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Errata[1]
Doppler Radar and Weather Observations, Second Edition

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Page	Para.	Line	Remarks: Paragraph 0 is any paragraph started on a previous page that carries over to the current page
xvii			add to list of symbols: g_s System gain
		6	change to: c Speed of light in a vacuum
xix			add to list of symbols: γ Mass density of air
xix			delete from list of symbols: ρ Mass density of air
10	Eq.(2.2a)		Change ψ to ψ_t
11	0	1	as above
	2	2	as above
	Eq.(2.2b)		as above
12	Fig.2.3		as above
14	2	1	Change to read: The path of electromagnetic waves depends principally on the change of refractive index $n = c/v$ with height (or relative..... is unity).
		4	"contet" should be "content"
		7	change period to comma after "content"
		8	insert "are" to read "developed herein are useful"
15	1		change ρ to γ in line 14, in Eqs.(2.8) and 2.9, and line 19

[1]The authors thank Dr. R.E. Rinehart of the University of North Dakota for many of these entries.

18	Fig.2.5		change caption to: “...in which *n* decreases with height.”
30	2	9	italicize the "o" in oscillator
		10	change "ad" to "and"
31	Fig.3.1		Change "synchronous detector" to "synchronous detectors"
32	5	4	Insert the sentence: "The region beyond $r = 2D_a^2/\lambda$ is called the far field; there the power density has an angular dependence independent of range, and an inverse r^2 dependence."
33	1	3	change “reflector” to “reflector’s aperture”
34	Eqs.3.2		replace D with D_a
35	1	3	delete period at end of line
35	1	9	insert the word "transmitting" before antenna
35	Eq.(3.6)		change K_m to K_w in this equation and in the line following it
36	0	7	change to "$\|K_m\|^2 \equiv \|K_w\|^2$"
		9	change to "$\|K_m\|^2 \equiv \|K_i\|^2$"
38	2	3	change "λ = 3 cm" to "$\lambda \leq$ 3 cm"
39	1	4,5	use the symbol for *l* in Eq. 3.13b as in 3.13a
40	Eq.(3.14)		replace subscript "m" with "w"
42	Fig. 3.5		insert *Z* in front of (dBZ) in the abscissa label
43	1	1	Replace "Remove" with "Remote"
	3	6	change to "...attenuation for liquid cloud is..."
	Eq.(3.17)		change subscript "m" to "w"
44	0	2	"0.9 dB" should be "0.43 dB"

	sect.3.3.4		add as a footnote: “Blake has published (1986, in "Radar range performance analysis", 2nd ed., ARTECH House, Norwood, MA.) new values of attenuation in gases. For example, at λ = 10 cm, r = 200 km, θ_e = 0^o, the two way loss is about 0.3 dB larger than that given in Fig.3.6.”
45	Fig.3.6		ϕ_e should be θ_e
47	Table 3.1		change footnote *c* to read: “....antenna port, and a 3 dB filter bandwidth of 0.63 MHZ is assumed.
50	1	last	remove comma
	Eq.(3.25)		change ψ to ψ_t
51	1	11	delete sentence beginning with "Thus the sign..."
	Eq.(3.27)		Delete "sin(ωt)"
52	1	9	Start a new paragraph at: "A physical explanation...
		13	Change "the scatter" to "its"
60	4	11	change “directly” to “correctly”
61	0	7	Delete "(or folding)"
	Fig.3.14		change γ (t) to ψ_e (t) and $\Delta\gamma$ to $\Delta\psi_e$
64	3	2	"than", not "then"
65	0	6	remove comma after "size"
	1	4	change to: ....pulses (I and Q) at the output.....
	Fig.4.2		replace W with I in the figure, and change caption to read:...output I (or Q) to....and r_o is the range where scatterers contribute maximum weight to the sample gate at τ_{s1} (Section 4.2.2).
66	0	2	change $V(t)=I(t)+jQ(t)$ to $V(\tau_{s1})=I(\tau_{s1})+jQ(\tau_{s1})$.
67	3	1	Insert after $V(\tau_s)$: "at the receiver's output"

68	1	7	bracketed text should end "...in Eq. (4.2).]", i.e., put period between right parenthesis and bracket
71	Eq.(4.4)		insert $(1/\sqrt{2}\,)$ in front of the sum sign in each of these equations
71	Eq.(4.6)		Delete the first "2"
74	Eq.(4.12)		delete the boldness of "**r**"
	4	1	measurem(m)ents; delete the extra "m"
75	1	6	change to "$G(0) \geq 1$"
76	0	5	change "output of" to "input to"
	1	5	envelope
		7	change to read:....the output of the receiver would be that sketched in Fig.3.12.).
	Fig.4.5		Change to read: The arrow(s) indicates sliding....
82	Eq.(4.31)		change Z to Z_w
	8-9		Eq.(4.32) and the line following it should read: "$Z_w(\mathbf{r})$ = ... is the *reflectivity factor* of water spheres. Whenever....."
	17		change to read: "10 $\log_{10} Z$, where Z is in units of mm^6/m^3 and the scale of Z(dBZ) ≡ 10 $\log_{10} Z$ is in dBZ units."
	Eq.(4.34)		place an overbar on "$P(\mathbf{r}_o)$"
83	Eq.(4.38)		subscript "r" should be "τ"
	3	14-16	change to read "...375 kHz. For a radar transmitting a rectangular pulse and using a matched Gaussian filter (i.e., $B_6\tau$=1), one finds..."
85	Fig.4.10		the ordinate should have the label "Correlation coefficient $R_{vv}/R_{vv}(0)$"
94	4	5	change to "Noise-like signals..."
101	3	2,3,5	add comma after "domain" and one after "(Fig. 5.10 RECT)"

103	caption		add comma after "Oklahoma,"
107	Eq.(5.40)		remove the bold print from $\mathbf{r}_1^4$ and in the factor$\|W(r_o,\mathbf{r}_1)\|$; θ and ϕ need to have the subscript 1 appended to be consistent with symbols in Fig.5.11, and add the subscript "s" to W to be consistent with Eq.4.9c.
108	1	last	add comma after "by definition,"
109	1	4	remove comma after "replenished"
112	Eq.5.57		add the subscript "s" to W in order to be consistent with Eqs.4.9c and 5.40 (modified)
113	2,3		Delete the sentences beginning with "Furthermore, we assume..." and ending with "...scatterer's axis of symmetry)." in paragraph 3. Change Eq.(5.59a) to read

$$
\begin{aligned}
R(mT_s) &= E[V^*(\tau_s,0)V(\tau_s,mT_s)] \\
&= E\left[\sum_i \sum_k F_i^*(0)A_i^*(0)F_k(mT_s)A_k(mT_s)\exp\{j(\phi_i-\phi_k-4\pi v_k mT_s/\lambda)\}\right] \\
&= \sum_k E\left[A_k^*(0)A_k(mT_s)F_k^*(0)F_k(mT_s)\exp\{-j4\pi v_k mT_s/\lambda\}\right]
\end{aligned}
\qquad (5.59a)
$$

Following this equation write:

The expectation in Eq.(5.59a) includes averages over the ensemble of statistically stationary and homogeneous turbulent velocity fields. The expectations of the off diagonal terms of the double sum are zero because the phases (ϕ_i - ϕ_k) are uniformly distributed across 2π; thus the double sum reduces to a single one. To simplify further analysis, assume that the weighted scatterer's cross section F_kA_k is independent of v_k, and that F_k does not change appreciably [i.e., $F_k(0)\approx F_k(mT_s)$] while the scatterer moves during the time mT_s. Furthermore, assume A_k varies randomly in time (i.e., a hydrometeor may oscillate or change its orientation relative to the electric field). Thus Eq.(5.59a) reduces to

$$
R(mT_s) = \sum_k R_k(mT_s)|F_k|^2 E[\exp\{-j4\pi v_k mT_s/\lambda\}] \qquad (5.59b)
$$

where

$$R_k(mT_s) \equiv E\left[A_k^*(0)A_k(mT_s)\right]$$

Because $R(0)$ is proportional to.....(continue from the sentence containing Eq.5.59c)

115 1 1 change Eq.(5.59a) to Eq.(5.59b)

2 2 change to: "....to the air) the expected (over the ensemble of turbulent velocity fields) normalized power spectrum

$$E\left[S_n(r_o,v)\right] = \frac{E\left[S(r_o,v)\right]}{\int_{-\infty}^{+\infty} E\left[S(r_o,v)\right]dv} \qquad (5.60)$$

is equal to..."

3 1 change to read: ".....the autocorrelation $R_k(mT_s)$ would..."

7 change Eq.(5.59a) to Eq.(5.59b)

Eq.(5.64) place E[] around $S_n(f)$

116 Eq.(5.66) place E[] around $S_n(-v)$

1 change to: "Thus, for homogeneous turbulence, the *expected* normalized ....and range weighting functions. Although, in deriving Eq.(5.66), we did not state reflectivity is uniform, our assumption that the weighted hydrometeor's cross section F_kA_k does not depend.....implicitly assumes reflectivity and $I_n(\mathbf{r}_o,\mathbf{r})$ are uniform. In practice, for Eq.(5.66) to be valid, it suffices that the *outer* scale of turbulence is *small* compared to the size of V_6."

117 2 7 eliminate "(e.g.x, y, z)"

3 1 change to read: " If the radial velocity is linear about v_o in the Cartesian coordinate system, it is expressed as

(5.71)

		3	add at the end of the sentence: "....various axes; but then the shear is non linear in the spherical system. In the remainder of the text we assume a *uniform* wind in the Cartesian system and analyze the effects of this wind in the spherical system. If the resolution volume dimensions are much smaller than its range, distances transverse to the beam axis can be approximated by arclengths. Therefore, the radial velocity can be expressed as

$$v - v_o = k_\phi r_o(\phi - \phi_o) + k_\theta r_o(\theta - \theta_o) + k_r(r - r_o), \tag{5.72}$$

where k_θ, k_ϕ, k_r are constant shears in the θ, ϕ, r directions."

Eliminate sentences starting with "Let us orient... " up to, but not including Eq. (5.74), and replace with: "If the weighting function

$$I(r,\theta,\phi) = C|W_s(r)|^2 f_\phi^4(\phi) f_\theta^4(\theta)/r_o^2 \tag{5.73}$$

and the reflectivity are product separable, substitution of (5.72) and (5.73) into (5.51) produces

(5.74)

122	3	2,3	change to read "...signals, estimates using few samples have a large statistical uncertainty and therefore don't allow meaningful ...."
125	2	10	after Eq.(6.5) add: ρ in chapter 5 (e.g., Eq.5.63) is the complex correlation function. Here, and henceforth it represents the magnitude of this complex function.
126	3	2-5	change "$\overline{P}$" to "*S*". Furthermore, the sentence beginning with "The $\overline{P}$ values of ..." should be moved to the end of the para.1, and there should be a subscript k on $\overline{P}$. The overbar on *P* should be removed in this sentence.
		last	change "*E*(P)" to "$E(\hat{P})$"
127	3	3	change σ_Q^2 to $\sigma_{\hat{Q}}^2$, (the Q needs a hat (^) over it)

	Eq.(6.9)		left side: place hat (^) over Q
		5	place hat (^) over Q in $\sigma^2_{\hat{Q}}$
128	Eq.(6.12)		the subscript 1 on M on the left side of this equation should be "I"
	2	6	change to "..... $\sigma_{\hat{Q}}$ of a M-sample power estimate equals $\overline{P}/M_I$."
129	0	6-7	insert at the end of line 6: ....independent samples can be determined using an.....
130	Table 6.1		add above **Reflectivity factor calculator:** "**Sampling rate:** 0.6 MHZ". Under "**Reflectivity factor calculator**" change "Range increment" to "Range interval Δr", and add "Range increment"equals "0.25 km"
	1	1	change to "Sometimes the bandwidth of the receiver is about.."
134	1	1	the first line before Eq.(6,22a) should read: If σ_{vn}<<1, but condition (6.20a) satisfied, the sum in Eq.(6.21).....
	Fig.6.5		on the plot change $\geq$ 20 dB to $\geq$ 15 dB
137	1	3	change to read: "..... it can be seen that the standard error of the estimates are relatively independent of SNR and σ_{vn} as long as $0.02 < \sigma_{vn} < 0.2$ and SNR $\geq$ 15 dB."
137	2	1	Delete "($\sigma_{vn} > 1/2\pi$)"
146	1	4	change unit to read "less than 1 dB", not "dBZ"
	Eq.(6.48)		$\lvert\rho(mT_s)\rvert^2$ should be $\lvert\rho(2mT_s\rvert^2$
150	Eq.(6.50)		change i - 1 below the summation sign to i = 1.
	1	4	change to read: "...= $-2T_s(k + k_v)v$ ...."
		6-8	change to read: ".... scattering; k_h and k_v are increments, due to the presence of hydrometeors, added to the propagation wavenumber k of the atmosphere. The phase of R_b is....."
		9,11	change k_o to k
151	0	7	change $\lvert\rho_{hv}(0)\rvert$ to $\lvert\rho_{hv}(0)\rvert^2$

	Eq.(6.57)		The approximate form of this equation should be: $$\approx \frac{\lvert\rho_{hv}(0)\rvert^2\left[\pi^{3/2}\sigma_{vn}-2\rho(2T_s)N/S\right]}{\pi^{3/2}\sigma_{vn}+N^2/S^2+2N/S}$$
156	1	12-15	change to read: “A normalized standard deviation is plotted in Fig.18 for a slightly simpler estimator in which the .....in (6.66) is not used. Inclusion of these terms.....”
164	2	3	at the end of this line add "(from Eq.3.40)"
171	0	3	T_s should be T_2
172	1	2	at the end of this line add "....the true velocity v_t is the least common multiple of v_{a1}, v_{a2}. Thus".
		4	delete "v_t is the true velocity,"
176	1	2	"PTR" should be "PRT"
182	Eq.(7.12)		W_iW_{i+1} should be W_iW_{i+l}
197	1	1	“though” should be “through”
	2	4	“Fig.3.3" should be “Fig.3.2"
198	0	18	change "Pate" to "Plate"
		19	replace "10 dBZ" with "20 dBZ"
200	Fig.7.28		correct caption to read as: The WSR-88D antenna pattern in the vertical plane, the polarization was circular but has since been changed to linear, and the antenna was without a radome. Sidelobes with radome are specified to be below the dashed envelope. Subsequent measurements suggested that the radome increases the near (i.e., $\pm5^o$) sidelobe levels by less than 2 dB and has negligible effect on the main lobe. (Note: the dashed lines are incorrectly drawn in the second edition, first printing. They should extend from -26 dB at $\pm2^o$ to -38dB at $\pm10^o$, and then the constant level should be at -42 dB)
201	0	2	“Norma” should be “Norman”
205	2	4	Eq.(5.61) should be Eq.(5.69)

209	1	1	put "by radar" at the end of the sentence after "precipitation
215	3	5	"Foot" should be "Foote"
		11	insert "up to" before the quantity 800 kg m^{-3}
		12	add comma after "frozen particles,"
216	Eq.(8.2)		change period to comma and add the following after the equation: "for a range of Λ from about 0.1 to 1 mm^{-1}.
	1	10	change to read "...and Kinzer. Nevertheless, we shall..."
217	0		in lines 1,2,3,8, and 12 change ρ to γ. In line 1 add γ after "...air density". But ρ_h in line 12 (i.e., Eq.(8.6a) remains as is.
222	2	2	$N_A(D)$ should be $dN_A(D)$, and the same correction applies to Eqs.(8.17) and (8.18); the differential dD on the left side of Eq.(8.18) must be deleted.
223			in title of section 8.4 change "measurement" to "measurements"
228	1	2-5	change to read: First, the radar equation, Eq. (4.35), retrieves an estimate of the reflectivity factor $Z_e = Z_w$ of water drops. If the scatterers are ice spheres, then Z_i is obtained from Z_w by using the following equation:

$$Z_i = (|K_w|^2/|K_i|^2)Z_w \qquad (8.24)$$

		10-17	change to read: "...is immaterial and the value for $|K_i|^2$ is 0.176. But researchers (e.g., Sekhon and Srivastava, 1970) usually express the drop size distributions in terms of the diameter of the melted particle. The diameters of melted particles are smaller by a factor of $0.92^{1/3}$ (0.92.....) and thus must be increased by a factor of 1.028 in order to obtain the drop size distributions of equivalent ice spheres (Smith, 1984).
	2	1-6	replace this paragraph with: For example, the Sekhon-Srivastava (1970) R, Z relation for snow is

$$Z = 1780R_s^{2.21}. \qquad (8.25a)$$

But this needs to be multiplied by $(1.028)^6$ to obtain

$$Z_i = 2103 R_s^{2.21}, \tag{8.25b}$$

the reflectivity factor of the ice particles. Eq.(8.25b) is the appropriate relation that must be used to estimate snowfall rate R_s from the Z_i measured by radar. To obtain radar measured Z_i , Eq.(8.24) should be used in Eq.(4.35) with $Z_w = Z_e$.

228	Eq.(8.26a)		change the period to a comma and add the following: "where Λ lies in the interval from about 0.1 to 1 mm^{-1}.
	3	7	change "Eq.(8.14)" to "Eq.(8.15)"
	Eq.(8.26b)		change to:

$$Z_H = \frac{115}{\Lambda^{3.37}} \gamma(7, \Lambda D_{max}) \tag{8.26b}$$

229	2	1	change "poduces" to "produces"
	Fig. 8.8		remove subscript to unit "dBZ"; add "MDT" after time of 1535
230	1	1	delete "Strong scattering capable to produce ...", and start paragraph with: "The three-body signature is ..."
232	0	10-11	change to: ...microwave (λ = 0.84 cm) path....
234	1	5	add comma after "(Fig. 8.1),"
	Eq.(8.30)		right bracket "}" should be matched in size to left bracket "{"
	2	4	(8.7) should be (8.8)
240	2	2	change to read: "...located at r_n. Using Eqs.(2.3), (3.20), and (3.24), it can be shown that...."
		5	change to: "...*k* is the precipitation-free atmospheric wave number, P_j is .."
		7	change to: "...is the rms received field. The magnitude of ...."

		10	place expectation brackets around $\|s_{ij}\|^2$. This should look like $<\|s_{ij}\|^2>$.
241	0	4-5	change to read: ...is zero because the phase $2kr_n$ is uniformly distributed over 2π. Thus, radar.....
	Eq.(8.44a)		Eq.(8.44a) and the lines following it should read as follows:

$$= \int n(\mathbf{r}) < s_{ij} s_{kl}^{*} > |F(\mathbf{r})|^2 dV \qquad (8.44a)$$

In the last equality the summation over n is replaced with the integral over the product of the density $n(\mathbf{r})$ of drops at position **r**, the ensemble average of $s_{ij}s_{kl}$,and the resolution volume weighting function.

242	2	2	change sentence to read "The number of attributes...."
	3	1-2	change to read: Variables in this list are combinations of the three real diagonal terms and one complex off diagonal term. The other two complex terms have been less .....
244	3	3	change to: ...s_{vv}, and s_{rr} given by Eq.(8.52a) is zero;..
245	0	8	s_{lr} should be s_{rr}
248	Eq.(8.57)		parenthesize ")" needs to be placed to the right of the term "(b/a"
249	2	2	change Prat to Pratt
	Eq.8.58		$\cos^2\delta$ should be $\sin^2\delta$; replace k_o with k; p_v and p_h should be replaced with p_a and p_b respectively
	Eq.8.59a,b		change the subscripts h to b, and v to a
	2	9	change to read: p_a and p_b are the drop's susceptibility in generating dipole moments along its axis of symmetry and in the plane perpendicular to it respectively, and e its eccentricity,
		12-13	rewrite as: ...symmetry axis, and ψ is the apparent canting angle (i.e., the angle between the electric field direction for "vertically" polarized waves (**v** in Fig.8.15) and the projection of the axis of symmetry onto the plane of polarization. The forward.....

		17	modify to read: $f_h = k^2 p_b$, and $f_v = k^2 [(p_a - p_b)\sin^2\delta + p_b]$ (Oguchi, ...
	3	4-5	Rewrite as: Hence from Eqs.(8.58) an oblate drop has, for horizontal propagation and an apparent canting angle equal to zero, the following cross sections for h and v polarizations:
250	Fig.8.15		change caption to read : "the linear polarization base vectors, and ψ' and ψ are the canting and apparent canting angles of the scatterer. The vector .....x, z plane, and **h** is parallel to the y axis. ψ is positive if n' is ccw from **v.**"
	1	9	change "K_w" to "K_m"
254		6	change to "...the data collection period, ..."
264	2	13	change ";" to "." and start new sentence "Instead..."
266	1	1	replace "the reduction" with "a reduction"
		2	replace "is due.." with "would be due..."
		3	replace sentence beginning with "The drop.." with "In general the change in the composite $\|\rho_{hv}(0)\|$ depends on the relative reflectivities, differential reflectivities, and the $\|\rho_{hv}(0)\|$s of the precipitation types."
270	0	1	insert "...the presence...."; add comma after "...diameter),"
272	1	2	change "survy" to "survey"
274			change title of section 8.6 to: "**Size Distributions derived from Doppler Spectra**"
275	1	9	"spectrum-broadening contributions"
275	1	10	change to: ".....from Eqs. (3.6) and (4.31), can be....
277	0	6	add comma after "At this wavelength,"
278	Fig. 8.36		add to figure caption: "$N(D)$ is in $m^{-3}mm^{-1}$ if 10 is added to the ordinate values."
288	1	11	"shelf-like cloud"

289	2	13	change to read: "...[from Eq.(8.5)] to account..."
292	2	5	"...phenomena are..."
294	Fig.9.4b		along the x axis the value “East 49.7" needs to be “East 44.7"
297	2	12,14	remove periods in time abbreviations (i.e., "CST", not C.S.T.", etc.) here and throughout the text
304	1	2,3	Delete hyphens between "three-Doppler" and "dual-Doppler" and add radar after "dual Doppler radar"
307	1	1	change this paragraph to be a continuation of the previous one and modify it to read: "where θ_e', the angle between the radar beam and the tangent plane below the data point, is the sum of ....."
	2	15	Sentence beginning with "If the ground below..." should be changed to read: "Eq.(9.11) can be generalized (i.e., wind can have any z dependence) and yet greatly simplified if the wind is linear on spherical surfaces and γ_o depends only on z (Problem 9.9)."
		19	insert v_z
309	3	3	"...if data are..."
313	1	10	change to "which, for r constant, can be solved.."
		16	change to "wind above it."
328	3	3	interchange word order to read "..by simultaneously displaying...."
338	Eq (9.33)		subscript on right side should be "t" instead of "r"
361	1	11	change "whch" to "which"
362	2	7	add comma after "...Arkansas,"
370	Fig 9.43		delete the last sentence of the caption
376	1	4	add comma before ", causing it to flow...."
386	2	2	change comma to semicolon after "...atmosphere; however, ..."

385 Prob.(9.9) Change to read: "Show that wind can have any z dependence and $w_x = w_y = 0$ if wind is horizontally linear and satisfies the anelastic continuity equation, Eq.(9.5b). Under these conditions show that the number of unknowns in Eq.(9.11) reduces from 11 to 6!"

387 1 7 put period between right parenthesis and right bracket "...Eq.(5.48).]"

389 2 2 delete “towers or even”

390 0 1 change to read “along the path ℓ of the aircraft, and $S_{ij}(K_\ell)$ is the Fourier transform of $R_{ij}(\ell)$ for displacements along this path. In contrast....”

391 0 1 append adjective to "Bessel function" so the line reads: where $K_\nu(\rho/\rho_o)$ is the modified Bessel function....

393 Eq.(10.29) modify this equation to read

$$D_{ii}(\rho) = 2R_{ii}(0)\left[1 - \frac{1}{2^{\nu-1}\Gamma(\nu)}\left(\frac{\rho}{\rho_{oi}}\right)^{\nu} K_\nu\left(\frac{\rho}{\rho_{oi}}\right)\right] \qquad (10.29)$$

1 10,11 change to read: "where the indices ii identify either the transverse or the longitudinal component. Furthermore, because $R_{\ell\ell}(0) = R_{tt}(0) \equiv R(0)$ for isotropic turbulence, ρ_{oi} is the only parameter that differs for transverse and longitudinal correlations. For small values of $\rho << \rho_{oi}$..."

Eq.(10.30) change to read:

$$D_{ii}(\rho) \approx 2R(0)[\Gamma(1-\nu)/\Gamma(1+\nu](\rho/2\rho_{oi})^{2\nu}. \qquad (10.30)$$

Eq.(10.32) change to read:

$$C_{ii}^2 = [3x2^{1/3}\Gamma(2/3)/\Gamma(1/3)]R(0)\rho_{oi}^{-2/3} \qquad (10.32)$$

1 delete last sentence beginning with " Furthermore,.."

394 Eq.(10.37) change to read:

$$R_{ii}(\rho, \tau_1 = 0)[1 - (\rho/\rho_{oi})^{2/3}]$$

Eq.(10.38) change the first equal sign to $\approx$.

	4	4	modify to read: "....where $K\rho_o >> 1$ has been assumed, and the subscript..."
398	1	16	$\mathbf{K}_1$ should be K_1 ; that is the K is not in bold print and should be italicized
401	Fig. 10.6		in caption: Eq.(5.67) should be Eq.(5.75); the parameter along the abscissa needs to be changed to $K_1 /2\pi$; and add to caption: "The curves are normalized by $S_i(0)$ for $K_o = 2\pi$ rad km^{-1}."
403	1	5	change to read: "...spectrum width, σ_t (Eq.5.67), due to turbulence, is given by Eq.(5.51). Thus,

$$\sigma_t^2 = \overline{v^2} - (\bar{v})^2 \ , \qquad (10.56)$$

where the ..... average of velocities weighted by $I_n(r_o,r)\eta(r)$. Note that σ_t is not necessarily the observed spectrum width σ_v which also includes contribution σ_s from shear of the mean radial flow. The variance.."

404	0	2-3	delete the phrase "the weighting functions symmetrical,"
	Eq.(10.59)		change to:

$$\sigma_p^2 = <\sigma_t^2> + \sigma_{\bar{v}}^2, \qquad (10.59)$$

	0	10	change to read: "the ensemble average of σ_t^2 and the variance of the turbulent velocities weighted spatially by..."
	1	1	delete the phrase "is independent of the weighting function but" in the first sentence.
	2		"In addition.....energy, the two variances σ_t^2 and $\sigma_{\bar{v}}^2$ have relative magnitudes that depend on $I_n(r_o,r)\eta(r)$. These two variances describe..".
405	2	2	replace σ_v with σ_t

Eqs.(10.61), (10.62)			replace σ_v^2 with σ_t^2
	3	1	replace $\sigma_v^2(\phi)$ with $\sigma_t^2(\phi)$
408	2	8	replace $<\sigma_v^2>$ with $<\sigma_t^2>$
	Eq.(10.65)		replace $<\sigma_v^2>$ with $<\sigma_t^2>$
409	1	1	replace "the Doppler spectrum width" with σ_t
		2	replace σ_v with σ_t
	2	4	replace σ_v with σ_t
		5	change to read: "...range resolution equal to or smaller than...."
	Eq.(10.67)		replace σ_v^2 with $<\sigma_t^2>$
	Eq.(10.68)		replace σ_v^3 with $<\sigma_t^2>^{3/2}$
	3	1	replace σ_v^2 with $<\sigma_t^2>$
	Eq.(10.70)		replace σ_v^3 with $<\sigma_t^2>^{3/2}$
410	last	last	change sentence starting with "An example.." to "In Fig.10.10 is an example of a radial velocity field in a thunderstorm which exhibits areas of large shear."
411	0	3	change to "...shear region is near the mesocyclone..."
412	2	2	change “plane surface” to “linear model”
		5	change “plane” to “model”
	3	1	change “surface” to “model”
		3	insertion: “...origin of the fitting surface.”
413	0	6	change to read “...to these uniform shears..”
414	0	1	space between "the up-" and "(down-)"

418	1		insert at the end of the paragraph: "Pilots consider turbulence to be severe if $\varepsilon \geq 0.1$ m^2s^{-3} (Trout and Panofsky, 1969)"
419	Fig. 10.18		The "-5/3" slope line drawn on this figure needs to be redrawn to have a -5/3 slope. Furthermore, remove the negative sign on "s" in the units (m^3/s^{-2}) on the ordinate scale; this should read (m^3/s^2).
423	0	14	(just after Eq. 8) change to "... the mean flow energy budget equation."
426			change section title to: Formulation of the Wave Equation for Inhomogenous and Random Media
427	Eq.(11.10)		delete the period at the end of the equation and add: where $c = \sqrt{\mu_o \epsilon_o}$ is the speed of light in a vacuum.
428	1	last	change to "..$k_0^2 \equiv \omega_0^2/c^2$, where k_0 is the wavenumber in vacuum.
431	2	13,16	change "scatter" to "scattering"
	Eq.11.20		τ needs to be replaced by t.
432	0	2	delete "when the beams intersect"
	0	5	change to: ...if the pulse widths and receivers are the same
	Eq.11.27		delete the term $e^{-jk_o r_r}$ (this term is included in $\mathbf{f}(\mathbf{r},t_0^*)$)
	2	20	start new paragraph at the line beginning with "With the proviso..."
433	2	1	change: "...antennas, and typical ranges and time resolutions used..."
		4	insert the following after Eq.(11.31c): , here and henceforth we drop the $e^{j\omega_o t}$ term.
434	0	16	change to: Applying the divergence theorem to $\phi\mathbf{u}$, and the argument following Eq.(11.33), the equation
			(11.39)
	Eq.(11.42)		the third unit vector $\mathbf{a}_{ro}$ should be $\mathbf{a}_{to}$
435	4	last	this line should end with a comma
436	0	1	change "Equation (11.46)" to "Inequality (11.46)"

	2	4	change to read: "....smaller subvolumes (i.e., Bragg scatterers having dimensions....."
		5,6	change to read: " ...The scattered fields from these subvolumes add incoherently...."
437	0	2	for consistency change "scatter" to "scattering"
		4	should read "substitution of Eqs...."
445/446			to avoid possibly confusing the Bragg wavelength with the outer scale (e.g., Chapter 10 and Fig.11.8), change all Λ_o to Λ_B , and all K_o to K_B; also change τ_o to τ_B.
447	Eq.(11.79)		L_z should be L_x only in the first line of Eq.(11.79).
448	1	3	change "when" to "if"
448	2	5	to have Fig.11.8 relate explicitly to the text, it is suggested to modify this line to read: "....$2L_y$, $2L_z$, and assume $\mathbf{q} = \mathbf{K} - \mathbf{a}_z k_o m_z$."
	2	7	after Eq.(11.85a) replace "whose first ...." with "where $q_z = K_z - k_o m_z$. $F(\mathbf{q})$ has first zeros at

$$K_x = \pm\frac{\pi}{L_x}, \quad K_y = \pm\frac{\pi}{L_y}, \quad K_z = k_o m_z \pm \frac{\pi}{L_z}. \tag{11.85b}$$

The region of wavenumber space over which $F(\mathbf{q})$ is appreciable is of the order of

$$\frac{\pi^3}{L_x L_y L_z} = \frac{8\pi^3}{V} \equiv \Upsilon \tag{11.86}$$

450	1	6	change to "Because $m_x = m_y = 0$, the point ($K_x = 0$, $K_y = 0$, $K_z = k_o \lvert\mathbf{m}\rvert$) locates the position...."
452	3	2	change "scatter" to "scattering"
453	1	6	modify sentence beginning with "The assumptions needed are...." to read: "The assumption needed is that the Bragg scatterer's correlation lengths transverse to **m** (Fig.11.10) must satisfy....". (Comment: the first assumption in the unmodified sentence is already used to derive Eq.11.80; see lines 5-6, p.447!)

	Eqs.(11.105) and (11.106)		The subscript "c," should be replaced by subscript "B"
	Eq.(11.106)		the square root radical sign needs to be extended over π.
		12	Here and everywhere in the text remaining throughout the book, replace "blob(s)" with "Bragg scatterer(s)".
		12,13	change subscript "c" to "B"
		14	Insert the sentence: “A Bragg scatterer is defined by correlation lengths of the refractive index irregularities *at the Bragg wavelength*; these lengths are inversely proportional to the width of $\Phi_n(\mathbf{K})$ at the Bragg wavenumber.”
	Eq.11.107		replace the comma at the end of this equation with a period
	Fig.(11.10)		Here and everywhere in the text remaining throughout the book, replace "scattering blob(s)" with "Bragg scatterer(s)". For example, the caption should read "A Bragg scatterer with a size determined by its correlation lengths. The Bragg scatterer is assumed to..". Furthermore, figure 11.10 needs to be redrawn to change "Scattering blob" to "Bragg scatterer", and subscripts "c" to "B"
454	0	0	delete the first line and modify the first sentence to read: "The phase is quadratic.....to **m** and nearly linear in **r** along **m**.". After this sentence insert the following: "But under condition (11.107), the phase in the plane perpendicular to **m** is essentially uniform across the Bragg scatterer.
		6	change subscript "c" to "B"
	Eq.(11.109)		the label is missing from this equation
455	0	2	the phrase "of the common volume V_c " should be placed after Eq.(11.111), but delete "V_c" in this phrase.
456	Eq.(11.115)		"P_r" should be "P_t". Absolute sign around W(r) should be removed
458	1	last	because 10! might be confused with ten factorial, change "10" to "ten"
	2	4	make a footnote after $\sqrt{2}$ to read: z' is the projection of r' onto the z axis; not to be confused with z' in Fig.11.12 which is the vertical of the rotated coordinate system used in section 11.5.4.

459	1	4	change "production" to "proportion"
		5	change word order to read "...(the larger $\sigma_\perp$ or σ_r are compared to....)"
	2	1	indent paragraph beginning with "Because we have.."
	3	10	modify sentence after condition (11.124) to read: If condition (11.124) is not satisfied, the Fresnel term in ...
		11	start new paragraph with sentence beginning with "Gurvich and Kon..." and delete the word "also".
		15	delete the word "near" and the parentheses around the word "Fresnel". ("near" commonly refers to the region within an aperture diameter away from the antenna)
459-460			Everywhere on these two pages delete the subscript c if attached to ρ.
460	0	2	add the following footnote or sentence at the end of the line: ρ_h given by Eq.(11.125) is the outer scale of the refractive index irregularities, but condition (11.124) applies to the transverse correlation lengths of the Bragg scatterers. Thus, conclusions reached apply if $R(\rho)$ is product separable; only in this case is the Bragg scatterer's correlation length identical to the outer scale.
	1	4-9	delete the third to fifth sentences in this paragraph and replace with the following: Condition (11.124) is more restrictive than (11.106); if (11.124) is violated the Fresnel term is required to account for the quadratic phase distribution *across the scattering volume*, whereas (11.106) imposes phase uniformity *across the Bragg scatterer*. Bragg scatterers outside the first Fresnel zone have a relatively large change of phase across them compared to those at the same height but within it. Condition (11.124) has the following physical interpretation: Bragg scatterers with transverse correlation lengths larger than an antenna diameter scatter mainly within a solid angle smaller than the transmitter's beam width, and the change of phase across the Bragg scatterer causes radiation to principally scatter in directions other than to the transmitter. Hence scatterers near the periphery of the illuminated area do not contribute as significantly to backscatter as those closer to the beam axis. The Fresnel term accounts for this diminished contribution from Bragg scatterers (also see comments at the end of section 11.5.3).

		9	start new paragraph with sentence beginning with: "If $\rho_{\perp}$ is much...."
461	Eq.(11.130)		change "$<P_t>$" to "$<P_r>$"
461	0	4	delete "along ρ" in this line.
462	2	2	alter this line to read: "Thus for a vertically directed beam and anisotropic....."
		3	It would be clearer to state: "For a radar beam pointed in the horizontal direction,...."
		5,13	delete "linear"
		7	delete the sentence beginning with "Only when this...." (comment: this sentence gives an erroneous interpretation because we have stated on p.459, para.2, that in the far field the resolution weighting function can be ignored if the Fresnel term can be ignored; that is, in the far field the sampling function $F(\mathbf{K})$ is principally dependent on the Fresnel term. Because of the reciprocal relations between spectral widths and correlation widths, however, even if the Fresnel term in Eq.(11.122) can be ignored, its spectral counterpart $F(\mathbf{K})$ cannot be ignored)
463	Eq.(11.133)		to be consistent with Fig.11.12, Eq.(11.133) should read: $\delta_x' = \delta_x \cos\psi + \delta_z \sin\psi, \quad \delta_y' = \delta_y, \quad \delta_z' = -\delta_y \sin\psi + \delta_z \cos\psi$
464	1	7	add comma after "...refractive index, it is...."
465	1	2	change to "...passive additive (e.g., chaff) is..."
471	4	4	the unit is missing its power in "5 x 10^{-13} $m^{-2/3}$..."
473	0	1	change to "...and about 30 times that...."
		6	add comma after "Kansas,"
478	0	2	change Eq.(3.12) to Eq.(3.21)
		last	space between units to read "16 m s^{-1}."
479	2	2	add comma after "Virginia,"

481	2	last	add comma before ", and thus"
483	3	6-8	change to read "...at the top of a stable layer that....about 300 m AGL. The second.....is at the base of another stable layer that extends from...."
	3	18	"...displacement is...."
484	Fig. 11.23d		date should be "14 July 1969", not "1979"
487	2	11	add comma after "...equal, coverage...."
		14	change to read: "frequencies) and by pulse width, which is longer at lower frequencies."
489	0	4	change to read: "SNR, the ratio of peak signal to....."
		5	change "time samples" to "*I*, *Q* samples"
493	1		delete the last sentence and make the following changes: 1) change lines 2 and 3 to read: "... $C_n^2 = 10^{-18}\,m^{-2/3}$ (Fig.11.17), the maximum altitude to which wind can be measured is computed from Eq.(11.152) to be about 4.5 km. 2) change lines 4 and 5 to read: "...with SNR = -19.2 dB (from Eq.11.153 for $T_s = 3.13 \times 10^{-3}$ s) and that $\sigma_v = 1.5$ m s^{-1}, SD(v) = 1 m s^{-1}, and a system temperature of about 200 K (section 11.6.3).
	2	2-4	change to read: Assuming that the WSR-88D had 10 dB more of average power by adding another high power amplifier, and pulse coding is used to maintain the same long pulse range resolution (i.e., 700 m) and PRF, the WSR-88D could provide hourly profiles of winds with an accuracy of about 1 m s^{-1} to 15 km above .....
503	1	3	"10-cm wavelength..."
	Fig. 11.35		add to the caption: "The elevation angle was 4.5^o."
516		15	Eq.(C.14): a right parenthesis needs to be inserted in the first line of this equation
524			citation for the Bebbington et al. reference should be IEE, not IEEE

526			interchange the order of the Browning references
535	Refer.		add: Kristensen, L., 1979: On Longitudinal spectral coherence. *Boundary Layer Meteorol.,* **16,** 145-153.
537			Nutten, et al. Remove redundant "T" in "TThe Ronsard radars"
539			Rinehart, 1991: "Grand Forks", not "Grandd Forks"
540			alphabetically, Seliga follows Sekhon
		15	The year for the Sachidananda and Zrnic reference should be 1989 instead of 1988, and the volume number should be **6** instead of **4**.
545		23	change “Doviack” to “Doviak”
548	Index		"Beamwidth, one-way" citation should read 32-34.
551	Index		add "Far field, antenna, 32; scattering volume,435-436.
		12	Insert "Bragg scatterer's" in front of "correlation"
			change entry for Dwell time to: Dwell time, 124,127 (comment: delete the phrase “sample time averaging” and change page numbers)
554	index		add after "Matched Filters ...", 77, 80
558	index		Scattering geometry, common volume scatter: change page numbers to 453-456.
	index		add: Scatter angle, 436-437.
	index		Resolution volume, range weighting, 75-79; delete this entry (comment: nowhere on these pages is there a reference to the resolution volume). Replace with: Resolution volume, weather radar equation, 80-81.
559	index		add: "Spectrum width, weighted velocity deviations, 110: as a sum, 116-118."
560	index		add: unambiguous interval, 132

The following comments and suggested insertions should clarify the text at the indicated places:

82 since there is considerable confusion concerning the use of the unit dBZ, and because some writers use dBz notation we should provide a **footnote** on this page that states the following:

Although the logarithm decibel dB is not an SI unit and according to SI rules should not be modified by the attachment of a qualifier such as in dBZ, dBZ has been accepted by the AMS as the symbol for the "unit" decibel of reflectivity factor referred to 1 mm^6m^{-3} (Bulletin, 1987, p.38). Furthermore, the dB has been accepted widely as the symbol of the decibel as a "unit" (e.g., The International Dictionary of Physics and Electronics, D. Van Nostrand Co. Inc., 1961, 1355 pp), and appendages to it usually refer to the reference level of the parameter being measured; e.g., dBm is the decibel unit for 10 $\log_{10}$ P where P is the power referenced to milliwatts (e.g., Reference Data for Radio Engineers, 5th Edition, p.3-3).

113	1	1-4	change to read: ".....associated with spatially dependent steady wind $v_s(\mathbf{r})$ and turbulence $v_t(\mathbf{r})$. Each contributes to the width of the power spectrum (uniform steady wind, contributes to the spread.....V_6; steady wind also brings...."
136	footnote		change to read: To avoid occurrence of negative $\hat{S}$ sometimes only the sum is used but multiplied with $\hat{SNR}/(\hat{SNR}+1)$
247	Fig.8.13		Figures a and b should have the same horizontal length
398			section 10.2.1: we introduce the parameter $\Phi_v(\mathbf{K})$ in Eq.(10.46) but define it later in Eq.(10.48). We should place Eq.(10.48), but label it (10.46), before Eq.(10.46) which now becomes Eq.(10.47). Other adjustments should be made to correct equation numbers; I believe these are minor.
444	0	2-3	Gossard in "Radar in Meteorology" (Atlas, editor), states that we define stochastic Bragg scatter in our text, but it is not defined there. Therefore, we suggest deleting the words "expected (i.e., time or ensemble average)" on line 2 and, on line 3, the words "the receiver location". Then change line 3 to read:"....statistical properties; this scatter is defined as *stochastic Bragg scatter*. The...."
454	0	3	Insert: "But if condition (11.107) is satisfied, the phase is essentially uniform across the Bragg scatterer in the plane perpendicular to **m**, although it is linear in directions parallel to **m**."

455	0	2	add the following footnote at the end of this line: Eq.(11.111) implicitly assumes the solid angle containing the principal radiation of each Bragg scatterer intersects the receiver (section 11.5.2).
459	2		at the end of this paragraph, “...in this section.”, add: Under far field conditions the beamwidth term in Eq.(11.122) does not contribute significantly to the integral, but the beamwidth, and also the range resolution, do contribute to the backscattered power because they multiply the integral in Eq.(11.122).
460	1	8	insert the following parenthetical phrase after the stating "...is linear across the Bragg scatterer": (yet uniform in a direction transverse to **m**)
461	0	11	insert after "...in space.": "This is a consequence of the greater importance of the Fresnel term relative to the resolution volume weighting term (i.e., in Eq.11.122) along the transverse directions."
Index			for usefulness add: Antenna; far field, 435-436, 459.

Some definitions:

Radial: A radial is the center of a band of azimuths over which the radar beam scans during the period (i.e., the dwell time) in which a number M of pulses are transmitted and echoes received and processed. M echo samples at each range are processed to obtain spectral moments (e.g., reflectivity, velocity, and spectrum width) which are assigned to the center azimuth. A “radial of data” is usually the set of spectral moments at all the range gates (or resolution volumes) along the assigned azimuth.

Additional errata to be reviewed by Dusan

page	para	line	
136	4	1-5	Change to read: "If spectra are not Gaussian, Rummler (1968) has derived an estimator valid for small spectrum widths (i.e., $\sigma_{vn} \ll 1$), This estimator is (6.29) At large widths Eq. (6.29) has an asymptotic ($M \to \infty$) negative bias which causes an underestimate of the true spectrum width (Zrnić, 1977), whereas..... is Gaussian)" At the end of this paragraph, add the following: "By expanding the argument of the logarithm in Eq. (6.27) for values of $\lvert\hat{R}_1\rvert$ close to $\hat{S}$, an estimator similar to Eq. (6.29) is obtained (i.e., the only difference is that the term in the absolute brackets is $(\hat{S}/\lvert\hat{R}_1\rvert) - 1$). This latter estimator has an asymptotic positive bias, almost as big in magnitude as the negative bias found for Eq. (6.29)."

Added Reference:

Rummler, W. D. (1968), Introduction of a New Estimator for Velocity Spectral Parameters. *Technical Memorandum, April 3, 1968.* Bell Laboratories, Whippany, New Jersey 07981.