ERRATA[1]
for the 1st and 2nd printings of the textbook:
"Doppler Radar and Weather Observations", Second Edition-1993
Richard J. Doviak and Dusan S. Zrnic'
Academic Press, Inc., San Diego, CA. 562 pp.
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Reprints of this textbook are available from
Dover Publications, Inc, www.doverpublications.com[2]

Page	Para.	Line	Remarks: Paragraph 0 is any paragraph started on a previous page that carries over to the current page. A sequence of dots is used to indicate a logical continuation to existing words in the textbook (e.g., see errata on pp. 14, 76, paragraph 3, on p. 108, etc.)		
xvii	1	1	Dover edition, rewrite as "…identical to the 1st and 2nd printings.."		
xvii			add to list of symbols:	g_s	System gain
			in list of symbols change:	c	Speed of light in a vacuum
			add to list of symbols:	γ	Mass density of air
			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		

[1] The authors thank Dr. R. E. Rinehart, University of North Dakota, for many of these entries.
[2] The Dover Edition is currently in print and, except for an additional preface, is identical to the 1st and 2nd printings (not the 3rd and 4th printings as stated in the preface to the Dover edition). Errata for these printings are posted on NSSL's website at .nssl.noaa.gov . In the "Quick Links" box select "Publications" to open the page to select "Recent Books" to find the book and listed Errata.

Academic Press had also released a 3rd and 4th printings, in which *some* errors in the earlier printings were corrected. The errata for these later printings are also presented on NSSL's website and these errata are updated periodically. Because the errata for the 1st and 2nd printings are not updated, readers of these earlier Academic printings and of the Dover reprint need to refer to both sets of errata to find all corrections.

14	2	1	change to read: "…on the change of the refractive index, $n = c/v$, with height (or, because the relative permeability μ_r of air is unity, on the change of relative permittivity, $\varepsilon_r = \varepsilon / \varepsilon_0 = n^2$, with height).
		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
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"
	3	7	delete the parenthetical phrase
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	Eq. (3.2)		replace D with D_a
35	1	3	delete period at end of line
	1	9	insert the word "transmitting" before antenna; at the end of the last sentence add: with origin at the scatterer.
	2	10	the equation on this line should read: $\sigma_b = \sigma_{bm}\left(1 - \sin^2\psi / \sin^2\theta\right)^2 \cos^4[(\pi/2)\cos\theta] / \sin^4\theta$
	Eq. (3.6)		change K_m to K_w in this equation and in the line following it
36	0	7	change to $\lvert K_m\rvert^2$ to $\lvert K_w\rvert^2$
		9	change the end of this line to read: "Ice water has a $\lvert K_i\rvert^2$…"

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	Eqs. (3.14a, b)		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"
45	Fig.3.6		ϕ_e should be θ_e
47	Table 3.1		change title to read: "The *nex*t generation *rad*ar, NEXRAD (WSR-88D), Specifications" change "Beam width" to "Beamwidth" change footnote *b* to read: "Initially the first several radars transmitted circularly polarized waves, but now all transmit linearly polarized waves". change footnote *c* to read: "....antenna port, and a 3 dB filter bandwidth of 0.63 MHZ is assumed.
50	1	8	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 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)"
		14	last line change to "velocity limits (Chapter 7)."

	Fig.3.14		change γ(t) to ψ_e (t) and $\Delta\gamma$ to $\Delta\psi_e$
	Eq. (3.40b)		place $\pm$ before v_a
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
	3	8	change to read as: "or expected power $E[P(\tau_s)]$."
68-69	4	1, 10, 12	change "$\overline{P}(\tau_s)$" on these three lines to "$E[P(\tau_s)]$"
71	Eqs. (4.4a, b)		insert $(1/\sqrt{2}\ )$ in front of the sum sign in each of these equations
	3	6	replace "p. 418" with "p. 498"
	Eq. (4.6)		Delete the first "2"
72	0	4	change $\overline{P}(\tau_s)$ to $E[P(\tau_s)]$
	2	1	change $\overline{P}(\tau_s)$ to $E[P(\tau_s)]$
		3	remove footnote
73	Eq. (4.11)		change "$\overline{P}(\boldsymbol{r}_0)$" to "$E[P(\boldsymbol{r}_0)]$".
74	Eq. (4.12)		delete the boldness of "**r**"
	4	1	measurem(m)ents; delete the extra "m"

74-75 Eqs. (4.12), (4.14), (4.16): change " $\overline{P}(\boldsymbol{r}_0)$ " to "$E[P(\boldsymbol{r}_0)]$".

75	1	6	change to "$G(0) \geq 1$"
	2	18	change " $\overline{P}(\boldsymbol{r}_0)$ " to "$E[P(\boldsymbol{r}_0)]$".
76	0	5	change "output of" to "input to"
	1	5	envelop<u>e</u>
		7	change to read:....the output of the receiver would be that sketched in Fig.3.12.).
Fig.4.5			change second sentence in caption to read: "The broad arrow indicates sliding of...."
82	Eq. (4.34)		change " $P(\bar{\boldsymbol{r}}_0)$ " to "$E[P(\boldsymbol{r}_0)]$".
	Eq. (4.35)		change " $\overline{P}$(mw) " to "$E[P$(mw)]
	1	9	should read: "... is the *reflectivity factor* of spheres."
		17	change to read: "10 $\log_{10} Z$, where Z is in units of mm^6/m^3 and the scale of Z(dBZ) $\equiv$ 10 $\log_{10} Z$ is in dBZ units."
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..."
84	Eq. (4.39)		change " $\overline{P}(\boldsymbol{r}_0)$ " to "$E[P(\boldsymbol{r}_0)]$".
85	Fig.4.10		the ordinate should have the label "Correlation coefficient $R_{vv}/R_{vv}(0)$"
	Problem 4.1		change " $\overline{P}$ " to "$E[P]$" in two places.
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 $\lvert W(r_o,\mathbf{r}_1)\rvert$; 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	1	change “stationary” to “steady”
	1	11	change “$d\overline{P}$” to “$E[dP]$”.
	Eq. (5.42)		change “$d\overline{P}(v)$” to “$E[dP(v)]$
		15	change “$\overline{P}(\mathbf{r}_0,v)$” to” $E[\Delta P(\mathbf{r}_0,v)]$”; add comma after "by definition,"
	Eq. (5.43)		change “$\overline{P}(\mathbf{r}_0,v)$” to” $E[\Delta P(\mathbf{r}_0,v)]$”
	3	2-3	change to read: “…..by new ones having different spatial configurations, *the estimates* $\hat{S}(\vec{r}_o,v)$ *of …*”
109	1	4	remove comma after "replenished"
	Eq. (5.45)		change “$\overline{P}(\mathbf{r}_0)$” to “ $E[P(\mathbf{r}_0)]$”
112	Eq. (5.57)		add the subscript “s” to W in order to be consistent with Eqs.4.9c and 5.40 (modified)
113	1	1-4	change to read: "Assume scatterer velocity is the sum of steady $v_s(\mathbf{r})$ and turbulent $v_t(\mathbf{r}, t)$ wind components. Each contributes to the width of the power spectrum (even uniform wind contributes to the width because radial velocities vary across V_6; steady wind also brings new...."
	2	10-18	delete the sentences beginning with "Furthermore, we assume..." and ending with "...scatterer's axis of symmetry)."
	Eq. (5.59a)		change to:

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

Following this equation retype the text up to and including Eq. (5.59c) as follows:

The expectation in Eq. (5.59a) includes 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 ($\varphi_i - \varphi_k$) 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 $F_k A_k$ 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

$$R_k(mT_s) = E[A_k^*(0) A_k(mT_s)]$$

Because $R(0)$ is proportional to the expected power E[P], and because

$$E[P(\boldsymbol{r}_0)] = \sum_k \sigma_{bk} I(\boldsymbol{r}_0, \boldsymbol{r}_k) \qquad (5.59c)$$

114 2 2-4 modify to read: "...mechanisms in Eq. (5.59b) act through product terms. Furthermore, the kth scatterer's radial velocity v_k can be expressed as the sum of the velocities due to steady and turbulent winds that move the scatterer from one range position..."

6-13 delete these lines and replace with:

Eq. (5.59b), the velocities $v_s(\boldsymbol{r})$ and $v_t(\boldsymbol{r}, t)$ associated with steady and turbulent winds can each be placed into separate exponential functions that multiply one another. Thus the expectation of the product can be expressed by the product of the exponential containing $v_s(\boldsymbol{r})$ and the expectation of the exponential function containing $v_t(\boldsymbol{r}, t)$. The Fourier transform of $R(mT_s)$, giving the composite spectrum $S(f)$, can then be expressed as a convolution of the spectra associated with each of the three functions of lag mT_s.

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

$$E[\hat{S}_n(\boldsymbol{r_0}, v)] = \frac{E[\hat{S}(\boldsymbol{r}_0, v)]}{\int_{\infty}^{\infty} E[\hat{S}(\boldsymbol{r}_0, v)] dv} \qquad (5.60)$$

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

7, 9 change Eq.(5.59a) to Eq.(5.59b)

3 14-15 Change these lines and Eq. (5.64) to read: "Because the correlation coefficient is related to the normalized power spectrum through Eq. (5.19), and because the Doppler shift $f = -2v/\lambda$, $\rho(mT_s)$ can be expressed as

$$\rho(mT_s) = \int_{-\lambda/4T_s}^{\lambda/4T_s} \frac{2}{\lambda} E[\hat{S}_n^{(f)}(-2v/\lambda))]e^{-j4\pi v mT_s/\lambda} dv$$

$$= \int_{-v_a}^{v_a} E[\hat{S}_n(v)]e^{-j4\pi v mT_s/\lambda} dv, \qquad (5.64)$$

116 0 1-4 change these lines to read: where $S_n^{(f)}(-2v/\lambda)$ is the normalized power spectrum in the frequency domain folded about zero, $S_n(v)$ is the normalized power spectrum in the Doppler velocity domain, and the two power spectra are related as

$$S(v) = \frac{2}{\lambda} S^{(f)}(-2v/\lambda). \qquad (5.65)$$

By equating Eq. (5.63) to Eq. (5.64), and assuming all power is confined to the Nyquist limits, $\pm v_a$, it can be concluded that

$$p(v) = E[\hat{S}_n(v)] \ . \qquad (5.66)$$

116 1 1-3 change to read: "Thus, for homogeneous turbulence, at least homogeneous throughout the resolution volume V_6, the *expected* normalized power spectrum is equal to the velocity probability distribution. Moreover, it is independent of reflectivity and the angular and range weighting functions.

1 3-7 Delete the last two sentences beginning with "Although, in deriving…."

2 19 change to read: "where σ_s^2 is due to shear of steady wind v_s, σ_α^2 to.."

117 2 4-7 Modify these lines to read: "where the terms are due to shear of v_s along the three spherical coordinates at $\mathbf{r}_0$. In this coordinate system (5.70) automatically includes…"

9 change to read: "the so-called beam-broadening term;...."

3 Replace the text in this paragraph up to and including Eq. (5.75) with: "Spherical coordinate shears of v_s can be directly measured with the radar and it is natural to express σ_s^2 in terms of these shears. If the resolution volume V_6 dimensions are much smaller than its range r_0, and angular and radial shears are uniform, v_s within V_6 can be expressed as

$$v_s - v_0 \approx k_\varphi r_0 \sin\theta_0 (\varphi - \varphi_0) + k_\theta r_0 (\theta - \theta_0) + k_r (r - r_0) \tag{5.71}$$

provided $\theta_1 \ll 1$ (radian) and $\theta_0 \gg \theta_1$, where

$$k_\varphi \equiv \frac{1}{r_o \sin\theta_0}\frac{\partial v_s}{\partial \varphi}, \quad k_\theta \equiv \frac{1}{r_o}\frac{\partial v_s}{\partial \theta}, \quad k_r \equiv \frac{\partial v_s}{\partial r} \tag{5.72}$$

are angular and radial shears of v_s. Angular shears are present even if Cartesian shears are non-existent, and are functions of $\mathbf{r}_0$. For example, if wind is uniform (i.e., constant Cartesian components u_0, v_0, w_0),

$$\frac{\partial v_s}{\partial \phi} = (u_0 \cos\phi_0 - v_0 \sin\phi_0)\sin\theta_0; \quad \frac{\partial v_s}{\partial \theta} = w_0 \sin\theta_0 - (u_0 \sin\phi_0 + v_0 \cos\phi_0)\cos\theta_0; \quad k_r = 0 . \tag{5.73}$$

If reflectivity is uniform and the weighting function is product separable and symmetric about $\mathbf{r}_0$, substitution of Eq. (5.71) into Eq. (5.51) produces

$$\sigma_s^2(\boldsymbol{r}_0) = \sigma_{s\theta}^2 + \sigma_{s\phi}^2 + \sigma_r^2 = k_\theta^2 r_0^2 \sigma_\theta^2 + k_\phi^2 r_0^2 \sin^2\theta_0 \sigma_\phi^2(\theta_0) + k_r^2 \sigma_r^2 . \tag{5.74}$$

Because lines of constant ϕ converge at the vertical, the second central moment $\sigma_\phi^2(\theta_0)$ of the two-way power pattern is $\sigma_\phi(\theta_0) = \sigma_\phi(0)/\sin\theta_0$, where $\sigma_\phi(0)$ is the intrinsic beamwidth; σ_r^2 is the second central moment of $|W(r)|^2$. For circularly symmetric Gaussian patterns,

$$\sigma_\theta = \frac{\theta_1}{4\sqrt{\ln 2}}; \quad \sigma_\phi(\theta_0) = \frac{\theta_1}{4\sqrt{\ln 2}}\frac{1}{\sin\theta_0} \tag{5.75}$$

122 3 2, 3 change to read "...signals, estimates using few samples have a large statistical uncertainty and therefore don't allow meaningful ...."

125 1 1 replace "average" with "expected"

Eq. (6.5) append to this equation the footnote: "In chapter 5 ρ is the complex correlation coefficient. Henceforth it represents the magnitude of this complex function."

	4	5	remove the overbar on *P*, *S*, and *N*
126	3	2	change " $\overline{P}$ " to " $\overline{S}$ ".
	3	2-4	the second sentence, modified to read, "The P_k values of meteorological interest...meeting this large dynamic range requirement", should be moved to the end of the paragraph 1
		5	change " $\overline{P}$ " to " S ".
		10	change "$E(P)$" to " $E[\hat{P}]$ "
127	0	1-2	remove the overbar on *P* in the three places
	3	1	remove the overbar on *Q*
		3	change σ_Q^2 to $\sigma_{\hat{Q}}^2$, (i.e., the subscript Q needs a (^) over it)
	Eq. (6.9)		left side: place hat (^) over Q
		5	place hat (^) over Q in σ_Q^2
		8	delete the citation "(Papoulis, 1965)"
128	1	8	change "unambiguous" to "Nyquist"
	2	4-7	rewrite the three sentences after Eq. (6.12) as: "For large *M* and σ_{vn} <<1, $M_I = 2M\sigma_{vn}\pi^{1/2}$. The variance of *S* estimated from *M* samples is calculated using the distribution given by Eq. (4.7) in which $S \equiv P$ (this gives, in Eq. (6.10), $\sigma_Q^2 = S^2$), and calculating M_I from Eq. (6.12). Thus the standard deviation of a M-sample signal power estimate is $S/\sqrt{M_I}$."
	Eq. (6.12)		the subscript 1 on M on the left side of this equation should be "I"
	3	1-2	change to read "To estimate *S* in presence of receiver noise, we need to subtract....."
129	0	5-6	change last sentence to read: ....then the number of independent samples can be determined using an analysis similar to.....

130	Table 6.1		add above **“Reflectivity factor calculator”** the new entry “**Sampling rate”,** and in the right column on the same line insert “0.6 MHz". Under "**Reflectivity factor calculator**", "Range increment" should be “0.25 km” and not “1 or 2 km”. But insert as the final entry under "**Reflectivity factor calculator**" the entry “Range interval Δr”, and on the same line insert “1 or 2 km” in the right column.
	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
136	footnote		change to read: To avoid occurrence of negative $\hat{S}$, only the sum in Eq. (6.28) is used but it is multiplied with $S\hat{N}R / (S\hat{N}R + 1)$
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 < σ_{vn} < 0.2 and SNR $\geq$ 15 dB.”
	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 second equation should be multiplied by $\lvert\rho_{hv}(0)\rvert^2$
155	3	3	in section 6.8.5 line 3, change “Because” to “If”

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....."
160	2	6	change "unambiguous velocity " to "Nyquist velocity"
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,"
173	0	1	change to read: "…velocity interval $\pm\, v_m$ for this…."
	Eq. (7.6b)		place ± before v_m
	3	9-11	change "unambiguous" to "Nyquist" at two places, and change "An unambiguous velocity" to "A Nyquist interval"
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., $\pm 5^o$) 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 $\pm 2^o$ to -38dB at $\pm 10^o$, 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 “measurement<u>s</u>”
228	1	2-5	change to read: First, the radar equation, Eq. (4.35), retrieves an estimate of the reflectivity factor Z_e of water drops. If the scatterers are ice spheres, then Z_i is obtained from Z_e by using the following equation: $Z_i = (\lvert K_w\rvert^2/\lvert K_i\rvert^2)Z_e$. (8.24)
		10-17	change to read: “...is immaterial and the value forline K sub i line sup 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 $Z = 1780R_s^{2.21}$. (8.25a) But this needs to be multiplied by $(1.028)^6$ to obtain $Z_i = 2103R_s^{2.21}$

the reflectivity factor of the ice particles. Eq. (8.25b) is the appropriate relation that must be used to estimate the equivalent rainfall rate R_s (mm/hr) from the Z_i measured by radar. To obtain radar measured Z_i, Eq. (8.24) should be used in Eq. (4.35).

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:

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

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:

$$= \int n(\boldsymbol{r}) < s_{ij} s_{kl}^* > |F(\boldsymbol{r})|^2 \, dV$$

In the last equality the summation over n is replaced with the integral over the product of the density $n(\boldsymbol{r})$ of drops at position $\boldsymbol{r}$, 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.**"
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.”
268	Fig. 8.29		LDR_{hv} on the ordinate axis should be LDR_{vh}
	0	1, 4	change LDR_{hv} to LDR_{vh} at the two places it appears in this paragraph.
269	Fig. 8.30		In the caption, change LDR_{hv} to LDR_{vh} at the two places it appears.
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"
	1	10	change to: “.....from Eqs. (3.6) and (4.31), can be....
277	0	6	add comma after "At this wavelength,"
	0	16	change “23000” to “230,000”
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	3	delete the sentence beginning with “In this chapter overbars….”
	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
298	Fig.9.4a, b		here and elsewhere in the text, remove periods in time abbreviations (i.e., should be: "CST", not C.S.T.")
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 $R_{ij}(\ell)$. 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) add an additional subscript to ρ_0 so that it reads as ρ_{0i}

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 $\rho << \rho_{oi}$..."

Eqs. (10.30), (1032) delete the subscripts "*ii*" on *R*, and add the subscript "*i*" to ρ_0 so that it reads as ρ_{0i}

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

Eq. (10.33) place subscript *l* on *C* so that it reads C_l.

394 0 1 change to read: "where C_l^2 is a dimensionless parameter with a value of about 2."

Eq. (10.37) change to read:

$$R_{ii}(\rho, \tau_1 = 0) = R(0)[1 - (\rho / \rho_{oi})^{2/3}] \tag{10.37}$$

Eq.(10.38) change the first equal sign to ≈.

4 4 modify to read: "....where $K\rho_o >> 1$ has been assumed, and the subscript..."

398 1 12 change to read: "…of the weighting function I_n, and $\Phi_v(\mathbf{K})$ is the spectrum of point velocities."

1 16 $\mathbf{K}_1$ should be K_1

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 $S_\ell(0)$ 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) in which steady wind is assumed not to be present. Thus,"

Eq. (10.56) in this equation replace the subscript "v" with "t"; the lines after this equation should read:

"where the ..... average of turbulent velocities weighted by $I_n(\boldsymbol{r}_0, \boldsymbol{r})\eta(\boldsymbol{r})$. The variance…"

Eq.(10.59) change the <u>first</u> subscript "v" to "t"

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 $I_n(\boldsymbol{r}_0, \boldsymbol{r})\eta(\boldsymbol{r})$. These two variances describe…..".

4 7 place an over bar on the subscript "u" in the next to last equation

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 $\langle\sigma_t^2\rangle$
	Eq. (10.68)		replace σ_v^3 with $\langle\sigma_t^2\rangle^{3/2}$
	3	1	replace σ_v^2 with $\langle\sigma_t^2\rangle$
	Eq. (10.70)		replace σ_v^3 with $\langle\sigma_t^2\rangle^{3/2}$
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, 7	change “surface” 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 $c = \sqrt{\mu_0 \varepsilon_0}$ 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 $e^{-jk_0 r_r}$
	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 $e^{j\omega_0 t}$ term.
434	0	16	change this line to read: Applying the divergence theorem to $\phi\mathbf{u}$, and the argument following Eq.(11.33), the equation
	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 sub volumes 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.
445	1	6	delete "time dependence of the"
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"

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

$$K_x = \pm\frac{\pi}{L_x}, \quad K_y = \pm\frac{\pi}{L_y}, \quad K_z = k_0 m_z \pm \frac{\pi}{L_z}. \qquad (11.85b)$$

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

$$\frac{\pi^3}{L_x L_y L_z} = \frac{8\pi^3}{V} \equiv \mathrm{Y}$$

450 1 6 change to "Because $m_x = m_y = 0$, the point ($K_x = 0$, $K_y = 0$, $K_z = k_o\,|\mathbf{m}|$) 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....".

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 sub n(bold 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.

Fig.11.11 caption should be changed to read: "........, a receiver, and an elemental scattering volume dV_c."

6 change subscript "c" to "B"

Eq. (11.109) the label is missing for the equation between Eqs. (11.108) and (11.110)

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, and the bold ***r*** should not be bolded.

Fig. 11.12 add a unit vector $\mathbf{a}_o$ drawn from the origin "**O**" along the line "r_0".

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 Eq. (11.125) delete the subscript "c" in this equation, as well as that attached to ρ_{ch} in the second line following Eq.(11.125) so that it reads "ρ_h".

459-460 Everywhere on these two pages delete the subscript c if attached to ρ.

460 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*; this latter condition is more easily satisfied the farther the scatterers are in the far field (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:

$$\delta'_x = \delta_x \cos\psi + \delta_z \sin\psi, \quad \delta'_y = \delta_y, \quad \delta'_z = -\delta_y \sin\psi + \delta_z \cos\psi \qquad (11.133)$$

464	Fig. 11.14		caption: the first citation is incorrect. It should read: “(data are from Röttger et al., 1981)”. Furthermore, delete the last parenthetical expression: “(Reprinted with permission from ….).”
	1	7	add comma after "...refractive index, it is...."
465	1	2	change to "...passive additive (e.g., chaff) is..."
468	2	11	change “(11.109)” to “11.104”
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)
478	0	7	Change to read: “...the gain g. Then g, now the directional gain (Section 3.1.2), is related...”
		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: "that velocity estimates are made with SNR = -19.2 dB (from Eq.11.153 for $T_s = 3.13 \times 10^{-3}$ s), and that σ_v = 0.5m s^{-1}, SD(v) =1 m s^{-1}, and a system temperature is about 200 K (section 11.6.3)."
	2	1-4	change to read: "Assuming that velocities could be estimated at SNRs as low as -35dB (May and Strauch, 1989), the WSR-88D could provide profiles of winds with an accuracy of about 1 m s^{-1} within the entire troposphere if C_n^2 values…"
		8	change "14" to "12"
		9	change "able to measure" to "capable of measuring"
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