Geomática en agronomía
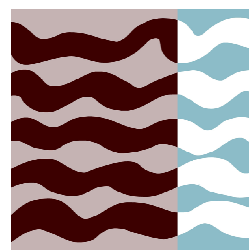
Levantamiento topográfico

Ingeniería agrónoma grado en hortofruticultura y jardinería

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1. <u>Libreta de campo</u>

Estación	Punto	Hz	Dr	Z
A	Antena	332,218	-	-
	B	321,521	10,092	-1,303
	4	397,863	4,023	0,017
	3	319,476	10,910	0,114
	C	335,865	65,59	-1,35
B	C	61,956	55,76	-0,033
	A	245,0278	10,088	-
	2	388,5152	3,457	0,069
	1	285,0498	8,171	0,078
	5	46,1862	21,258	0,041
	6	78,1586	25,508	-0,031
	7	171,004	7,211	-0,078
	8	92,7872	10,010	0,003
	9	79,0734	16,817	0,022
	10	55,6926	43,533	0,121
	11	47,2674	30,772	0,102
	12	51,4492	6,928	0,012
	13	105,6788	8,515	0,030
C	14	396,750	5,621	0,032
	15	250,225	5,773	-0,0033
	16	340,118	38,412	0,046
	5	347,565	35,419	0,041
	B	338,153	55,789	0,035
	A	335,591	65,593	-0,078
	10	359,095	13,116	0,380

2. <u>Cálculo de acimuts y error de cierre</u>

$$Co_A = \theta_A^{ant} - L_A^{ant} = 290,290 - 332,218 = -41,928$$
$$\theta_A^B = L_A^B + Co_A = 321,521 + (-41,928) = 279,593$$
$$(\theta_A^C)_{Trig} = L_A^C + Co_A = 335,865 + (-41,928) = 293,937$$

$$\theta_A^B = \theta_A^B \mp 200^g = 279,593 - 200 = 79,593$$
$$Co_B = \theta_B^A - L_B^A = 79,593 - 245,0278 = -165,4348$$
$$\theta_B^C = Co_B + L_B^C = 165,4348 + 61,956 = -103,4788 = 296,5212$$

$$\theta_C^B = \theta_B^C \pm 200^g = 296,5212 - 200 = 96,5212$$
$$Co_c = \theta_C^B - L_C^B = 96,5212 - 338,153 = -241,6318$$
$$\theta_C^A = Co_C + L_C^A = -241,6318 + 335,591 = 93,9592$$
$$(\theta_A^C)_{Top} = \theta_C^A \pm 200^g = 93,9592 + 200 = 293,9592$$

$$e_a = (\theta_A^C)_{Top} - (\theta_A^C)_{Trig} = 293,9592 - 293,937 = 0,0222 \text{ por exceso}$$
$$f_c = \frac{e_a}{n^o \text{ estaciones}} = \frac{0,0222}{3} = 7,4 \cdot 10^{-3}$$

3. Compensación de acimuts

$$\left(\theta_A^B\right)_c = \theta_A^B - 1f_c = 279,593 - 0,0074 = 279,5856$$
$$\left(\theta_B^C\right)_c = \theta_B^C - 2f_c = 296,5212 - 2 \cdot 0,0074 = 296,5'64$$
$$\left(\theta_C^A\right)_c = \theta_C^A - 3f_c = 93,9592 - 3 \cdot 0074 = 93,937$$

4. Calculo de coordenadas parciales sin compensar

$$X_A^B = D_A^B \cdot \sin\left(\theta_A^B\right)_c = 10,09 \cdot \sin 279,5856 = -9,5756$$
$$Y_A^B = D_A^B \cdot \cos\left(\theta_A^B\right)_c = 10,09 \cdot \cos 79,5856 = -3,1803$$

$$X_B^C = D_B^C \cdot \sin\left(\theta_B^C\right)_c = 55,7745 \cdot \sin 296,5064 = -55,6905$$
$$Y_B^C = D_B^C \cdot \cos\left(\theta_B^C\right)_c = 55,7745 \cdot \cos 296,5064 = -3,0592$$

$$X_C^A = D_C^A \cdot \sin\left(\theta_C^A\right)_c = 63,5915 \cdot \sin 93,937 = 45,2942$$
$$Y_C^A = D_C^A \cdot \cos\left(\theta_C^A\right)_c = 63,5915 \cdot \cos 93,937 = 6,2373$$

5. Coordenadas compensadas

$$\sum X = ecx = X_A^B + X_B^C + X_C^A = 0,0280$$
$$\sum Y = ecy = Y_A^B + Y_B^C + Y_C^A = -0,0027$$

- Para las x

$$\sum |x| = 130,5604$$
$$\left(X_A^B\right)_c = -9,5756 - 0,0280 \cdot \frac{9,5756}{130,5604} = 9,5777$$
$$\left(X_B^C\right)_c = -55,6905 - 0,0280 \cdot \frac{55,6905}{130,5604} = 55,7025$$
$$\left(X_C^A\right)_c = -65,2942 - 0,0280 \cdot \frac{65,2942}{130,5604} = 65,2802$$

- Para las y

$$\sum |y| = 12,4769$$
$$\left(Y_A^B\right)_c = -3,1803 - (-2,2764 \cdot 10^{-3}) \cdot \frac{3,1803}{12,4769} = -3,1797$$
$$\left(Y_B^C\right)_c = -3,0592 - (-2,2764 \cdot 10^{-3}) \cdot \frac{3,0592}{12,4769} = -3,0586$$
$$\left(Y_C^A\right)_c = -6,2373 - (-2,2764 \cdot 10^{-3}) \cdot \frac{6,2373}{12,4769} = 6,2384$$

$$\sum X_C = 8 \cdot 10^{-9} \qquad\qquad Z_{Y_C} = 0$$

6. <u>Coordenadas absolutas</u>

$$X_A = 1000 \qquad Y_A = 1000$$
$$X_B = X_A + \left(X_A^B\right)_C = 1000 + (-9{,}5777) = 990{,}4222$$
$$X_C = X_B + \left(X_B^C\right)_C = 990{,}4222 + (-55{,}7025) = 934{,}7197$$
$$X_A = X_C + \left(X_C^A\right)_C = 934{,}7197 + 65{,}2802 = 1000$$

$$Y_B = Y_A + \left(Y_A^B\right)_C = 1000 + (-3{,}1797) = 996{,}8202$$
$$Y_C = Y_B + \left(Y_B^C\right)_C = 1000 + (-3{,}0586) = 993{,}7615$$
$$Y_A = Y_B + \left(Y_C^A\right)_C = 1000 + 6{,}2384 = 1000$$

7. <u>Radiación</u>

Punto 1

$$\theta_B^1 = Co_B + L_B^1 = -165{,}4348 + 285{,}0498 = 119{,}615$$

Coordenadas parciales

$$X_B^1 = D_{B1} \cdot \sin \theta_B^1 = 8{,}171 \cdot \sin 119{,}615 = 7{,}7862$$

$$Y_B^1 = D_{B1} \cdot \cos \theta_B^1 = 8{,}171 \cdot \cos 119{,}615 = -2{,}4779$$

Coordenadas absolutas

$$X_1 = X_B + X_B^1 = 990{,}4222 + 7{,}7862 = 998{,}2084$$

$$Y_1 = Y_B + Y_B^1 = 996{,}8202 + (-2{,}4777) = 994{,}3422$$

Punto 2

$$\theta_B^2 = Co_B + L_B^2 = -165{,}4348 + 388{,}5152 = 223{,}0804$$

Coordenadas parciales

$$X_B^2 = D_{B2} \cdot \sin \theta_B^2 = 3{,}457 \cdot \sin 223{,}0804 = -1{,}2260$$

$$Y_B^2 = D_{B2} \cdot \cos \theta_B^2 = 3{,}457 \cdot \cos 223{,}0804 = -3{,}2322$$

Coordenadas absolutas

$$X_2 = X_B + X_B^2 = 990{,}4222 + 7{,}7862 = 989{,}1962$$

$$Y_2 = Y_B + Y_B^2 = 996{,}8202 + (-2{,}4777) = 993{,}5879$$

Punto 3

$$\theta_A^3 = Co_A + L_A^3 = -165{,}4348 + 388{,}5152 = 277{,}548$$

Coordenadas parciales

$$X_A^3 = D_{A3} \cdot \sin\theta_A^3 = 10{,}910 \cdot \sin 277{,}548 = -10{,}2385$$

$$Y_A^3 = D_{A3} \cdot \cos\theta_A^3 = 10{,}910 \cdot \cos 277{,}548 = -3{,}7684$$

Coordenadas absolutas

$$X_3 = X_A + X_A^3 = 1000 + (-10{,}2385) = 989{,}7614$$

$$Y_3 = Y_A + Y_A^3 = 1000 + (-3{,}7684) = 996{,}2315$$

Punto 4

$$\theta_A^4 = Co_A + L_A^4 = -41{,}928 + 397{,}863 = 355{,}935$$

Coordenadas parciales

$$X_A^4 = D_{A4} \cdot \sin\theta_A^4 = 4{,}023 \cdot \sin 355{,}935 = -2{,}5675$$

$$Y_A^4 = D_{A4} \cdot \cos\theta_A^4 = 4{,}023 \cdot \cos 355{,}935 = -3{,}0971$$

Coordenadas absolutas

$$X_4 = X_A + X_A^4 = 1000 + (-10{,}2385) = 987{,}4324$$

$$Y_4 = Y_A + Y_A^4 = 1000 + (-3{,}7684) = 1003{,}0971$$

Punto 5

$$\theta_B^5 = Co_B + L_B^5 = -165{,}4348 + 46{,}1862 = -119{,}2486 + 400 = 280{,}7514$$

Coordenadas parciales

$$X_B^5 = D_{B5} \cdot \sin\theta_B^5 = 21{,}258 \cdot \sin 280{,}7514 = -20{,}2936$$

$$Y_B^5 = D_{B5} \cdot \cos\theta_B^5 = 21{,}258 \cdot \cos 280{,}7514 = -6{,}3300$$

Coordenadas absolutas

$$X_5 = X_B + X_B^5 = 990{,}422 + (-20{,}2936) = 987{,}4324$$

$$Y_5 = Y_B + Y_B^5 = 996{,}8202 + (-6{,}3300) = 990{,}4901$$

Punto 6

$$\theta_B^6 = Co_B + L_B^6 = -165,4348 + 78,1586 = -87,2762 = 312,7238$$

Coordenadas parciales

$$X_B^6 = D_{B6} \cdot \sin \theta_B^6 = 25,508 \cdot \sin 312,7238 = -25,0002$$

$$Y_B^6 = D_{B6} \cdot \cos \theta_B^6 = 25,508 \cdot \cos 312,7238 = 5,0642$$

Coordenadas absolutas

$$X_6 = X_B + X_B^6 = 990,422 + (-20,2936) = 965,4220$$

$$Y_6 = Y_B + Y_B^6 = 996,8202 + 5,0642 = 1001,8844$$

Punto 7

$$\theta_B^7 = Co_B + L_B^7 = -165,4348 + 171,004 = 5,5692$$

Coordenadas parciales

$$X_B^7 = D_{B7} \cdot \sin \theta_B^7 = 7,211 \cdot \sin 5,5692 = 0,6300$$

$$Y_B^7 = D_{B7} \cdot \cos \theta_B^7 = 7,211 \cdot \cos 5,5692 = 7,1834$$

Coordenadas absolutas

$$X_7 = X_B + X_B^7 = 990,422 + 0,6300 = 991,0523$$

$$Y_7 = Y_B + Y_B^7 = 996,8202 + 7,1834 = 1004,0036$$

Punto 8

$$\theta_B^8 = Co_B + L_B^8 = -165,4348 + 92,7872 = 327,3524$$

Coordenadas parciales

$$X_B^8 = D_{B8} \cdot \sin \theta_B^8 = 10,01 \cdot \sin 327,3524 = -9,1002$$

$$Y_B^8 = D_{B8} \cdot \cos \theta_B^8 = 10,01 \cdot \cos 327,3524 = 4,1696$$

Coordenadas absolutas

$$X_8 = X_B + X_B^8 = 990,422 + 0,6300 = 981,3220$$

$$Y_8 = Y_B + Y_B^8 = 996,8202 + 7,1834 = 1000,9898$$

Punto 9

$$\theta_B^9 = Co_B + L_B^9 = -165,4348 + 79,0734 = -86,3614 = 313,6386$$

Coordenadas parciales

$$X_B^9 = D_{B9} \cdot sin \, \theta_B^9 = 16,817 \cdot sin \, 313,6386 = -16,4325$$

$$Y_B^9 = D_{B9} \cdot cos \, \theta_B^9 = 16,817 \cdot cos \, 313,6386 = 3,5752$$

Coordenadas absolutas

$$X_9 = X_B + X_B^9 = 990,422 + (-16,4325) = 973,9897$$

$$Y_9 = Y_B + Y_B^9 = 996,8202 + 3,5752 = 1000,3935$$

Punto 10

$$\theta_B^{10} = Co_B + L_B^{10} = -165,4348 + 55,6926 = -109,7422 = 290,2578$$

Coordenadas parciales

$$X_B^{10} = D_{B10} \cdot sin \, \theta_B^{10} = 43,533 \cdot sin \, 290,2578 = -43,0242$$

$$Y_B^{10} = D_{B10} \cdot cos \, \theta_B^{10} = 43,533 \cdot cos \, 290,2578 = -6,63588$$

Coordenadas absolutas

$$X_{10} = X_B + X_B^{10} = 990,422 + (-43,0242) = 947,3980$$

$$Y_{10} = Y_B + Y_B^{10} = 996,8202 + (-6,63588) = 990,1843$$

Punto 11

$$\theta_B^{11} = Co_B + L_B^{11} = -165,4348 + 51,4492 = -113,9856 = 286,0144$$

Coordenadas parciales

$$X_B^{11} = D_{B11} \cdot sin \, \theta_B^{11} = 30,772 \cdot sin \, 286,0144 = -29,5274$$

$$Y_B^{11} = D_{B11} \cdot cos \, \theta_B^{11} = 30,772 \cdot cos \, 286,0144 = -8,6627$$

Coordenadas absolutas

$$X_{11} = X_B + X_B^{11} = 990,422 + (-29,5274) = 960,8948$$

$$Y_{11} = Y_B + Y_B^{11} = 996,8202 + (-8,6627) = 988,1574$$

Punto 12

$$\theta_B^{12} = Co_B + L_B^{12} = -165,4348 + 51,4492 = -113,9856 = 286,0144$$

Coordenadas parciales

$$X_B^{12} = D_{B12} \cdot \sin \theta_B^{12} = 6,928 \cdot \sin 286,0144 = -6,7614$$

$$Y_B^{12} = D_{B12} \cdot \cos \theta_B^{12} = 6,928 \cdot \cos 286,0144 = -1,509$$

Coordenadas absolutas

$$X_{12} = X_B + X_B^{12} = 990,422 + (-6,7614) = 983,6607$$

$$Y_{12} = Y_B + Y_B^{12} = 996,8202 + (-1,509) = 995,3104$$

Punto 13

$$\theta_B^{13} = Co_B + L_B^{13} = -165,4348 + 105,6788 = -59,756 = 340,244$$

Coordenadas parciales

$$X_B^{13} = D_{B13} \cdot \sin \theta_B^{13} = 8,515 \cdot \sin 340,244 = -6,8695$$

$$Y_B^{13} = D_{B13} \cdot \cos \theta_B^{13} = 8,515 \cdot \cos 340,244 = 5,0313$$

Coordenadas absolutas

$$X_{13} = X_B + X_B^{13} = 990,422 + (-6,8695) = 983,5527$$

$$Y_{13} = Y_B + Y_B^{13} = 996,8202 + 5,0313 = 1001,8515$$

Punto 14

$$\theta_C^{14} = Co_C + L_C^{14} = -241,6318 + 396,780 = 155,1182$$

Coordenadas parciales

$$X_C^{14} = D_{C14} \cdot \sin \theta_C^{14} = 5,621 \cdot \sin 155,1182 = 3,6426$$

$$Y_C^{14} = D_{C14} \cdot \cos \theta_C^{14} = 5,621 \cdot \cos 155,1182 = -4,2801$$

Coordenadas absolutas

$$X_{14} = X_C + X_C^{14} = 934,7197 + 3,6426 = 938,3623$$

$$Y_{14} = Y_C + Y_C^{14} = 993,7615 + (-4,2810) = 989,4805$$

Punto 15

$$\theta_C^{15} = Co_C + L_C^{15} = -241{,}6318 + 250{,}225 = 8{,}5932$$

Coordenadas parciales

$$X_C^{15} = D_{C15} \cdot \sin\theta_C^{15} = 5{,}773 \cdot \sin 155{,}1182 = 0{,}7768$$

$$Y_C^{15} = D_{C15} \cdot \cos\theta_C^{15} = 5{,}773 \cdot \cos 155{,}1182 = 5{,}7204$$

Coordenadas absolutas

$$X_{15} = X_C + X_C^{15} = 934{,}7197 + 0{,}7768 = 935{,}4966$$

$$Y_{15} = Y_C + Y_C^{15} = 993{,}7615 + 5{,}7204 = 999{,}4820$$

Punto 16

$$\theta_C^{16} = Co_C + L_C^{16} = -241{,}6318 + 340{,}118 = 98{,}4862$$

Coordenadas parciales

$$X_C^{16} = D_{C16} \cdot \sin\theta_C^{16} = 38{,}412 \cdot \sin 98{,}4862 = 38{,}4011$$

$$Y_C^{16} = D_{C16} \cdot \cos\theta_C^{16} = 38{,}412 \cdot \cos 98{,}4862 = 0{,}9133$$

Coordenadas absolutas

$$X_{16} = X_C + X_C^{16} = 934{,}7197 + 38{,}4011 = 973{,}1209$$

$$Y_{16} = Y_C + Y_C^{16} = 993{,}7615 + 0{,}9133 = 994{,}6748$$