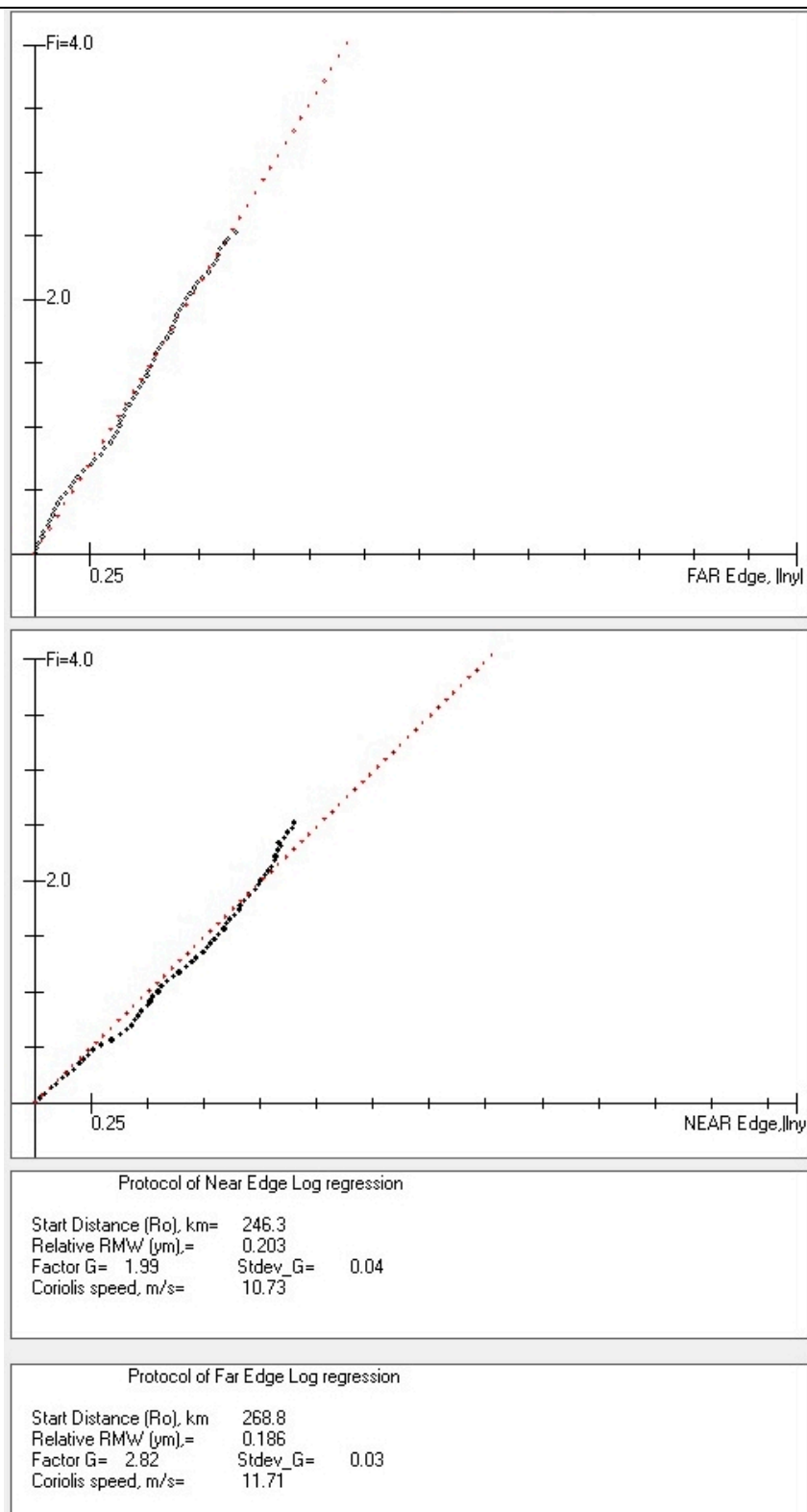


Fig. 3S2. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Dean

Supplemental file 3_Ewiniar

SAR Image index: 20060703205345

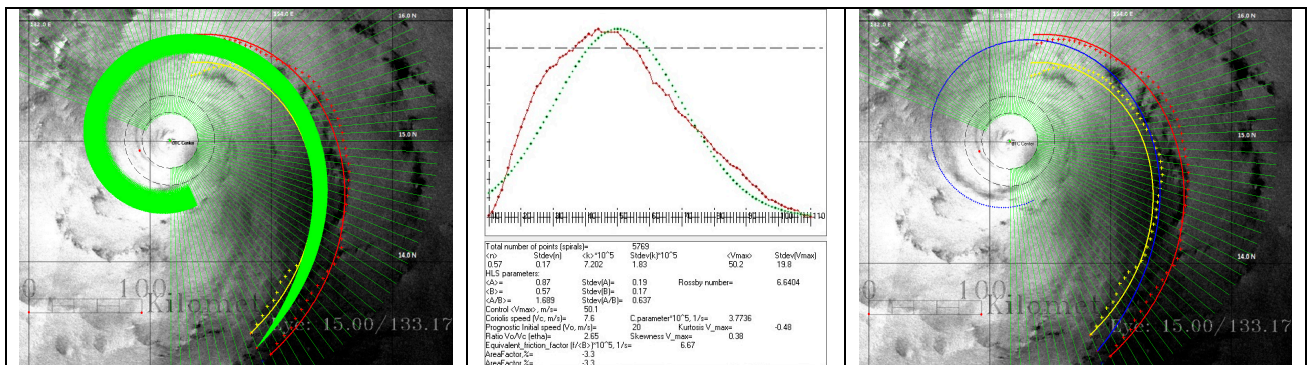


Figure 1S3 HLS-approximation of spiral band of TC Ewiniar at $R_m=40$ km and V_m range=10-110 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve); trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

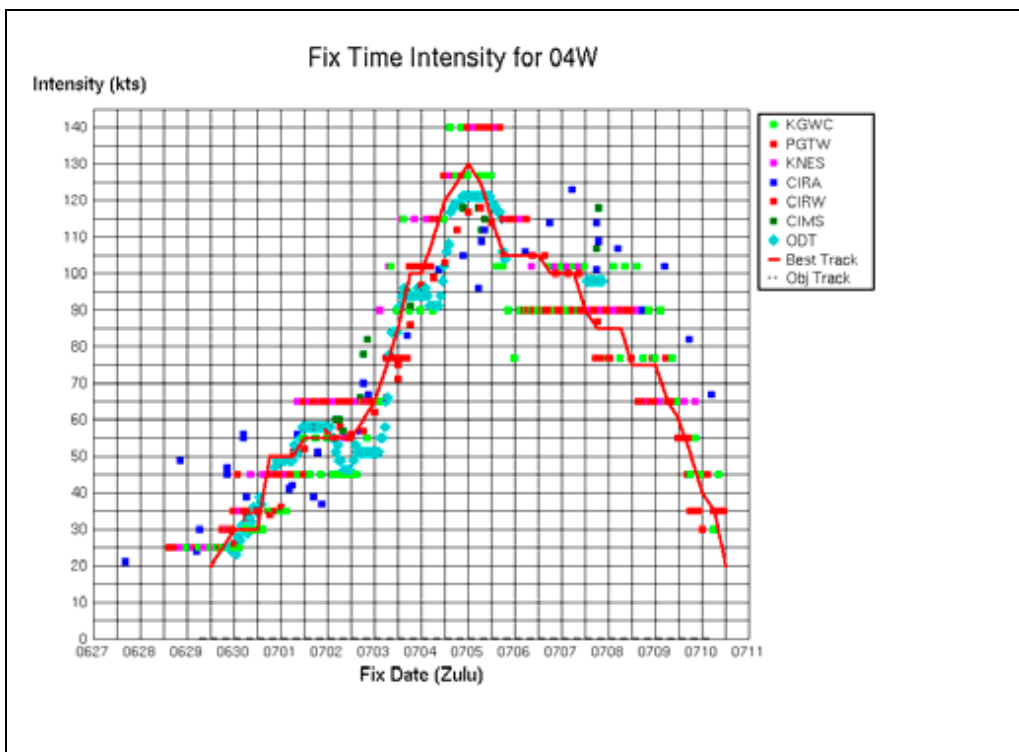


Fig. 2S3. Best Tack data for TC Ewiniar

Source: O'Hara J.F., Falvey R. 2006 Annual Tropical Cyclone Report. Super Typhoon 04W (Ewiniar) 29 June-10 July 2006. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pearl Harbor, Hawaii, pp. 98, p.19. <https://www.metoc.navy.mil/jtwc/products/atcr/2006atcr.pdf>.

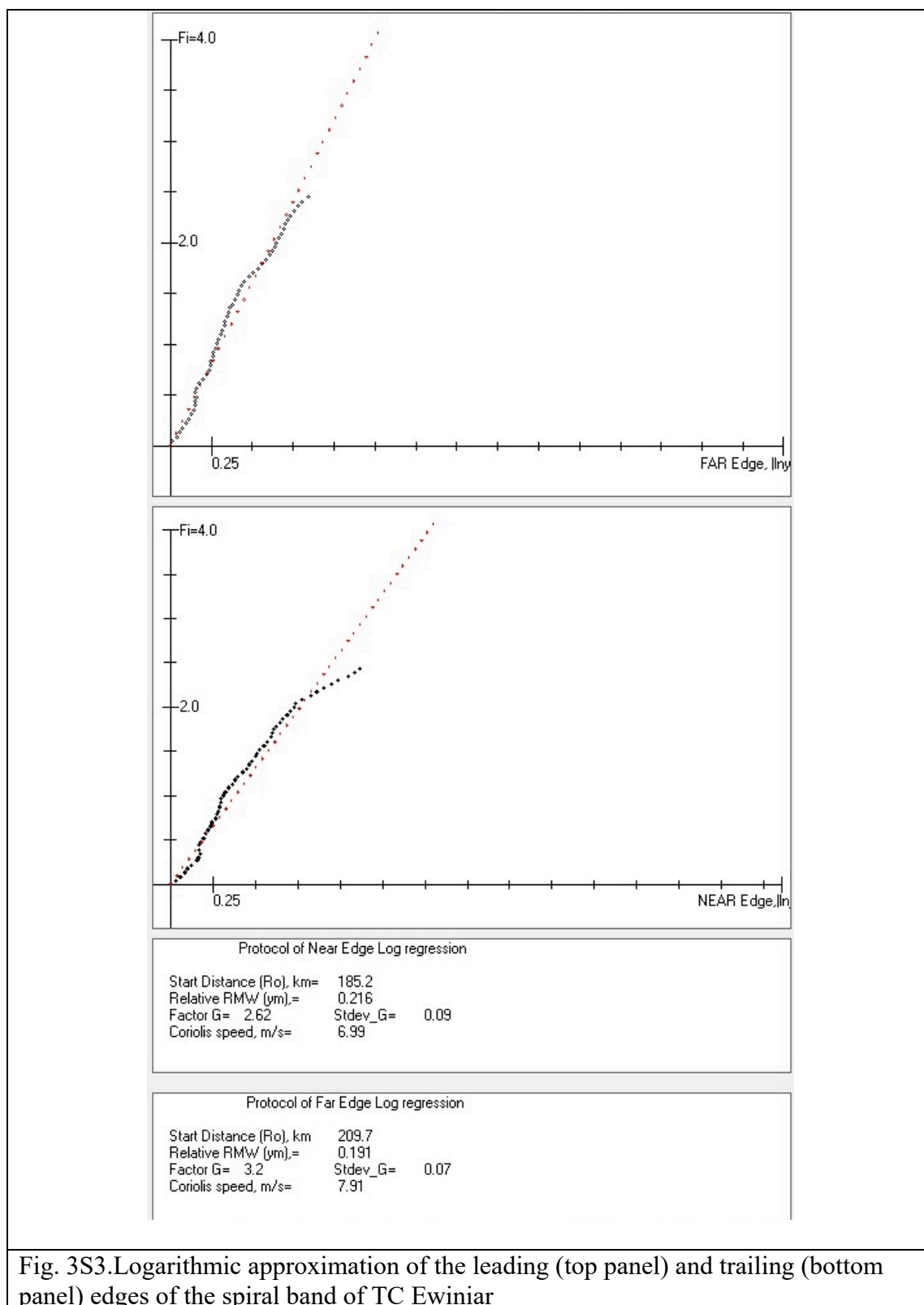


Fig. 3S3. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Ewiniar

Supplemental file 4 Flossie

SAR Image index: 200108301353745

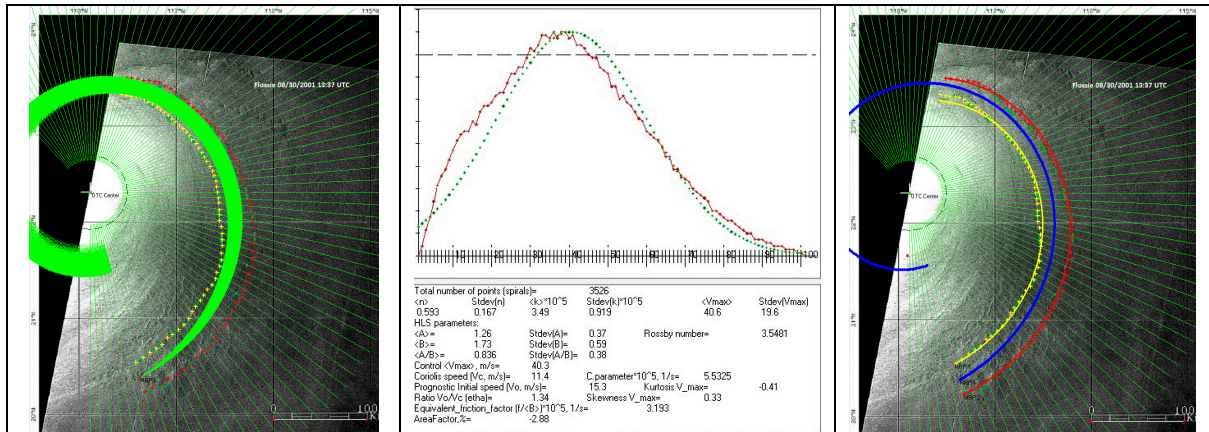


Fig. 1S4. HLS-approximation of spiral band of TC Flossie at $R_m=40$ km and V_m range=1-100 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

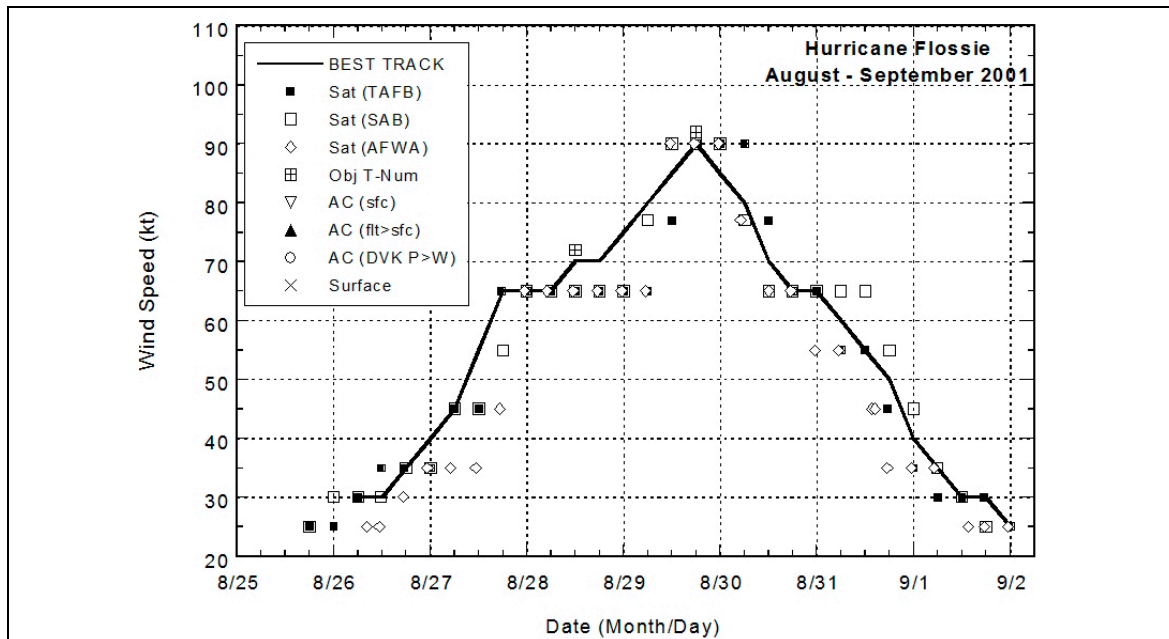


Fig. 2S4. Best Tack data for TC Flossie

Source: S.R. Stewart. Tropical Cyclone Report, Hurricane Flossie, 26 August-2 September 2001. National Hurricane Center. 27 October 2001.
https://www.nhc.noaa.gov/data/tcr/EP072001_Flossie.pdf

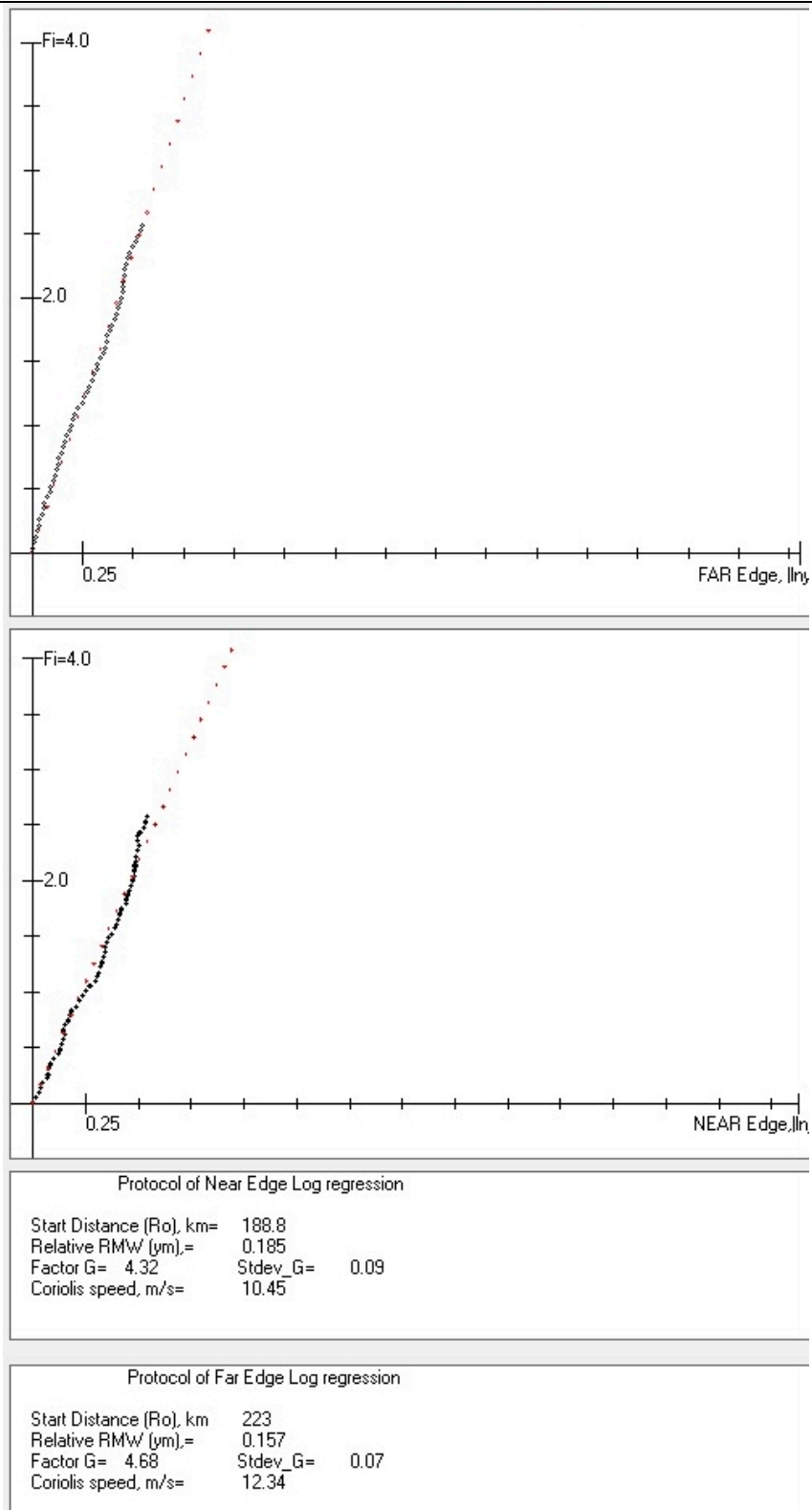


Fig. 3S4. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Flossie

SAR Image index: 20050728221603

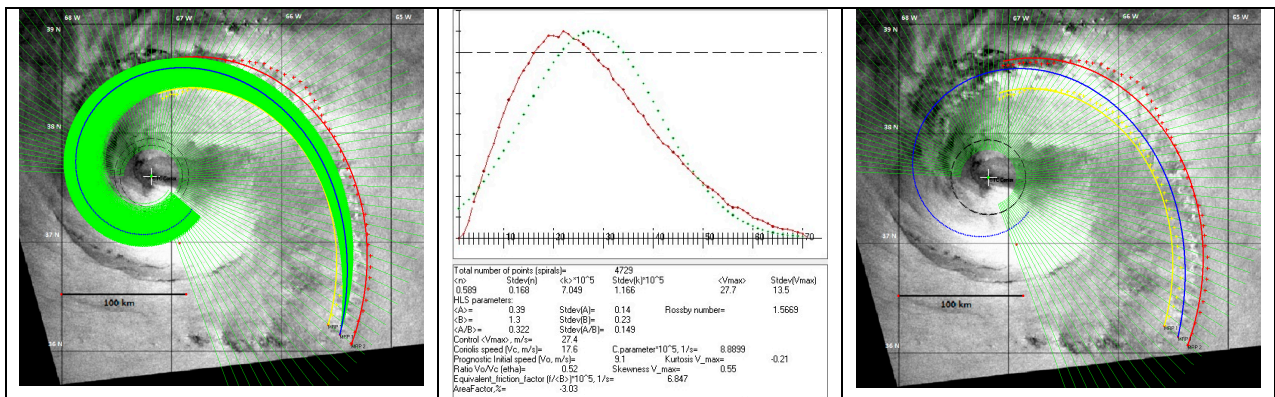


Figure 1S5. HLS-approximation of spiral band of TC Franklin at $R_m=30$ km and V_m range=1-70 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve); trailing (yellow curve) and leading (red curve) edges smoothed by a logarithmic spiral

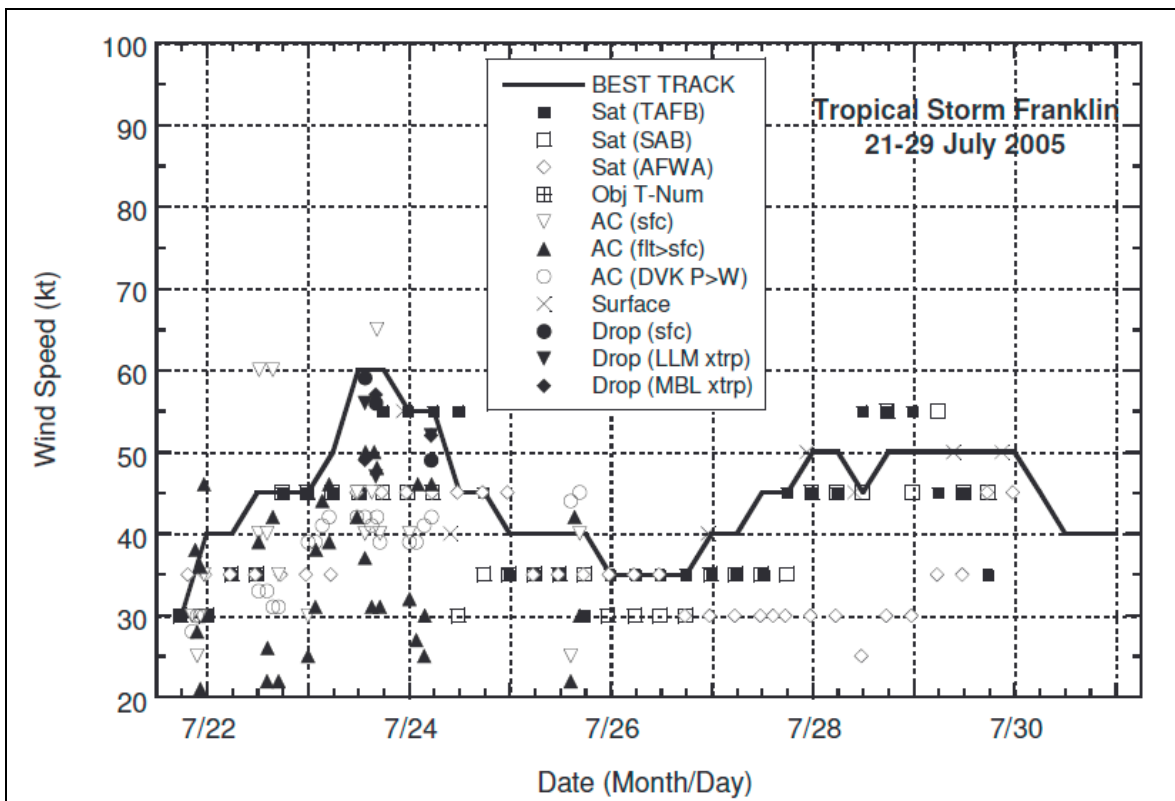
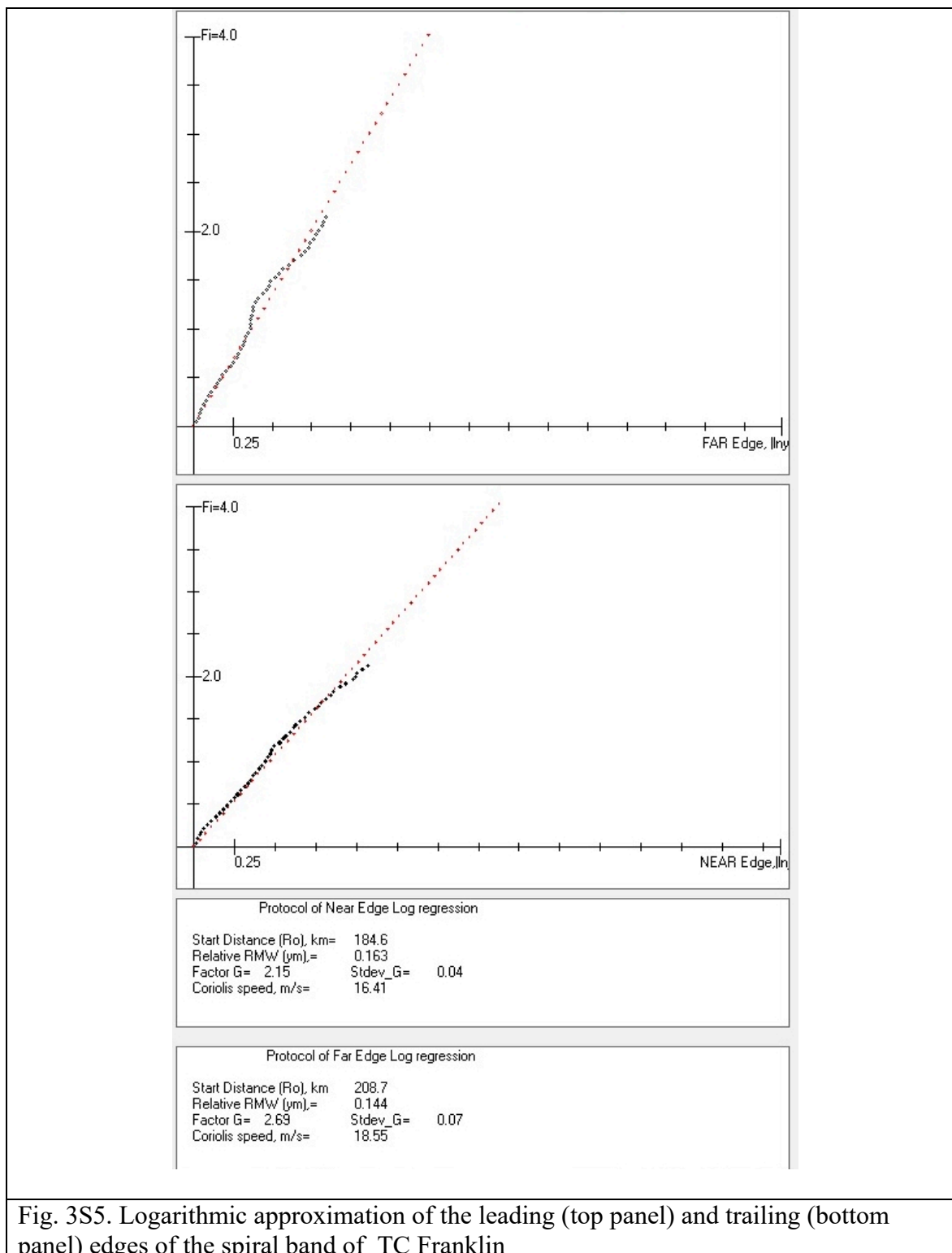


Fig. 2S5. Best Tack data for TC Franklin

Source: Knabb R.D. Tropical Cyclone Report, Tropical Storm Franklin 21-29 July 2005. National Hurricane Center, 17 March 2006.

https://www.nhc.noaa.gov/data/tcr/AL062005_Franklin.pdf.



Supplemental file 6_Javier

SAR Image index: 20040917012033

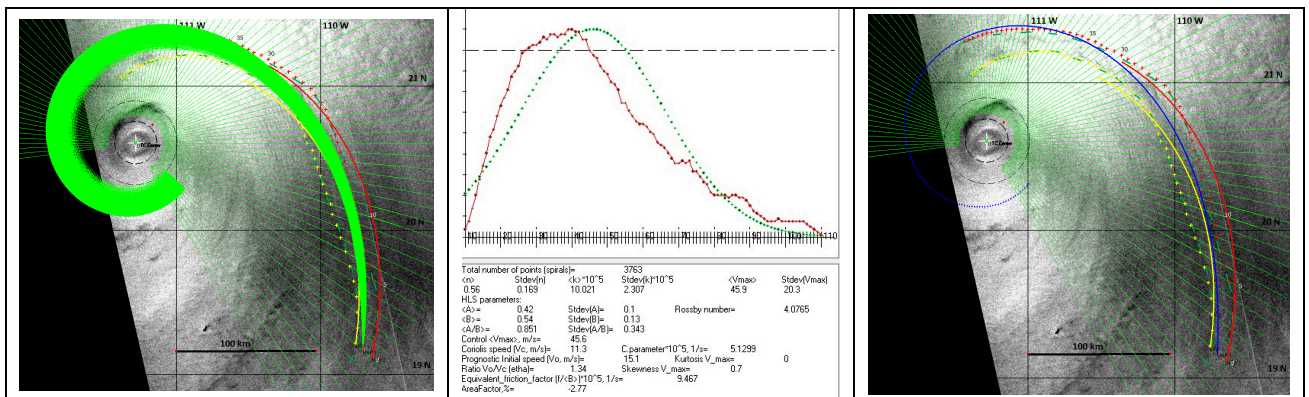


Fig. 1S6. HLS-approximation of spiral band of TC Javier at $R_m=30$ km and V_m range=10-110 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve). Approximation interval=0-30 points. Trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

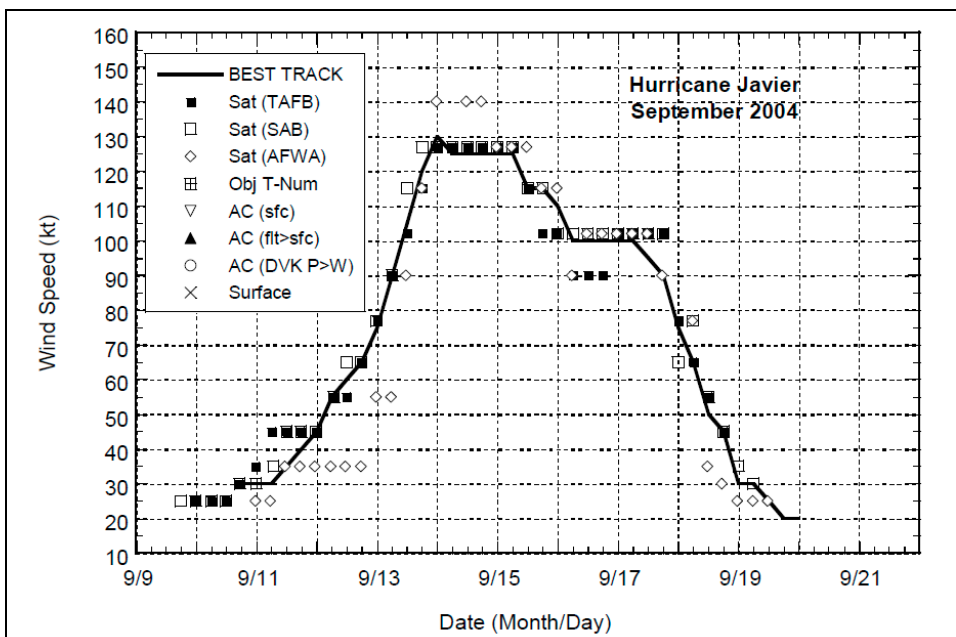


Fig. 2S6. Best Tack data for TC Javier

Source: Avila L.A. Tropical Cyclone Report, Hurricane Javier 10-15 September 2004. National Hurricane Center, 15 November 2004.
https://www.nhc.noaa.gov/data/tcr/EP132004_Javier.pdf.

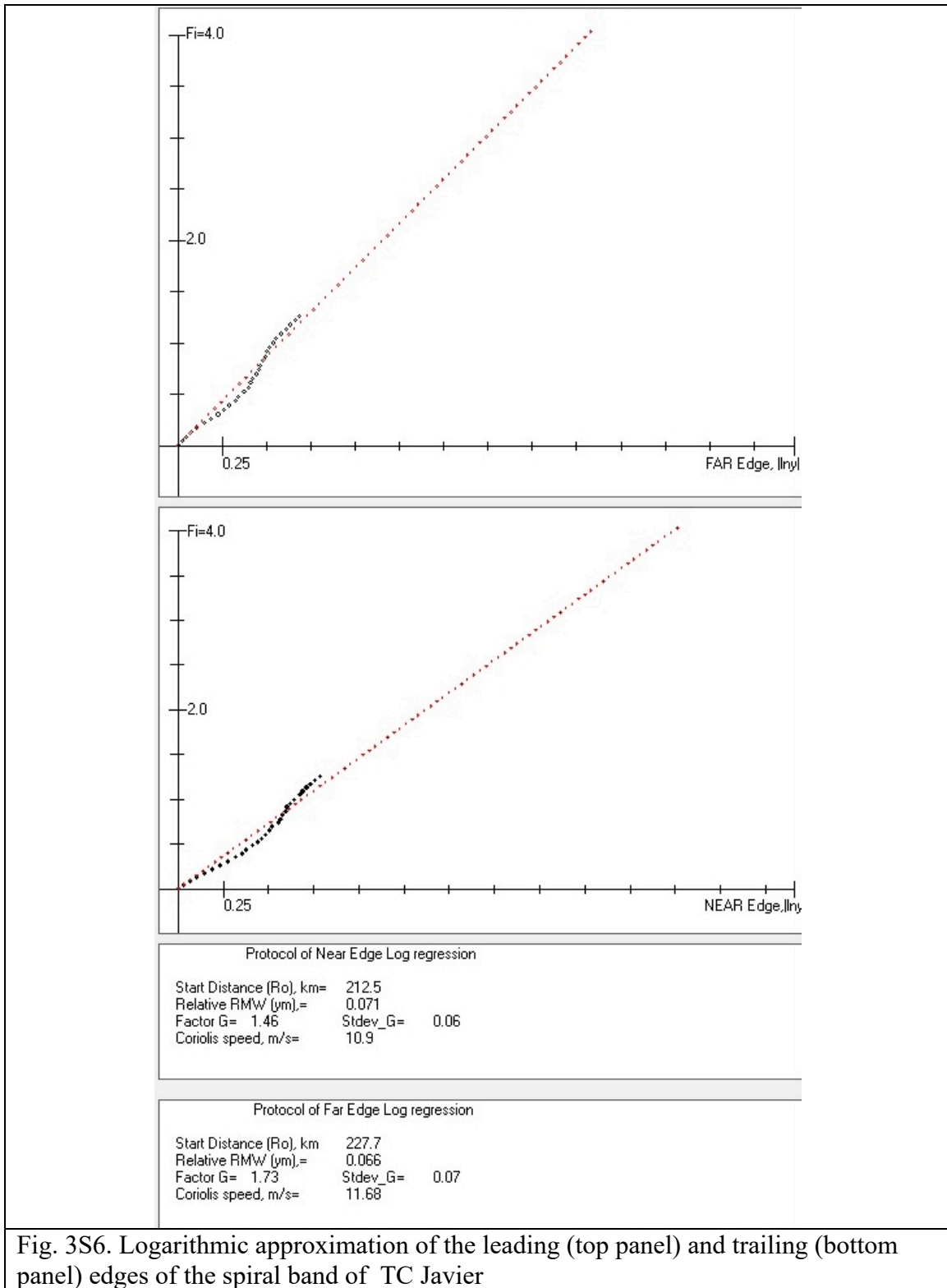


Fig. 3S6. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Javier

Supplemental file 7 Jova

SAR Image index: 20050919152220

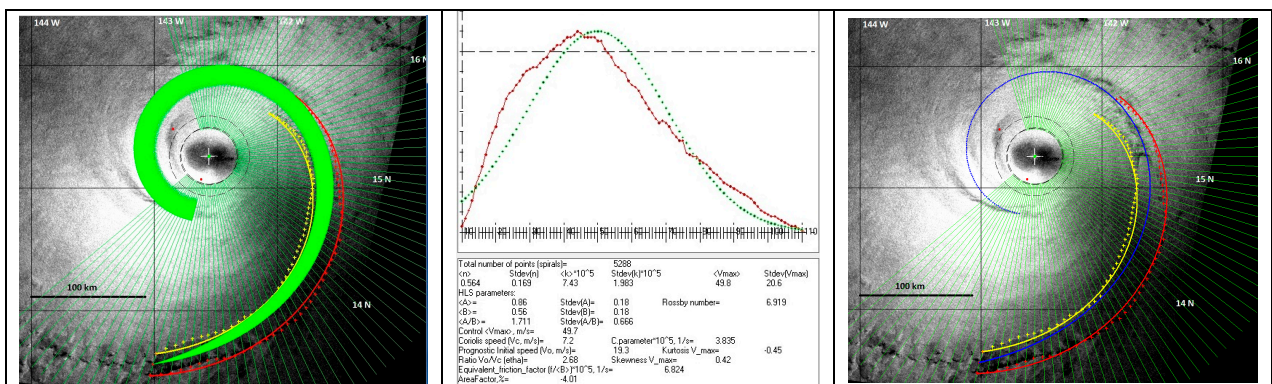


Figure 1S7. HLS-approximation of spiral band of TC Jova at $R_m=35$ km and V_m range=10-110 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve); trailing (yellow curve) and leading (red curve) edges smoothed by a logarithmic spiral

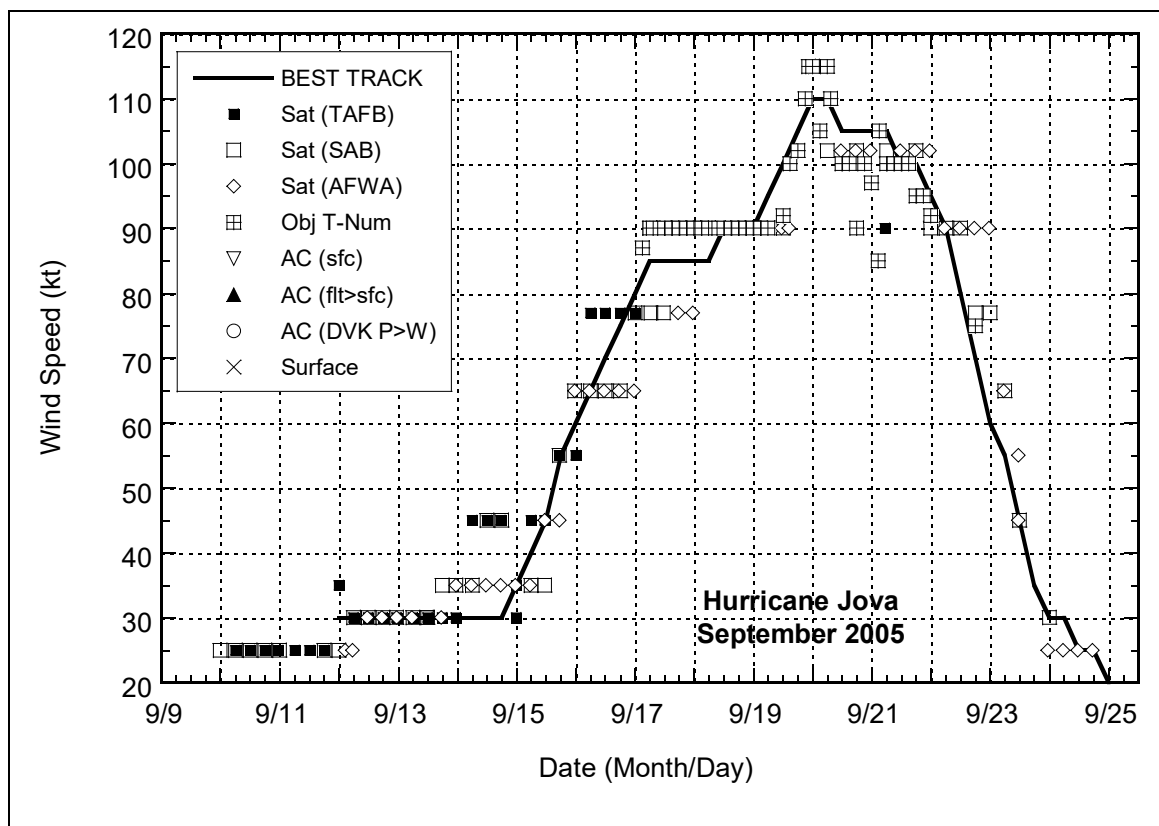


Fig. 2S7. Best Track data for TC Jova

Source: Stewart S.R. Tropical Cyclone Report, Hurricane Jova, 12-25 September 2005.

National Hurricane Center, 27 February 2006.

https://www.nhc.noaa.gov/data/tcr/EP102005_Jova.pdf

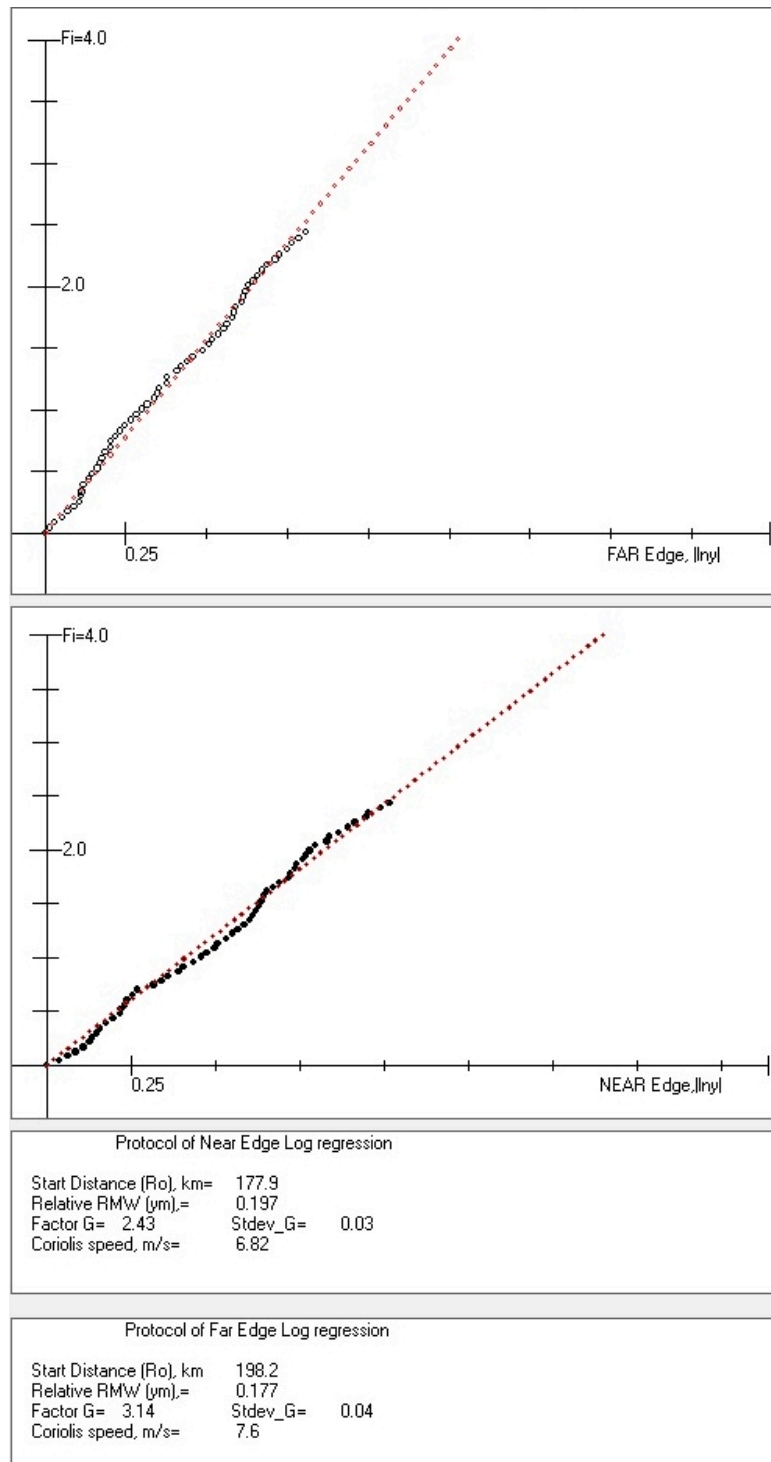


Fig. 3S7. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Jova

Supplemental file 8_Katrina

SAR Image index: 20050828234840

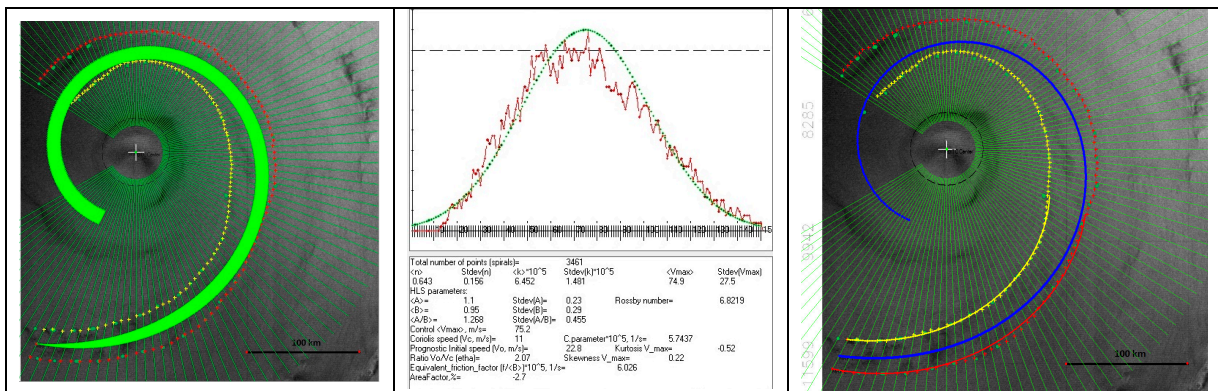


Fig. 1S8. HLS-approximation of spiral band of TC Katrina at $R_m=30$ km and V_m range=1-150 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve); the initial portions of trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

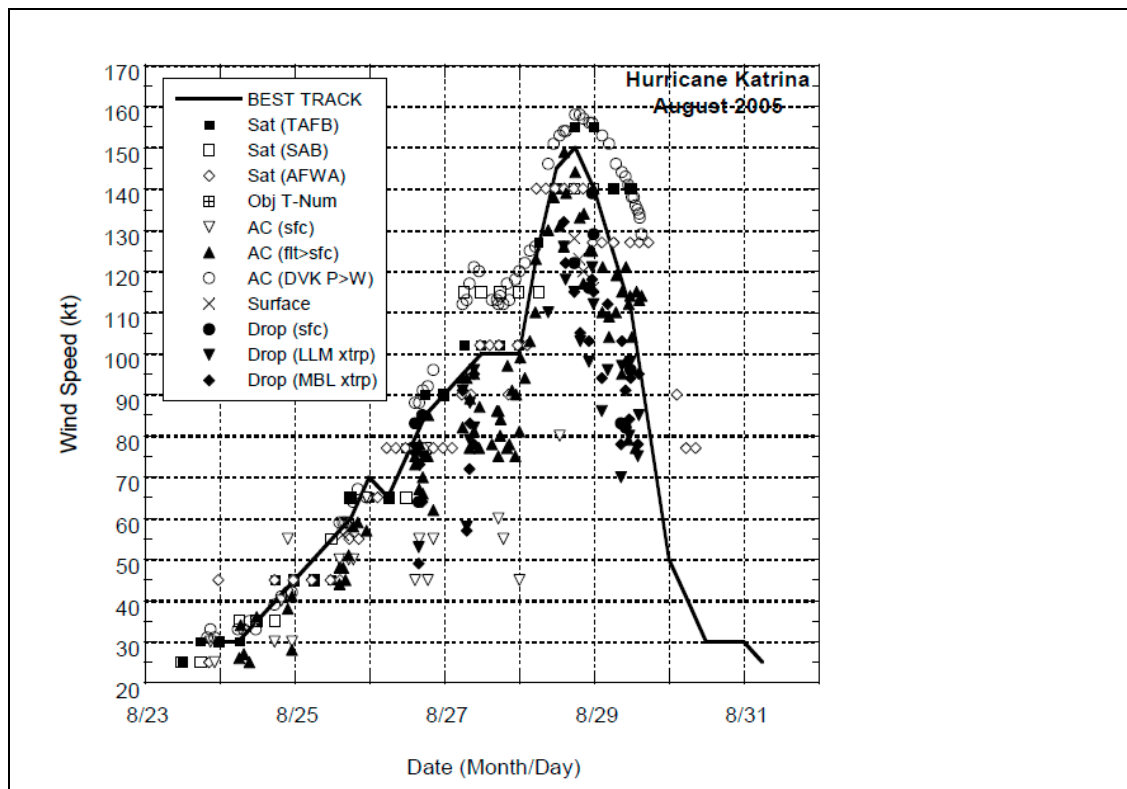
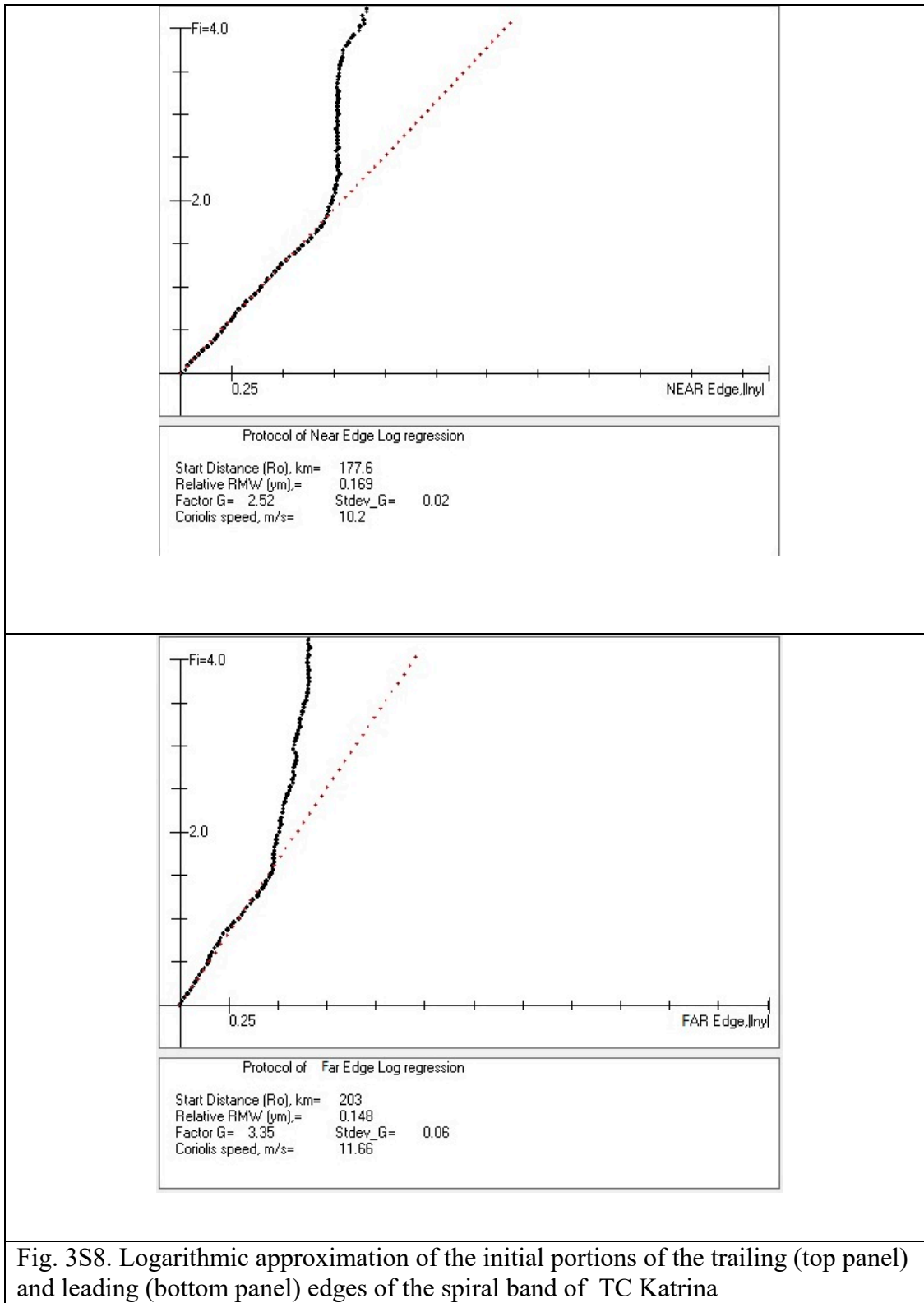


Fig. 2S8. Best Track data for TC Katrina

Source: Knabb R.D. et al. Tropical Cyclone Report, Hurricane Katrina, 23-30 August 2005. National Hurricane Center, 20 December 2005.

https://www.nhc.noaa.gov/data/tcr/AL122005_Katrina.pdf



SAR Image index: 20050925032031

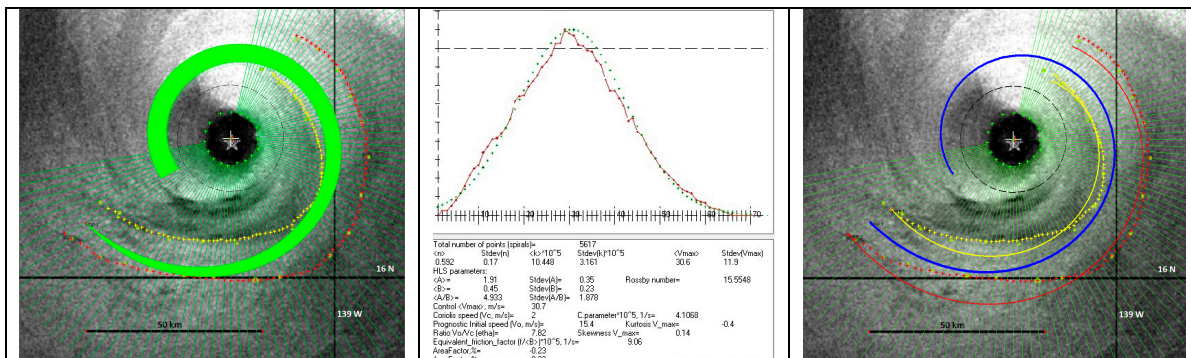


Fig. 1S9. HLS-approximation of spiral band of TC Kenneth at $R_m=15$ km and V_m range=1-65 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

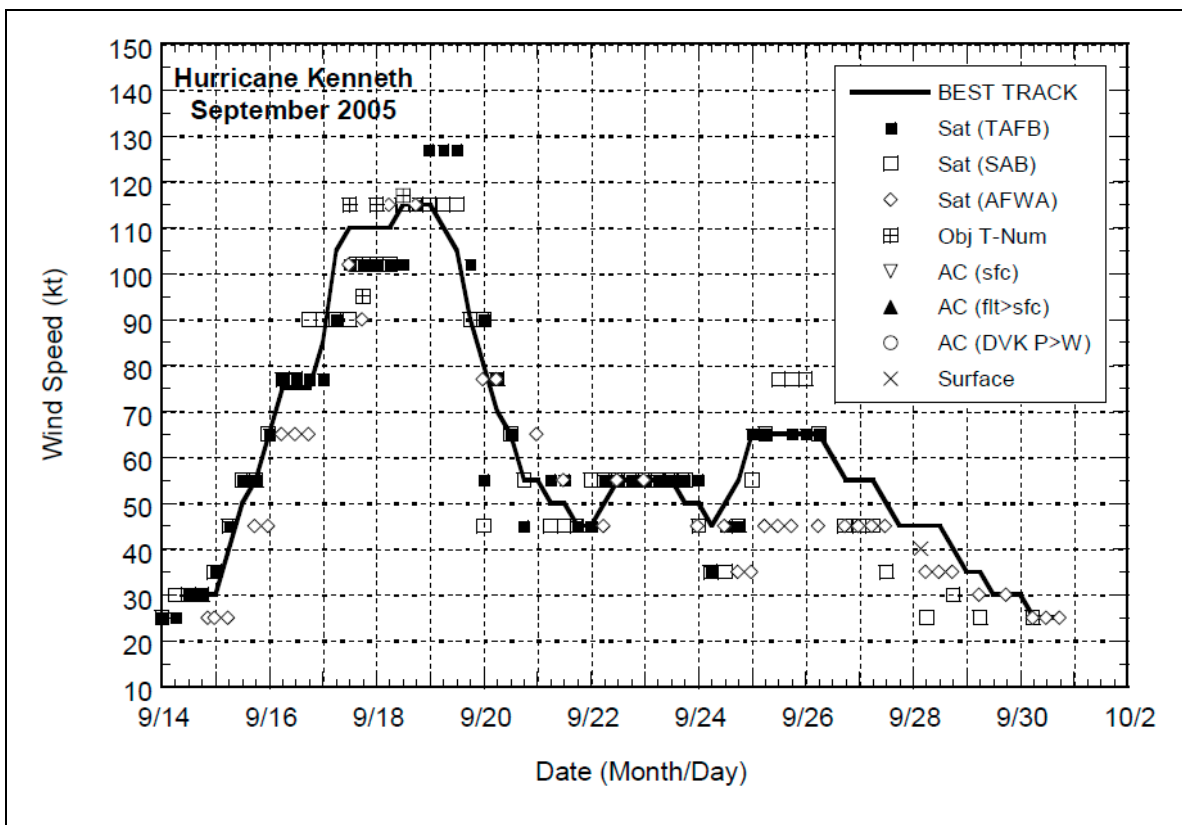


Fig. 2S9. Best Tack data for TC Kenneth
Source: Pasch R.J. Tropical Cyclone Report, Hurricane Kenneth, 14-30 September 2005.
National Hurricane Center, 20 April 2006.
https://www.nhc.noaa.gov/data/tcr/EP112005_Kenneth.pdf.

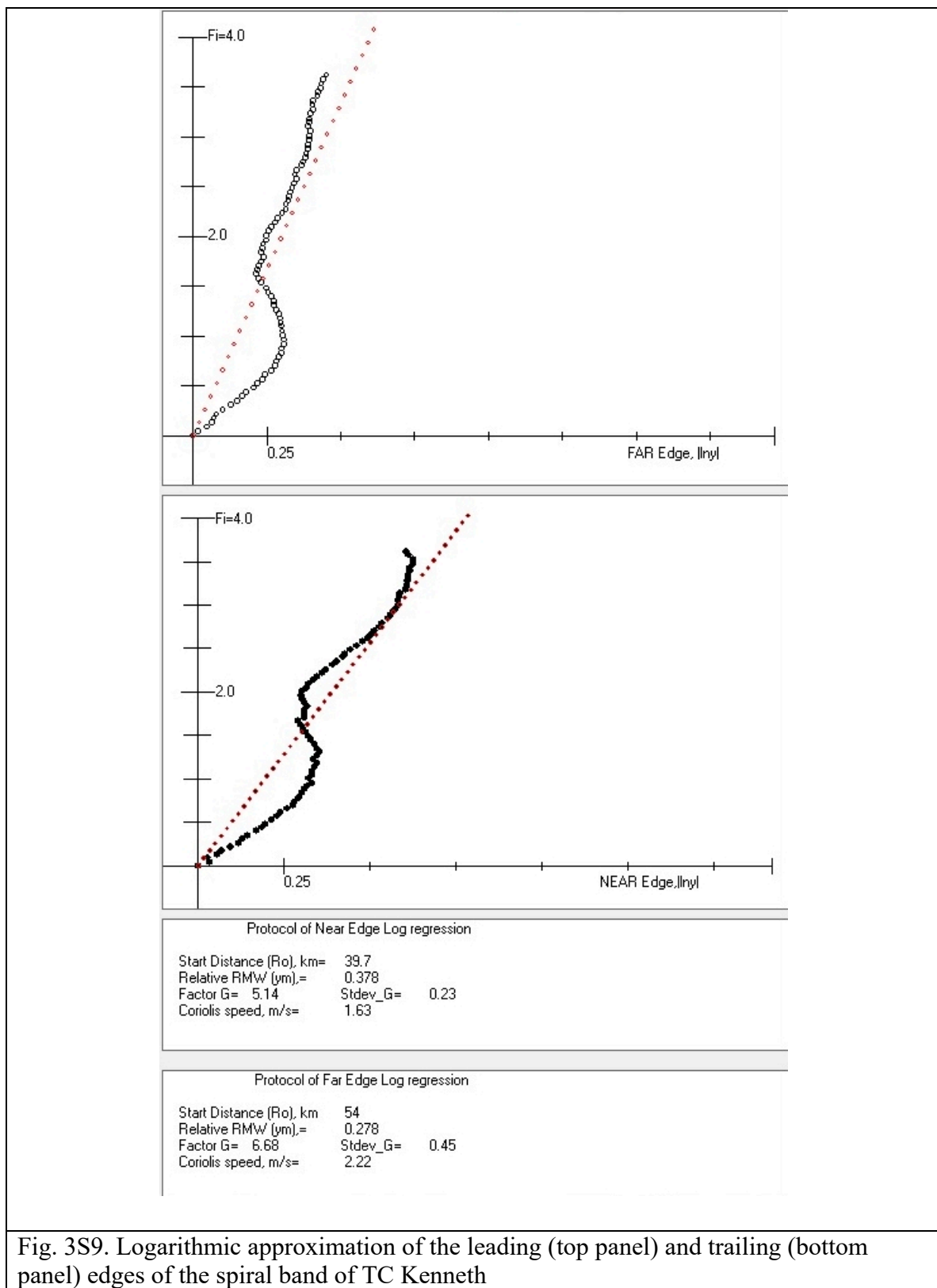


Fig. 3S9. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Kenneth

Supplemental file 3.10 Kirogi

SAR Image index: 20051015210400

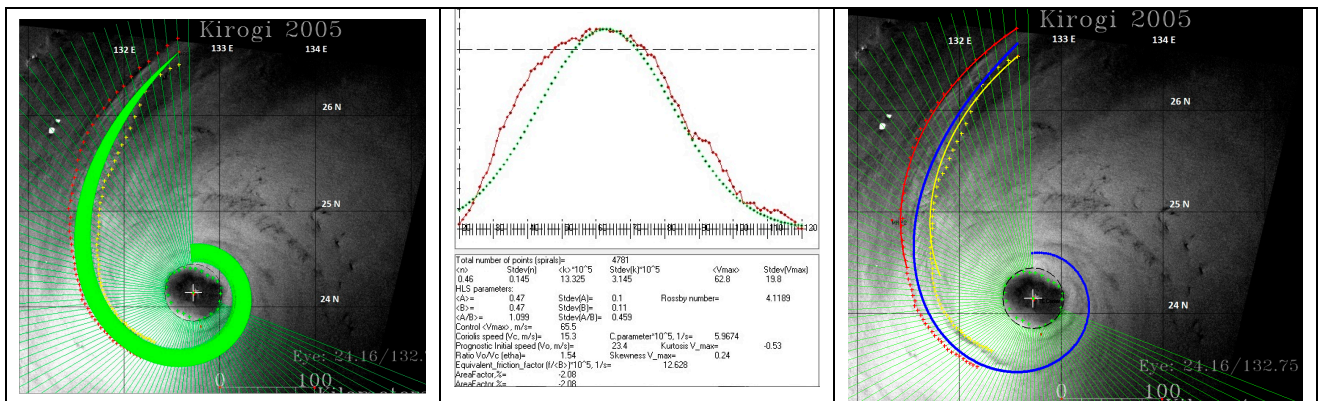


Fig. 1S10. HLS-approximation of spiral band of TC Kirogi at $R_m=30$ km and V_m range=20-120 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), the initial portions of trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

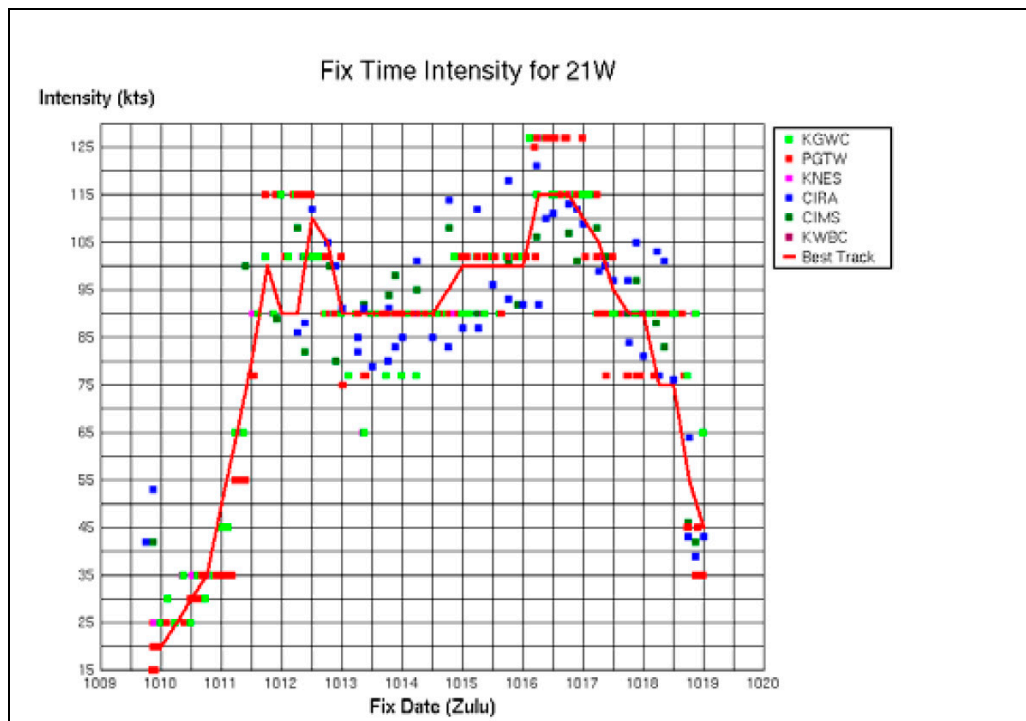


Fig. 2S10. Best Tack data for TC Kirogi

Source: Atangan J.F., Preble A. 2005 Annual Tropical Cyclone Report. Typhoon 21W (Kirogi) 10-19 October 2005. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pear Harbor, Hawaii, pp. 109, p.38. <https://www.metoc.navy.mil/jtwc/products/atcr/2005atcr.pdf>.

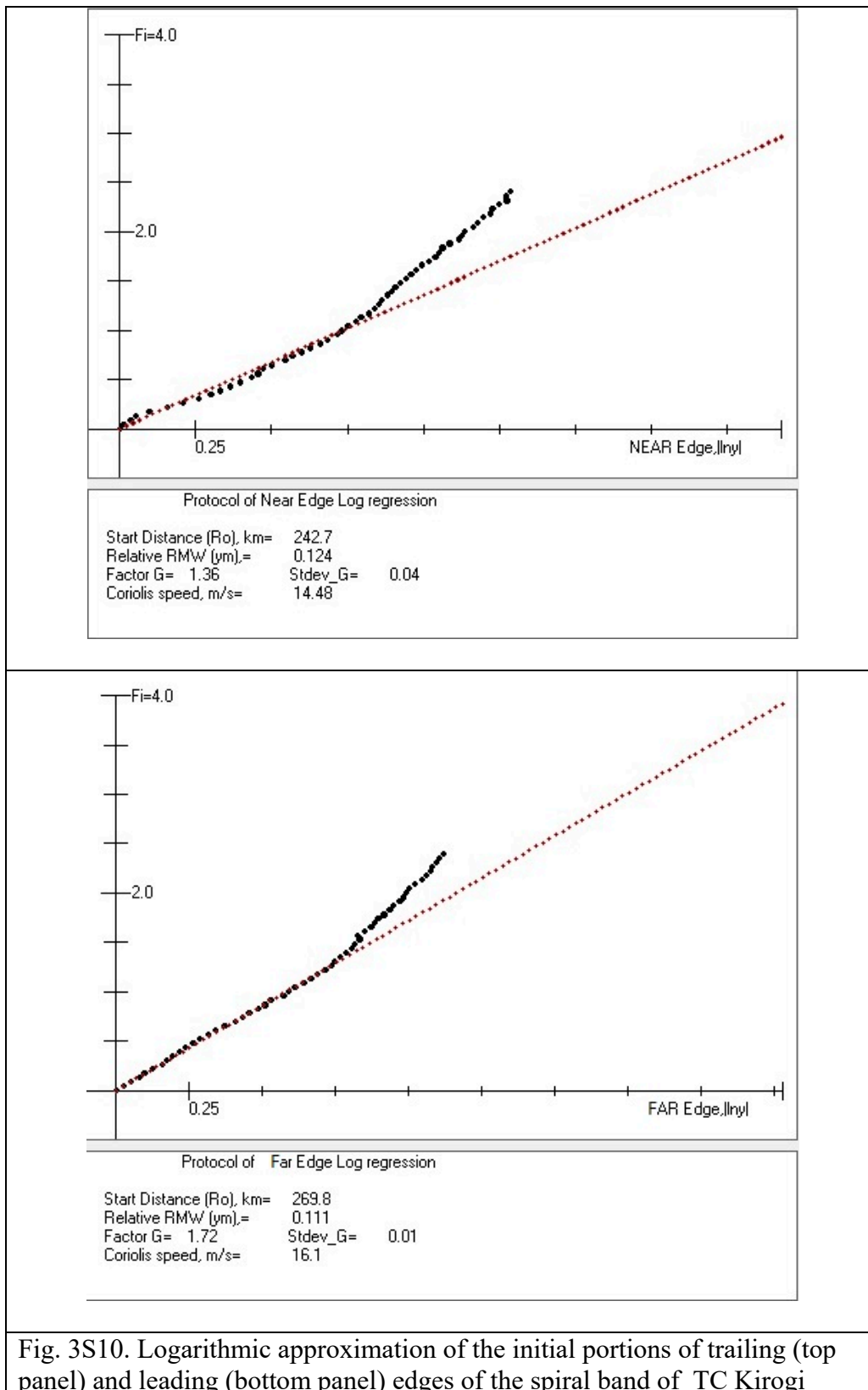


Fig. 3S10. Logarithmic approximation of the initial portions of trailing (top panel) and leading (bottom panel) edges of the spiral band of TC Kirogi

Supplemental file 11 Mawar

SAR Image index: 20050822203846

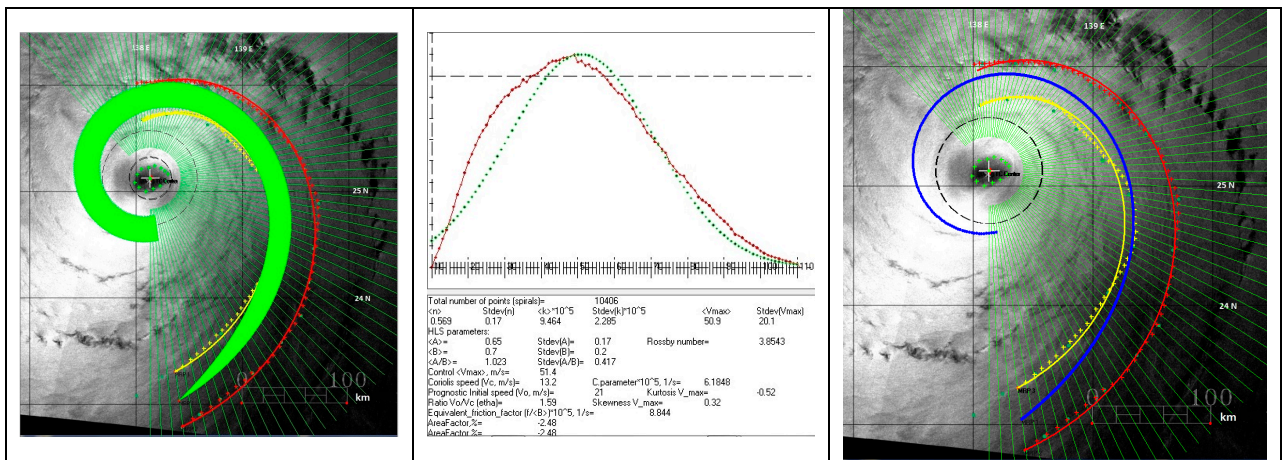


Fig. 1S11. HLS-approximation of spiral band of TC Mawar at $R_m=45$ km and V_m range=10-110 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), the trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

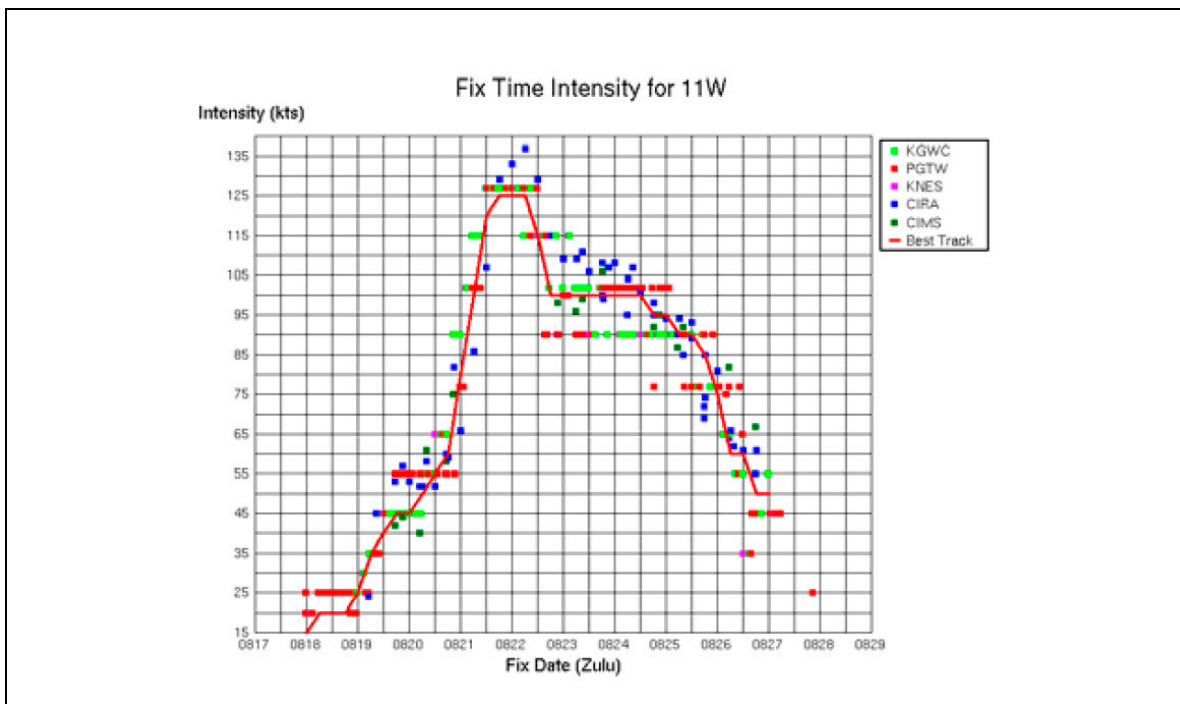


Fig. 2S11. Best Tack data for TC Mawar

Source: Atangan J.F., Preble A. 2005 Annual Tropical Cyclone Report. Super Typhoon 11W (Mawar) 18-27 August 2005. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pearl Harbor, Hawaii, pp. 109, p.28.

<https://www.metoc.navy.mil/jtwc/products/atcr/2005atcr.pdf>

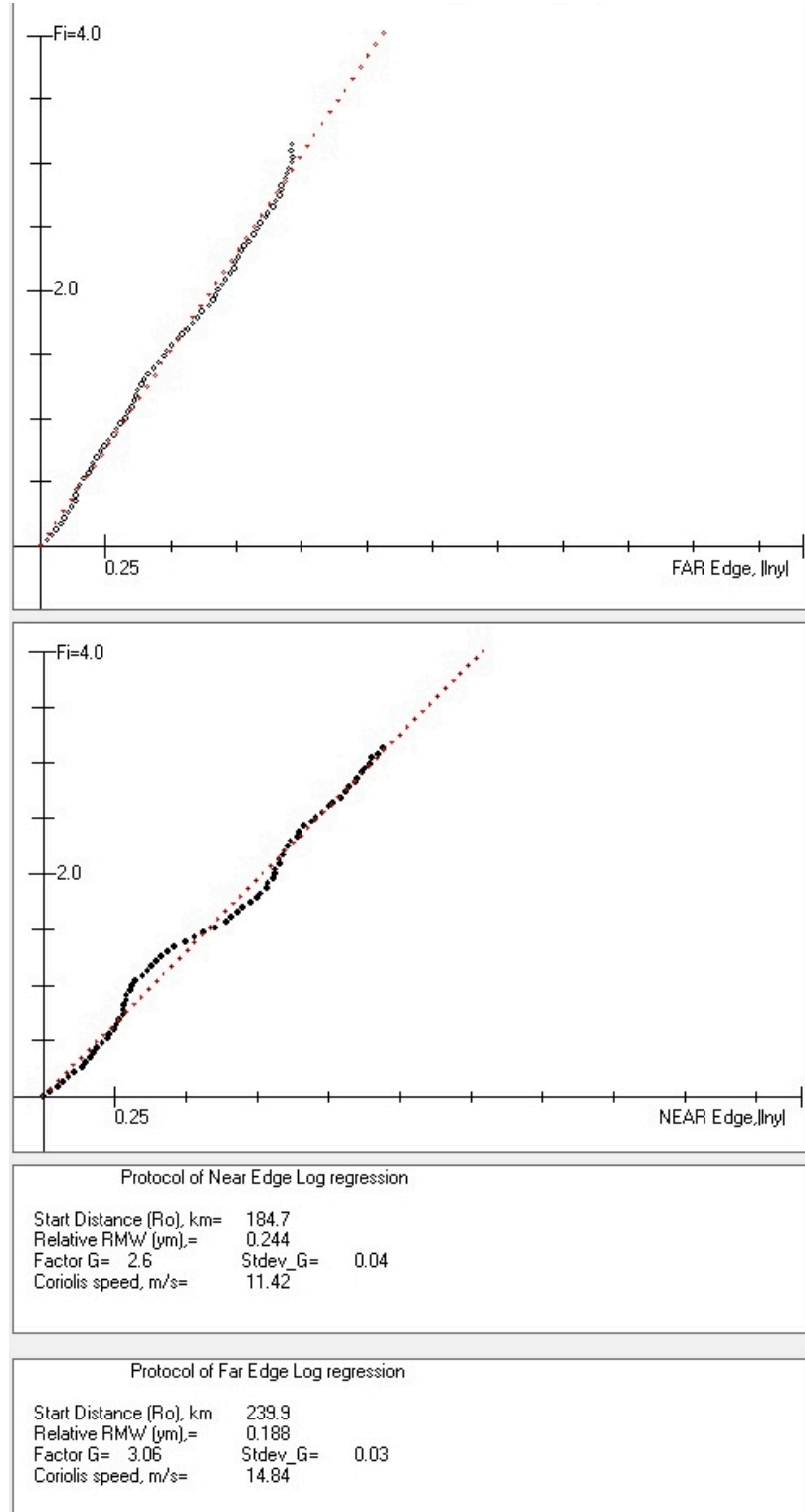


Fig. 3S11. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Mawar

Supplemental file 12_Meari

SAR Image index: 20040928092545

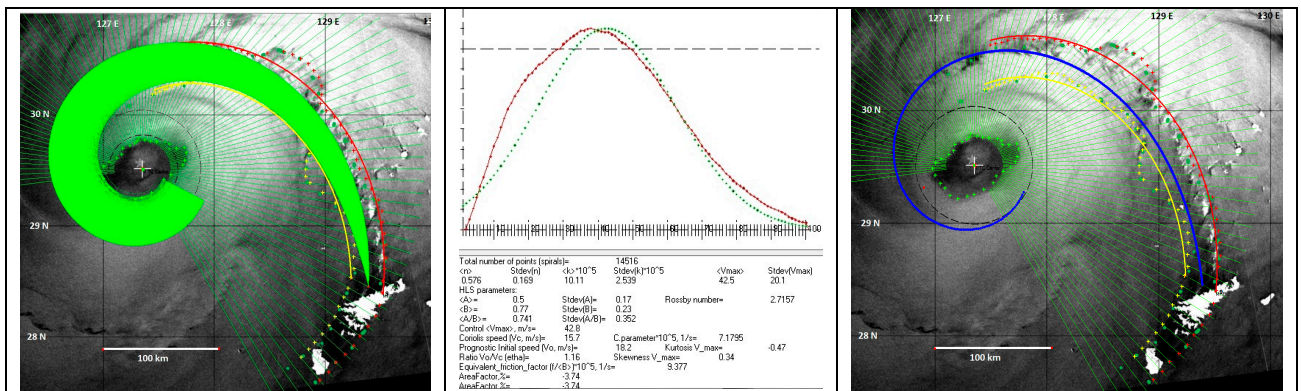


Figure 1S12. HLS-approximation of spiral band of TC Meari at $R_m=50$ km and V_m range=1-100 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve). Approximation interval= 9-54 points. The trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

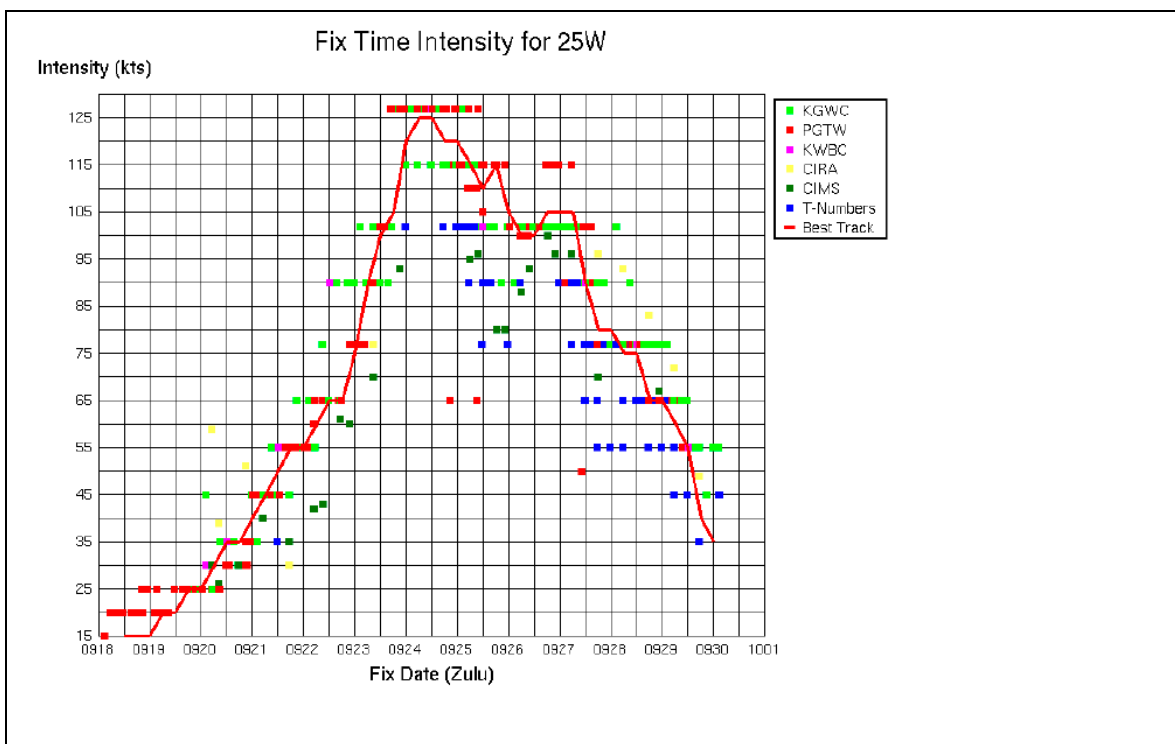


Fig. 2S12. Best Tack data for TC Meari

Source: Atangan J.F., Preble A. 2004 Annual Tropical Cyclone Report. Typhoon 25W (Meari) 20-29 Sep 2004. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pear Harbor, Hawaii, pp. 327, p.138.

<https://www.metoc.navy.mil/jtwc/products/atcr/2004atcr.pdf>

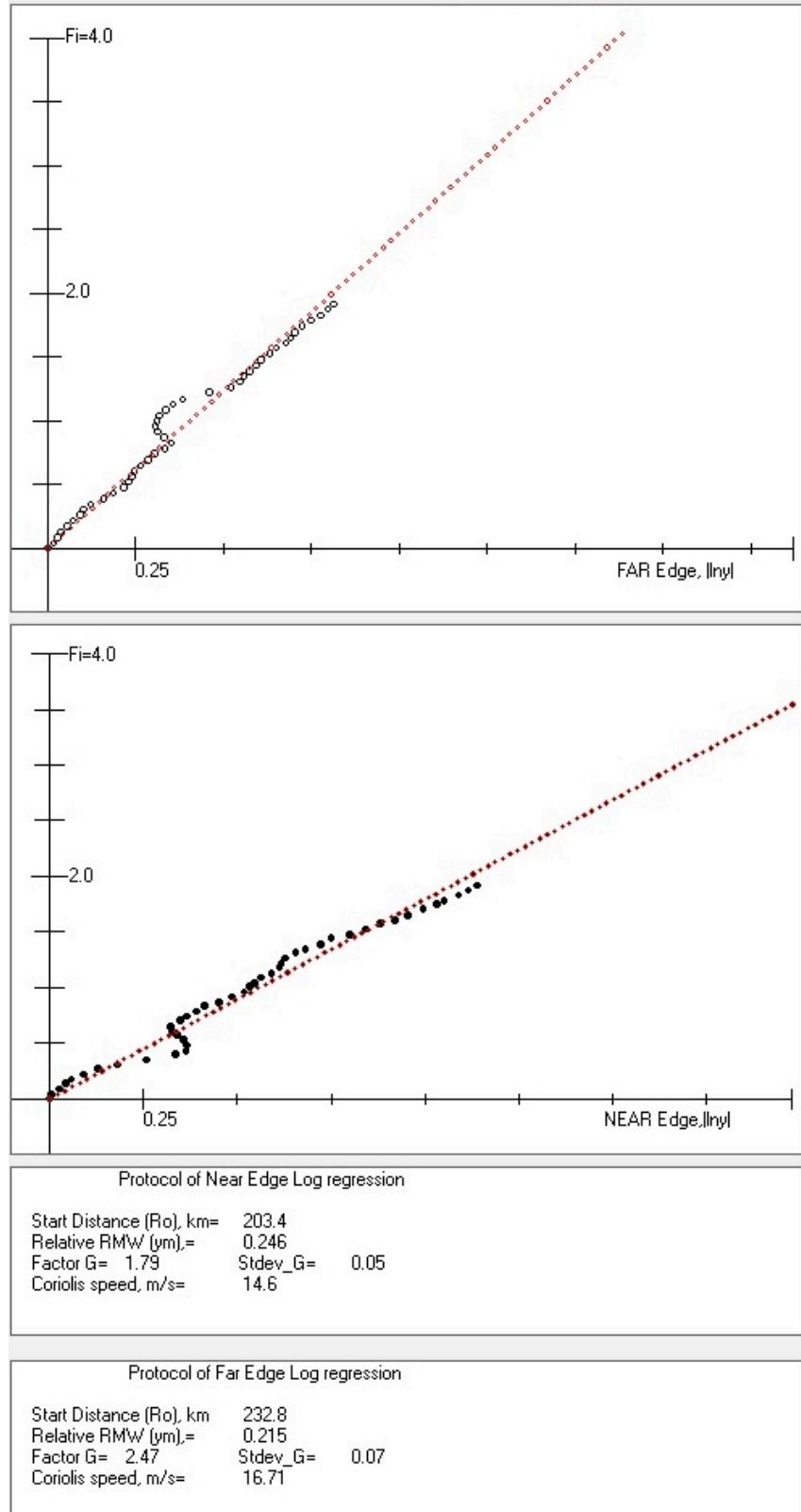


Fig. 3S12. Logarithmic approximation of the of leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Meari

Supplemental file 13_Xangsane

SAR Image index: 20060930223832

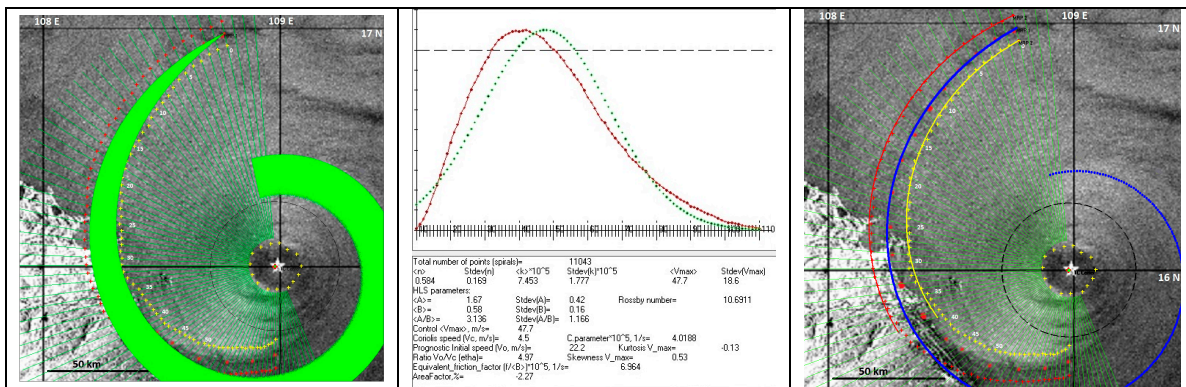


Figure 1S13. HLS-approximation of spiral band of TC Xangsane at $R_m=30$ km and V_m range=10-110 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve). Approximation interval= 0-40 points. The trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

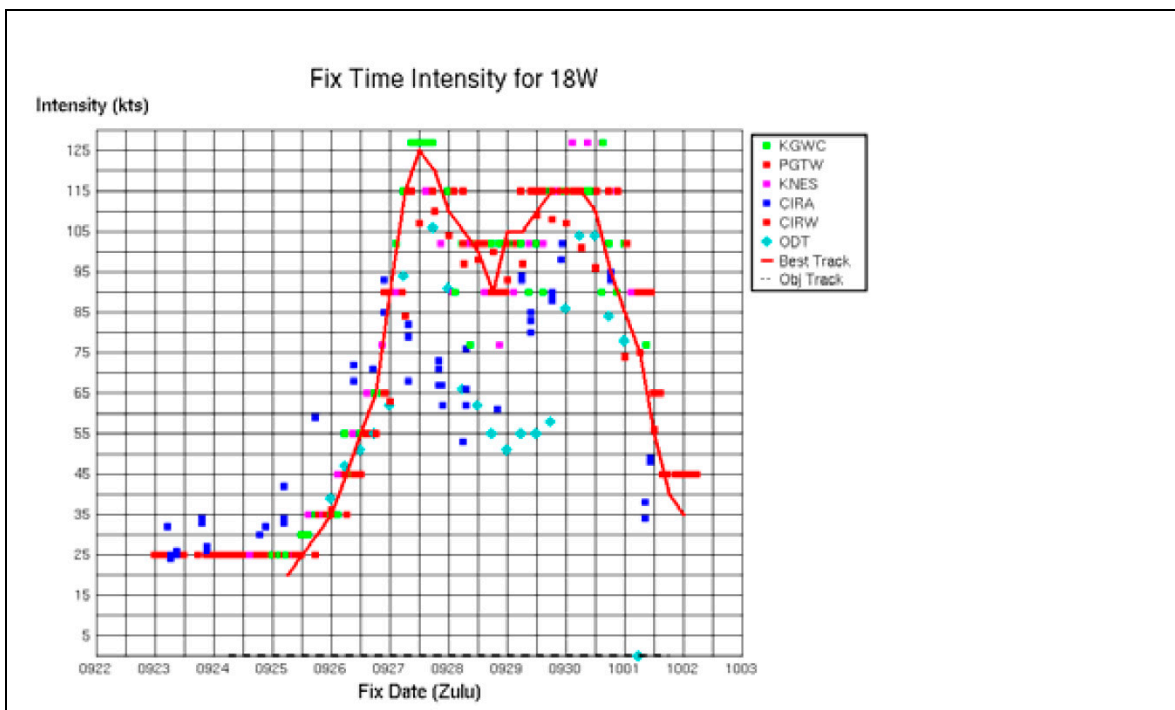
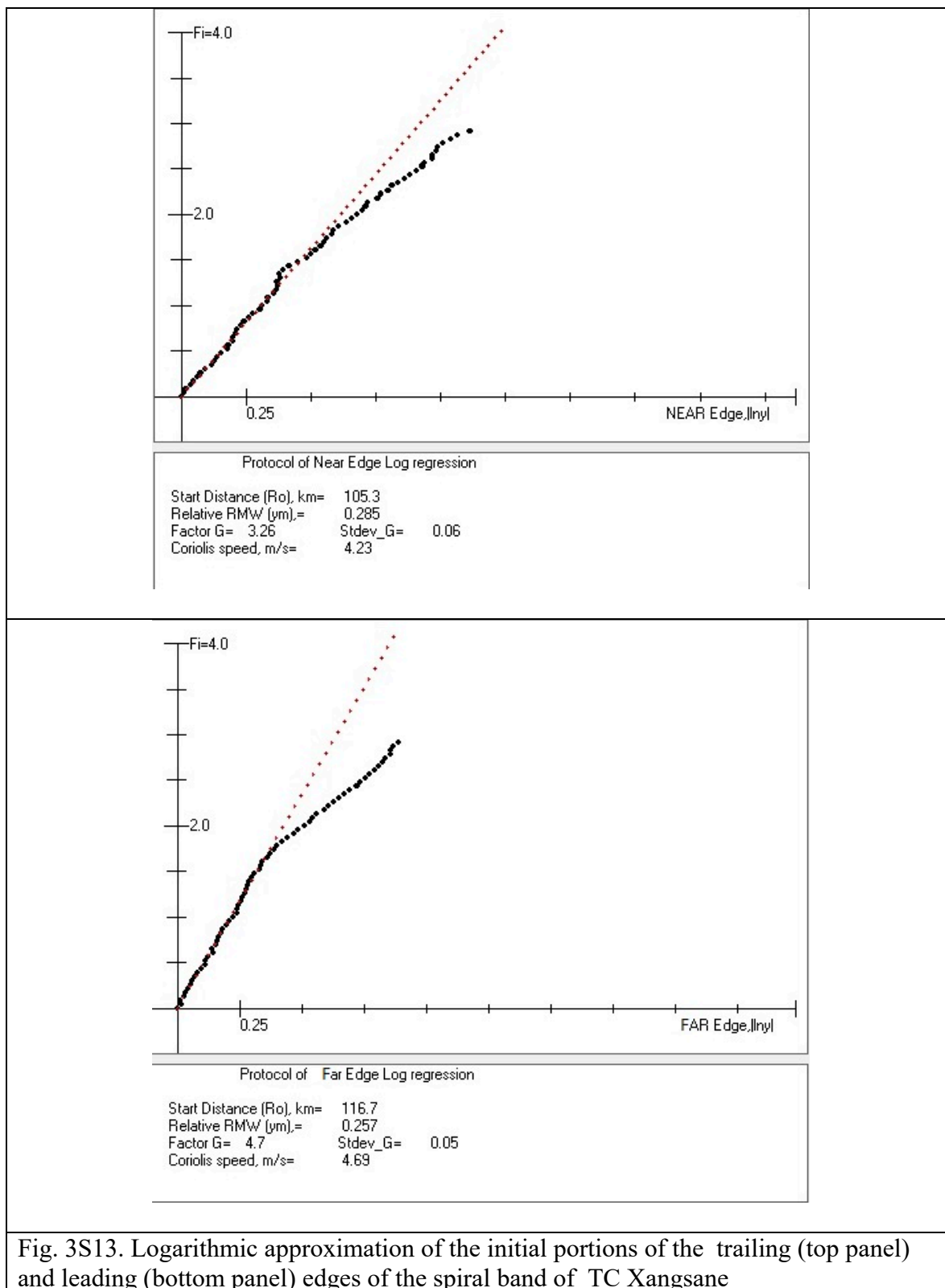


Fig. 2S13. Best Tack data for TC Xangsane

Source: O'Hara J.F., Falvey R. 2006 Annual Tropical Cyclone Report. Typhoon 18W (Xangsane) 25 September-02 October 2006. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pearl Harbor, Hawaii, pp. 98, p.19.
<https://www.metoc.navy.mil/jtwc/products/atcr/2006atcr.pdf>.



Supplemental file 14_Yagi

SAR Image index: 20060921201753

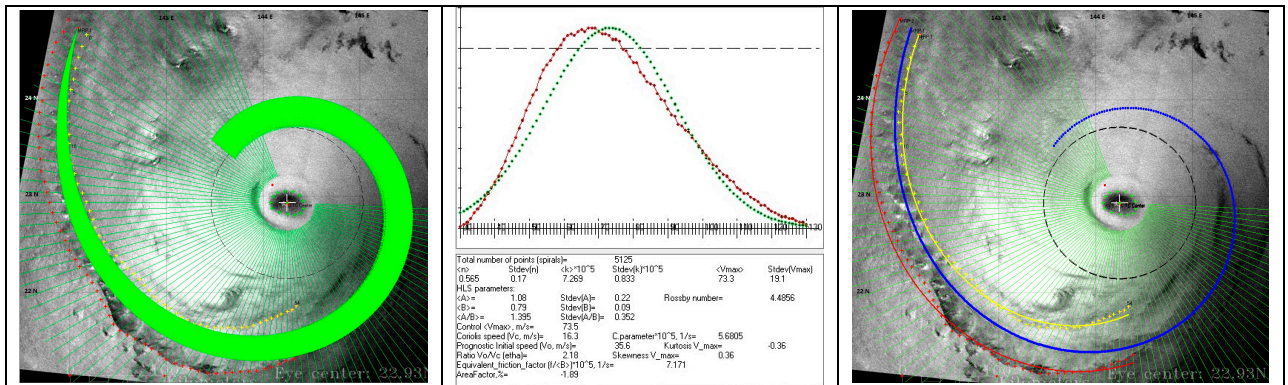


Fig. 1S14. HLS-approximation of spiral band of TC Yagi at $R_m=80$ km and V_m range=30-130 m/s; left panel: family of signature HLS; center panel: histogram of V_m ; right panel: mean HLS of the spiral band (blue curve), trailing (yellow curve) and leading (red curve) edges approximated by a logarithmic spiral

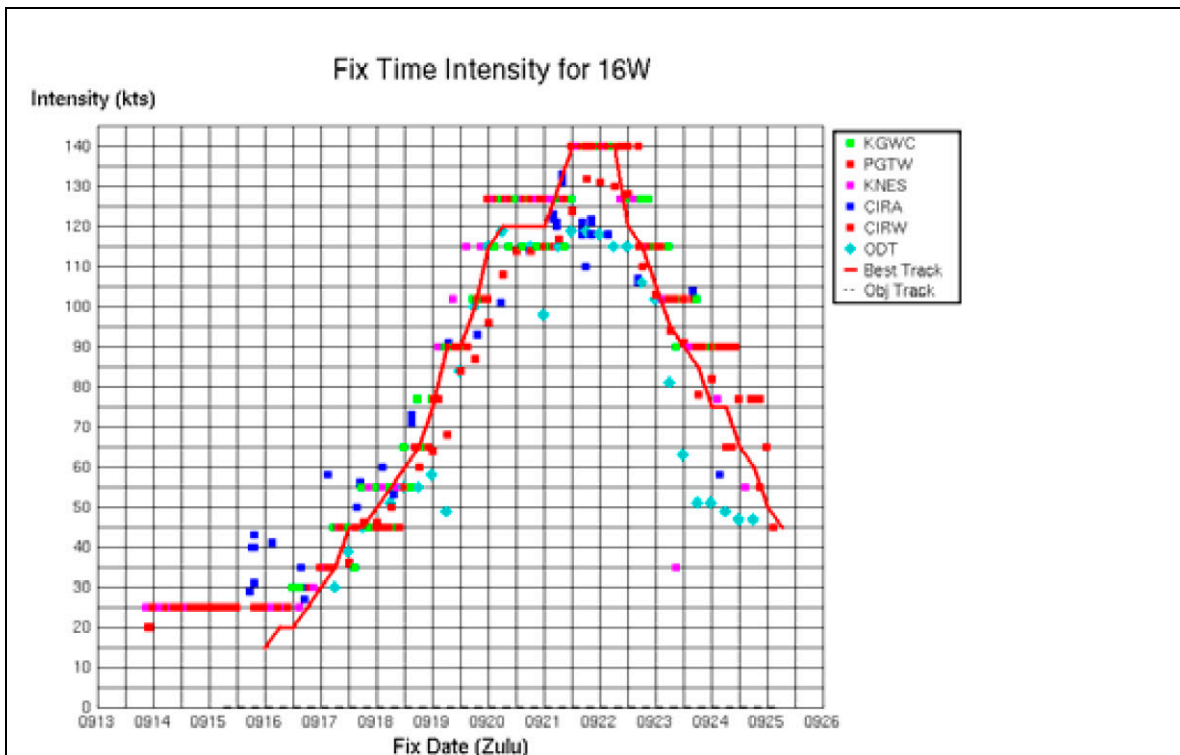


Fig. 2S14. Best Track data for TC Yagi

Source: O'Hara J.F., Falvey R. 2006 Annual Tropical Cyclone Report. Super Typhoon 16W (Yagi) 16-25 September 2006. U.S. Naval Maritime Forecast Center/ Joint Typhoon Warning Center. Pearl Harbor, Hawaii, pp. 98, p.31.

<https://www.metoc.navy.mil/jtwc/products/atcr/2006atcr.pdf>.

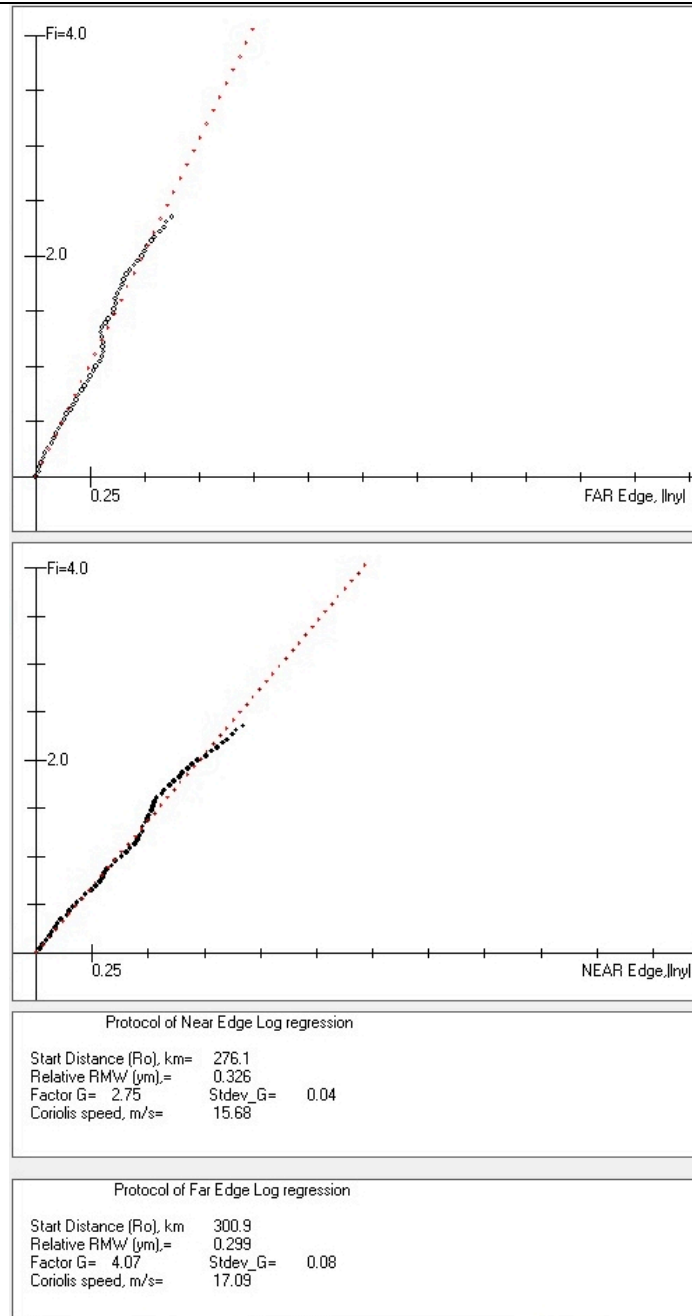


Fig. 3S14. Logarithmic approximation of the leading (top panel) and trailing (bottom panel) edges of the spiral band of TC Xangsane