LAI2000 angles θ	$k_{NR}(\theta)$	$k(\theta)$	$\lambda(\theta)$
7.2°	0.339	0.392	0.863
23°	0.404	0.463	0.873
38°	0.515	0.593	0.868
53°	0.741	0.840	0.882
68°	1.253	1.424	0.880

Table 1

Shortgrass canopy			$Y = 1 - \exp(-k_1 . PAI)$		$Y = a - b.\exp(-k_2 . PAI)$					$Y = c . (1 - \exp(-k_3 . PAI))$			
fDIPAR or fDAPAR	Day	Soil albedo	k_1	r^2	a	b	k_2	**$b . k_2$**	r^2	c	k_3	**$c . k_3$**	r^2
fDIPAR	Clear	-	0.585	0.9992	0.885	0.881	0.702	**0.618**	0.9999	0.875	0.718	**0.628**	0.9999
fDIPAR	Cloudy	-	0.659	0.9981	0.856	0.850	0.842	**0.716**	0.9999	0.845	0.869	**0.734**	0.9998
fDAPAR	Clear	0.15	0.568	0.9963	0.784	0.779	0.828	**0.645**	0.9999	0.774	0.854	**0.661**	0.9999
fDAPAR	Clear	0.25	0.611	0.9953	0.781	0.775	0.908	**0.704**	0.9998	0.771	0.937	**0.722**	0.9998
fDAPAR	Cloudy	0.15	0.627	0.9941	0.771	0.765	0.960	**0.734**	0.9998	0.762	0.992	**0.756**	0.9997
fDAPAR	Cloudy	0.25	0.670	0.9931	0.774	0.767	1.034	**0.793**	0.9998	0.765	1.070	**0.819**	0.9997
RLD canopy													
fDIPAR	Clear	-	0.665	0.9992	0.900	0.896	0.782	**0.701**	0.9999	0.890	0.802	**0.714**	0.9999
fDIPAR	Cloudy	-	0.744	0.9980	0.873	0.866	0.930	**0.805**	0.9998	0.862	0.961	**0.828**	0.9998
fDAPAR	Clear	0.15	0.637	0.9958	0.798	0.792	0.917	**0.726**	0.9998	0.788	0.948	**0.747**	0.9998
fDAPAR	Clear	0.25	0.684	0.9946	0.795	0.788	1.006	**0.793**	0.9998	0.786	1.040	**0.817**	0.9997
fDAPAR	Cloudy	0.15	0.701	0.9933	0.786	0.779	1.058	**0.824**	0.9997	0.777	1.096	**0.852**	0.9997
fDAPAR	Cloudy	0.25	0.748	0.9921	0.788	0.780	1.140	**0.889**	0.9997	0.780	1.182	**0.922**	0.9996

Table 2

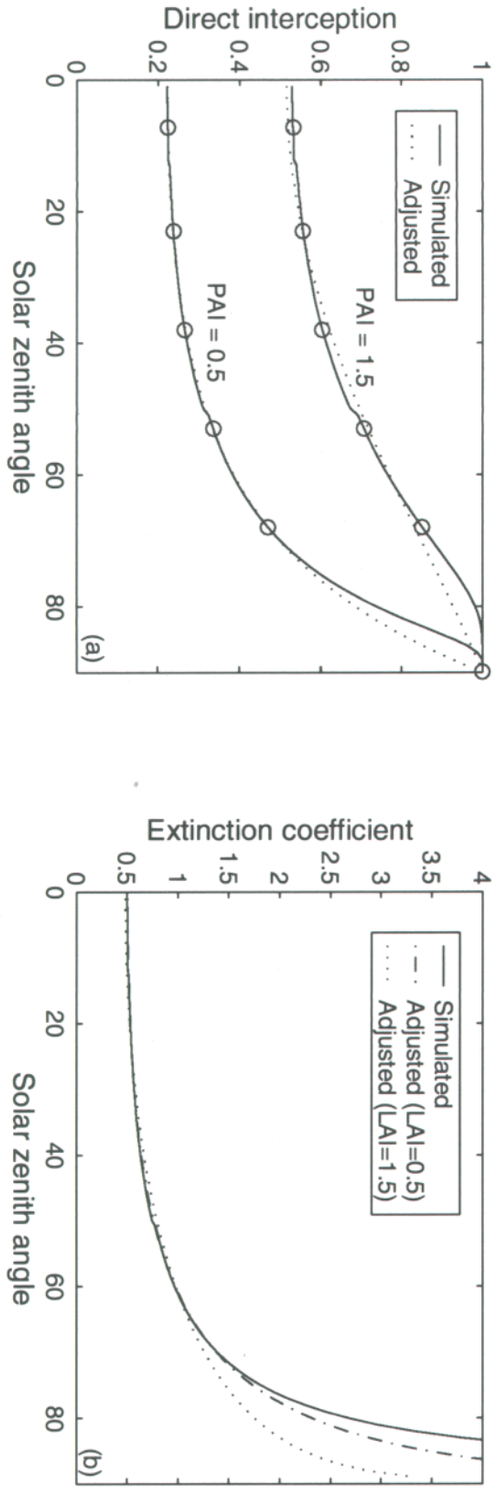

Direct interception
Simulated
Adjusted
PAI = 1.5
PAI = 0.5
Solar zenith angle
(a)
Extinction coefficient
Simulated
Adjusted (LAI=0.5)
Adjusted (LAI=1.5)
Solar zenith angle
(b)

Figure 1

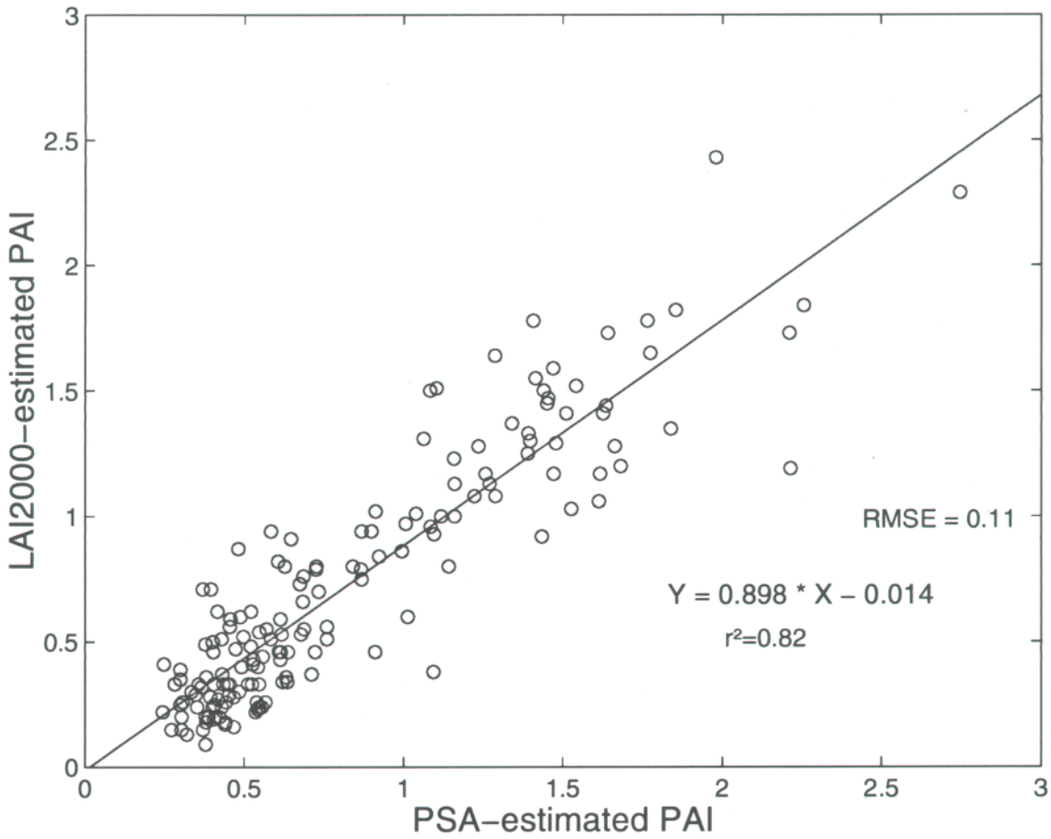
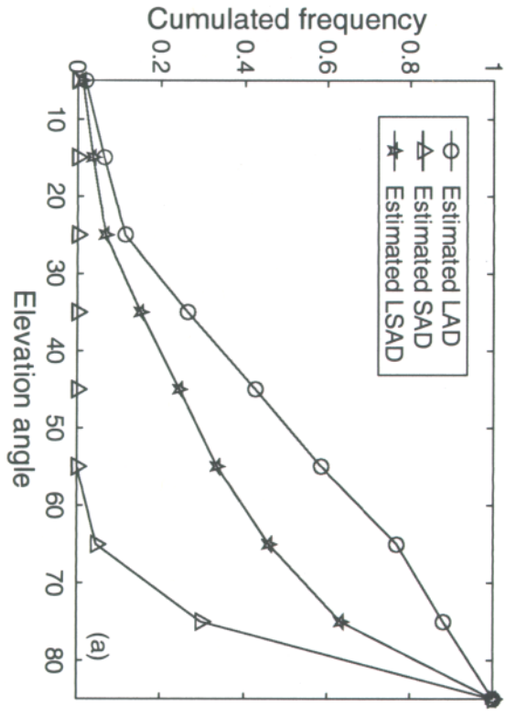

LAI2000–estimated PAI
PSA–estimated PAI
RMSE = 0.11
Y = 0.898 * X – 0.014
r²=0.82
0
0.5
1
1.5
2
2.5
3

Figure 2


Estimated LAD
Estimated SAD
Estimated LSAD
Cumulated frequency
Elevation angle
(a)

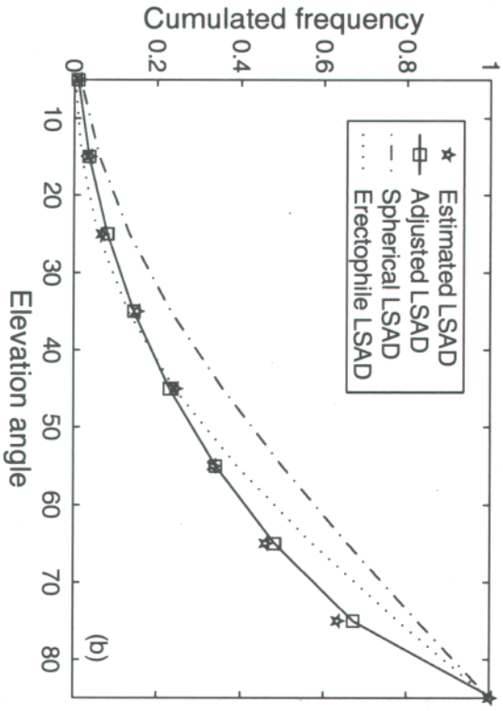

Estimated LSAD
Adjusted LSAD
Spherical LSAD
Erectophile LSAD
Cumulated frequency
Elevation angle
(b)

Figure 3

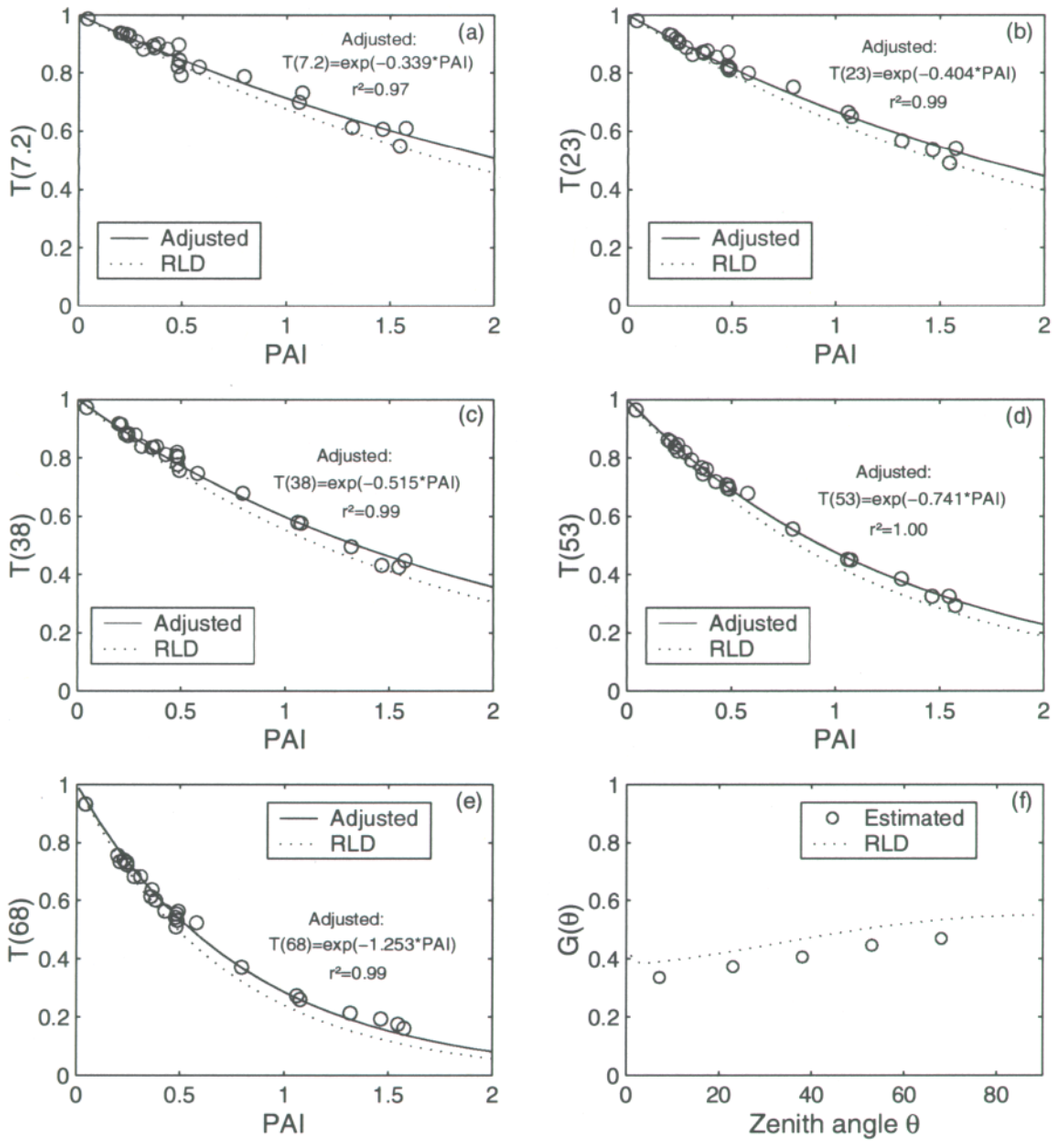

(a)
Adjusted:
T(7.2)=exp(−0.339*PAI)
r²=0.97
Adjusted
RLD
T(7.2)
PAI
(b)
Adjusted:
T(23)=exp(−0.404*PAI)
r²=0.99
Adjusted
RLD
T(23)
PAI
(c)
Adjusted:
T(38)=exp(−0.515*PAI)
r²=0.99
Adjusted
RLD
T(38)
PAI
(d)
Adjusted:
T(53)=exp(−0.741*PAI)
r²=1.00
Adjusted
RLD
T(53)
PAI
(e)
Adjusted
RLD
Adjusted:
T(68)=exp(−1.253*PAI)
r²=0.99
T(68)
PAI
(f)
Estimated
RLD
G(θ)
Zenith angle θ

Figure 4

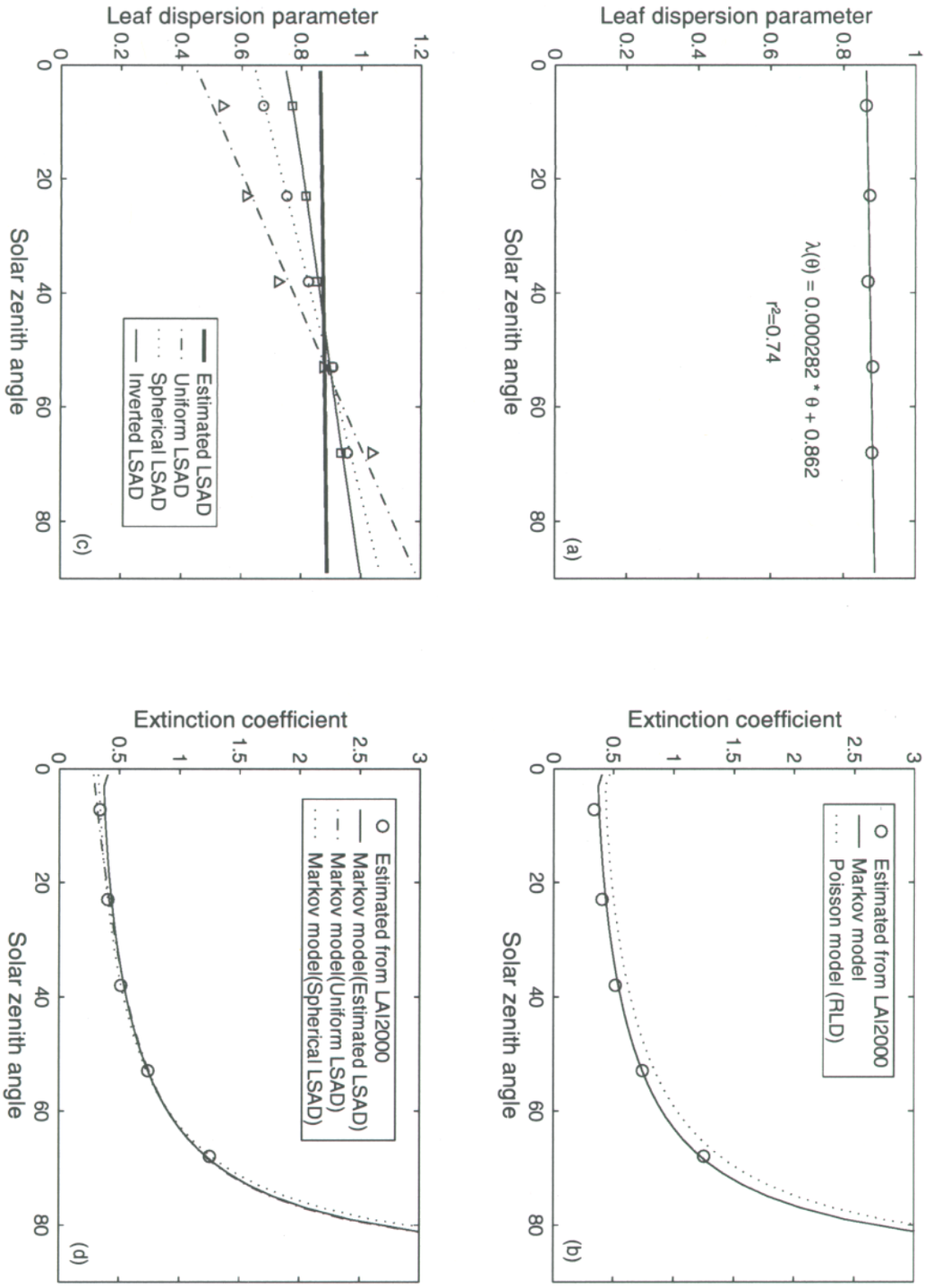

Leaf dispersion parameter
λ(θ) = 0.000282 * θ + 0.862
r²=0.74
Solar zenith angle
(a)
Leaf dispersion parameter
Estimated LSAD
Uniform LSAD
Spherical LSAD
Inverted LSAD
Solar zenith angle
(c)
Extinction coefficient
Estimated from LAI2000
Markov model
Poisson model (RLD)
Solar zenith angle
(b)
Extinction coefficient
Estimated from LAI2000
Markov model(Estimated LSAD)
Markov model(Uniform LSAD)
Markov model(Spherical LSAD)
Solar zenith angle
(d)

Figure 5

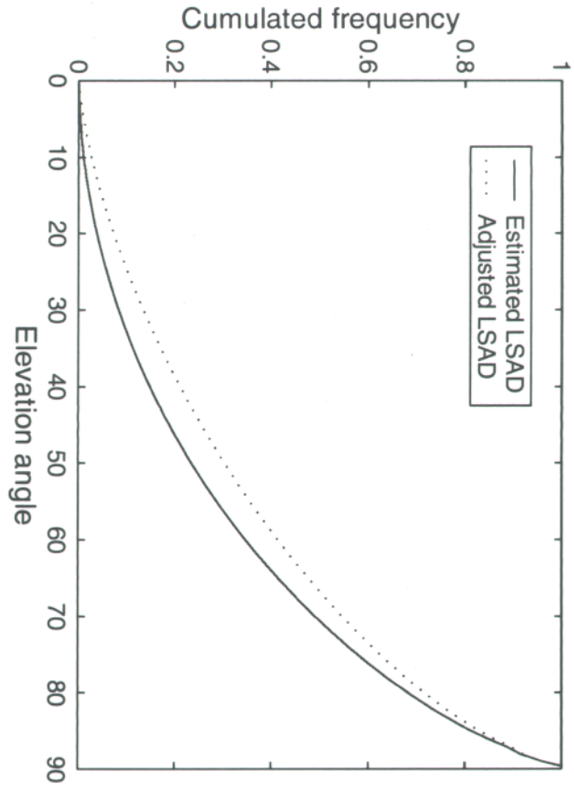

Estimated LSAD
Adjusted LSAD
Cumulated frequency
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
60
70
80
90
Elevation angle

Figure 6

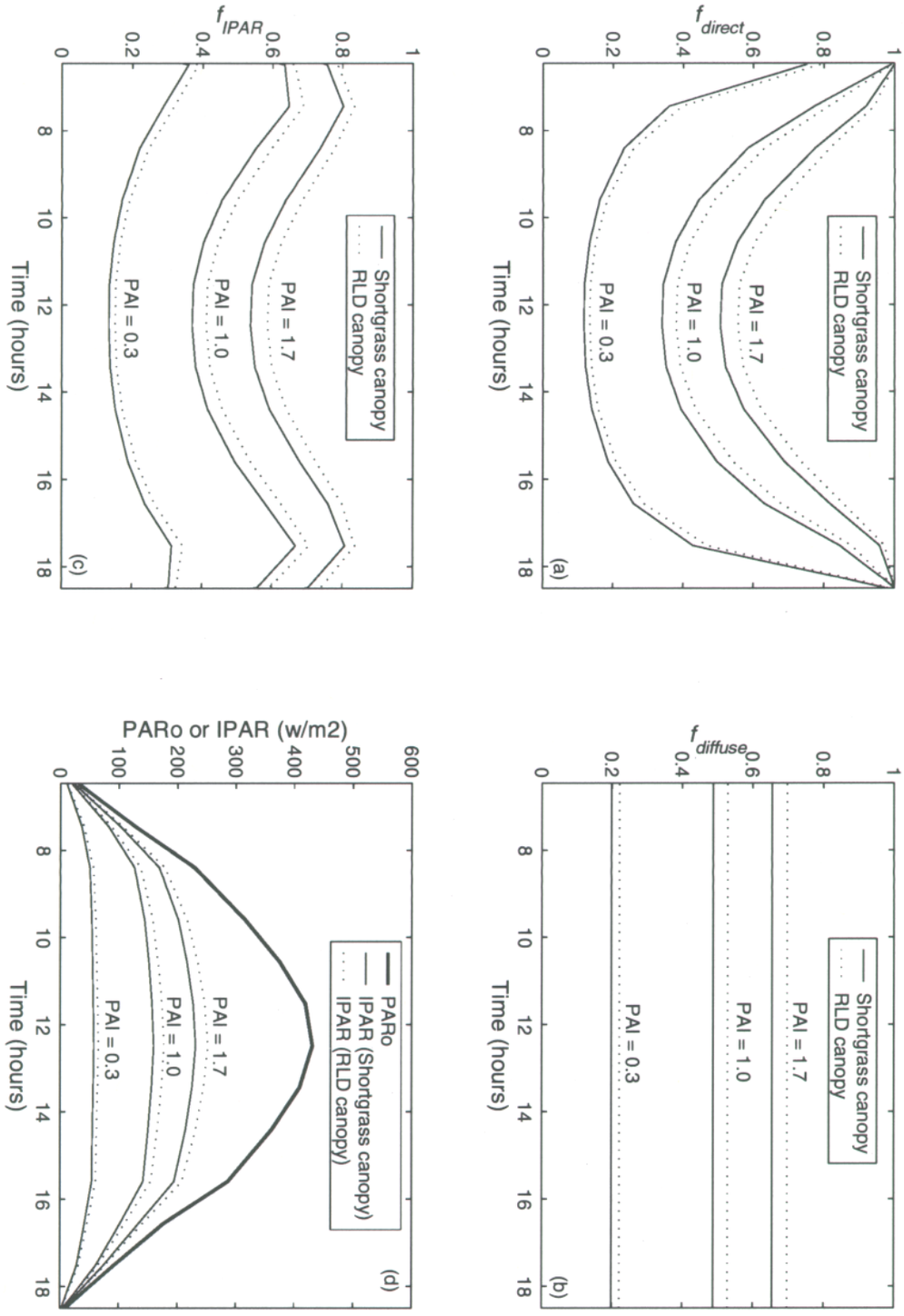

Shortgrass canopy
RLD canopy
PAI = 1.7
PAI = 1.0
PAI = 0.3
(a)
f_{direct}
Time (hours)
(b)
$f_{diffuse}$
(c)
f_{IPAR}
(d)
PARo
IPAR (Shortgrass canopy)
IPAR (RLD canopy)
PARo or IPAR (w/m2)

Figure 7

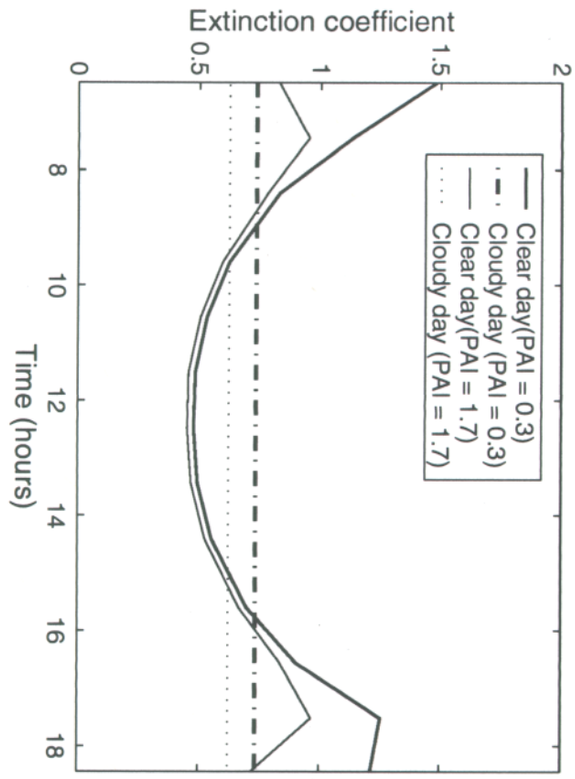

Extinction coefficient
2
1.5
1
0.5
0
8
10
12
14
16
18
Time (hours)
Clear day(PAI = 0.3)
Cloudy day (PAI = 0.3)
Clear day(PAI = 1.7)
Cloudy day (PAI = 1.7)

Figure 8

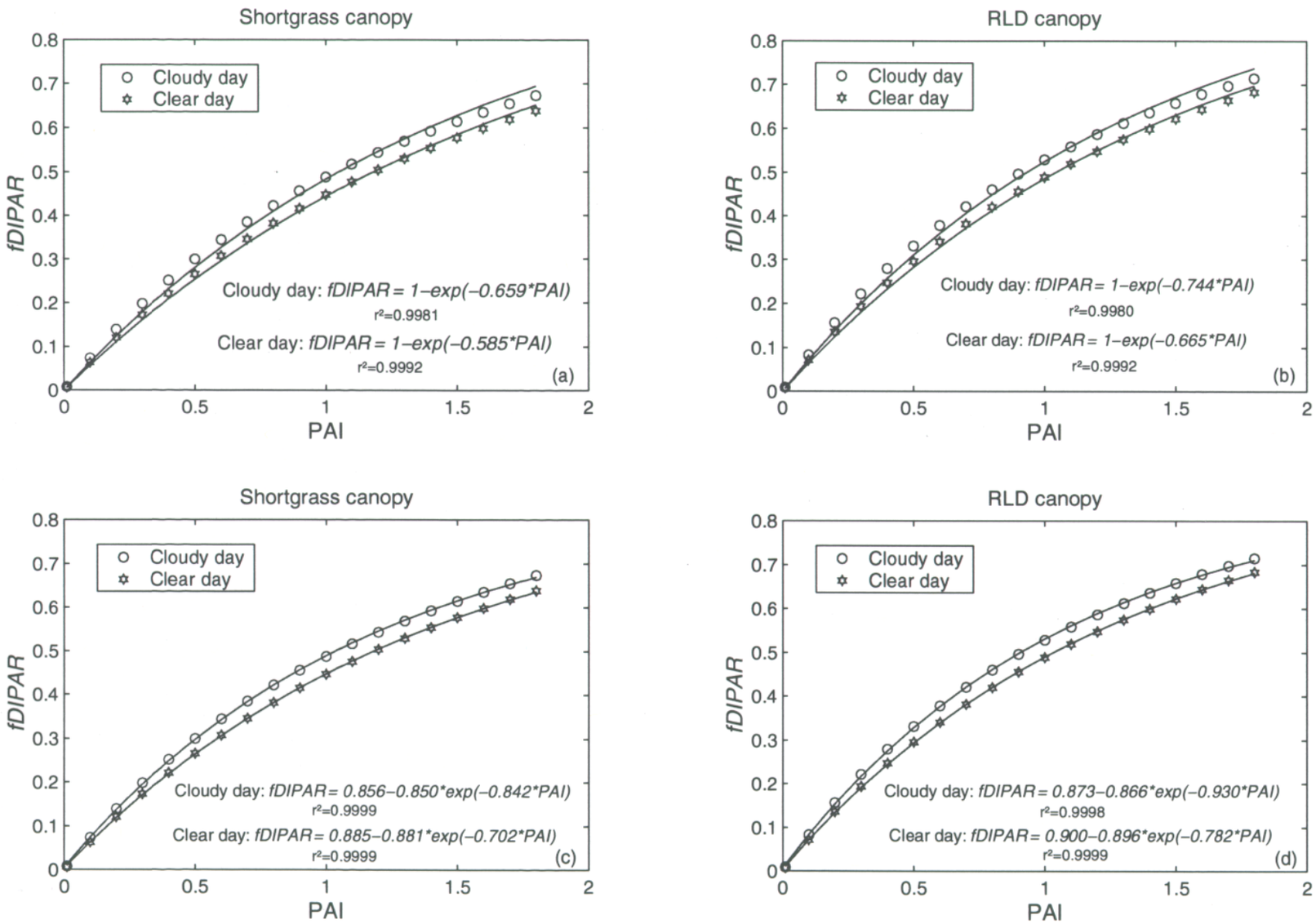

Shortgrass canopy
Cloudy day
Clear day
Cloudy day: fDIPAR= 1−exp(−0.659*PAI)
r²=0.9981
Clear day: fDIPAR= 1−exp(−0.585*PAI)
r²=0.9992
(a)
RLD canopy
Cloudy day
Clear day
Cloudy day: fDIPAR= 1−exp(−0.744*PAI)
r²=0.9980
Clear day: fDIPAR= 1−exp(−0.665*PAI)
r²=0.9992
(b)
Shortgrass canopy
Cloudy day
Clear day
Cloudy day: fDIPAR= 0.856−0.850*exp(−0.842*PAI)
r²=0.9999
Clear day: fDIPAR= 0.885−0.881*exp(−0.702*PAI)
r²=0.9999
(c)
RLD canopy
Cloudy day
Clear day
Cloudy day: fDIPAR= 0.873−0.866*exp(−0.930*PAI)
r²=0.9998
Clear day: fDIPAR= 0.900−0.896*exp(−0.782*PAI)
r²=0.9999
(d)
fDIPAR
PAI
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.5
1
1.5
2

Figure 9

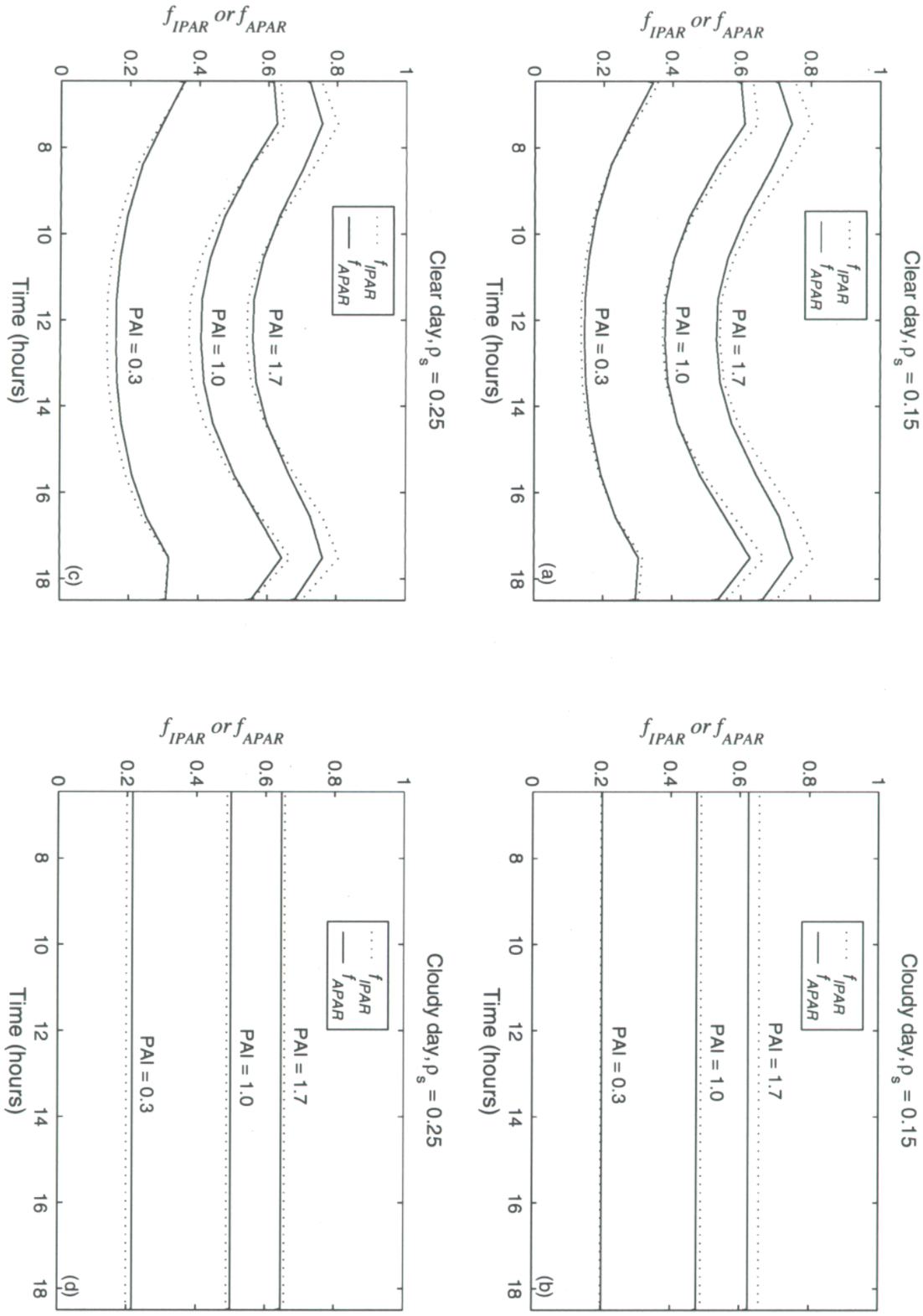

Clear day, ρs = 0.15
Cloudy day, ρs = 0.15
Clear day, ρs = 0.25
Cloudy day, ρs = 0.25
fIPAR or fAPAR
fIPAR
fAPAR
PAI = 1.7
PAI = 1.0
PAI = 0.3
Time (hours)
(a)
(b)
(c)
(d)

Figure 10

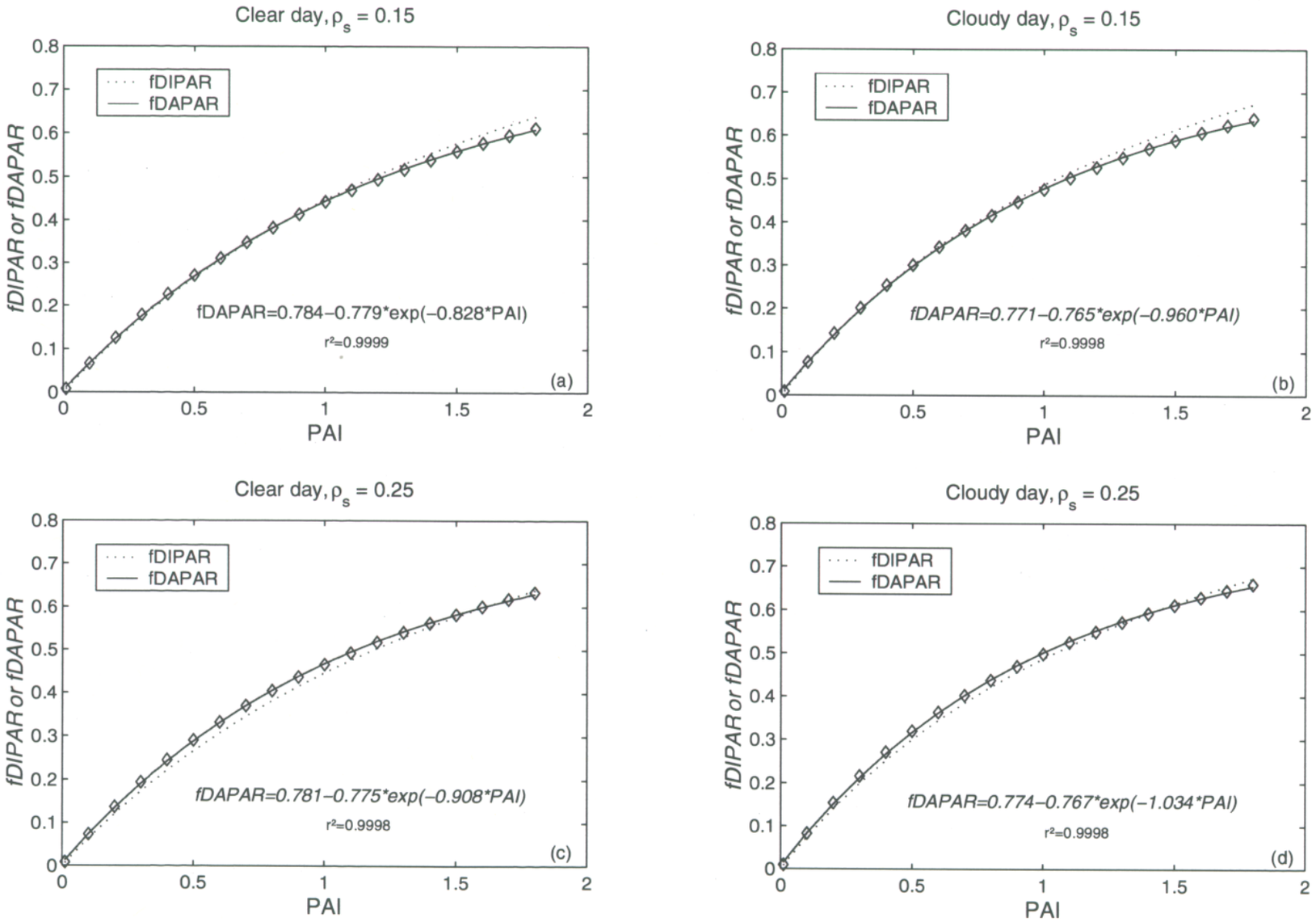

Clear day, ρ_s = 0.15
fDIPAR
fDAPAR
fDIPAR or fDAPAR
PAI
fDAPAR=0.784−0.779*exp(−0.828*PAI)
r²=0.9999
(a)
Cloudy day, ρ_s = 0.15
fDIPAR
fDAPAR
fDIPAR or fDAPAR
PAI
fDAPAR=0.771−0.765*exp(−0.960*PAI)
r²=0.9998
(b)
Clear day, ρ_s = 0.25
fDIPAR
fDAPAR
fDIPAR or fDAPAR
PAI
fDAPAR=0.781−0.775*exp(−0.908*PAI)
r²=0.9998
(c)
Cloudy day, ρ_s = 0.25
fDIPAR
fDAPAR
fDIPAR or fDAPAR
PAI
fDAPAR=0.774−0.767*exp(−1.034*PAI)
r²=0.9998
(d)

Figure 11

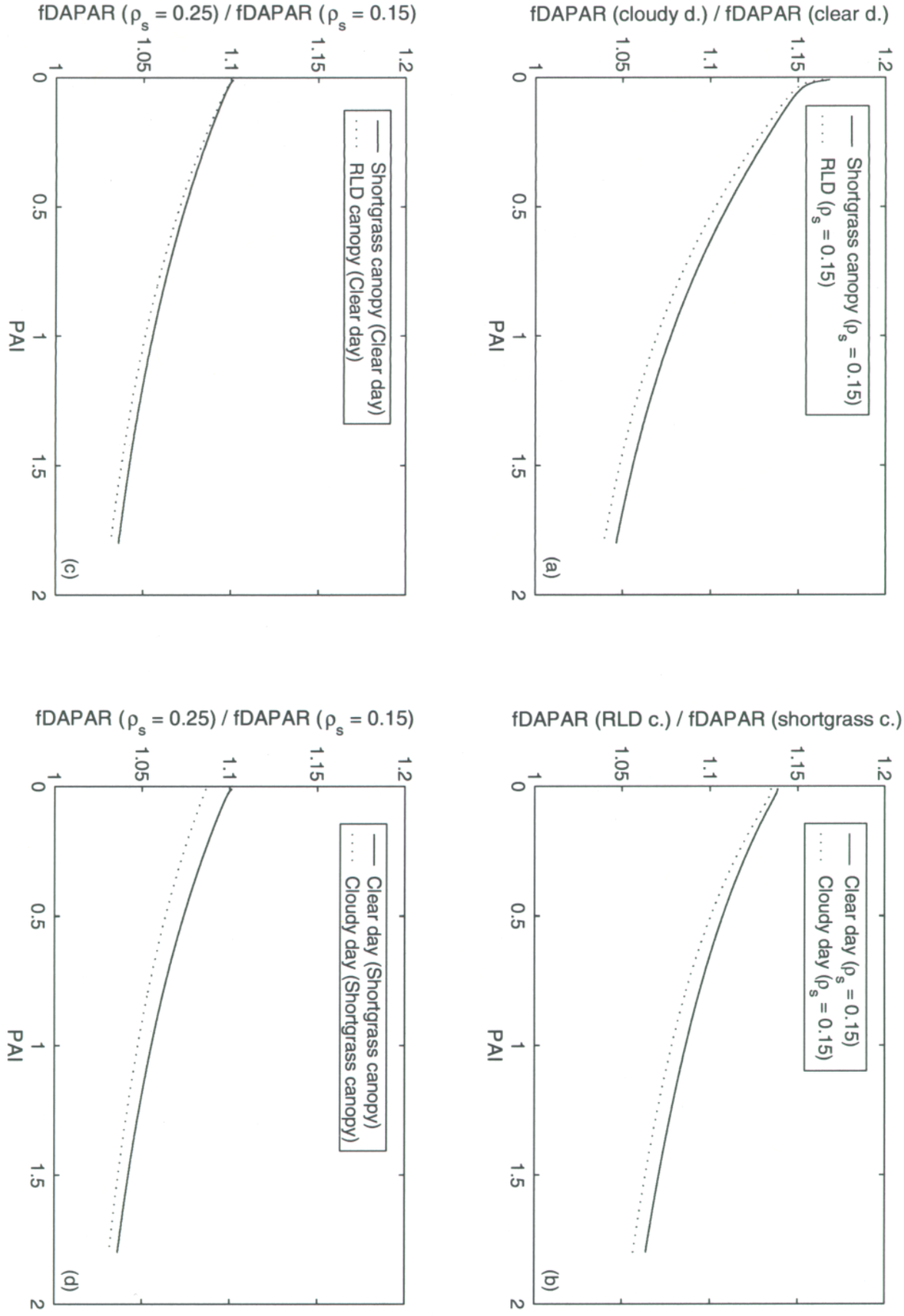

fDAPAR (cloudy d.) / fDAPAR (clear d.)
Shortgrass canopy (ρ_s = 0.15)
RLD (ρ_s = 0.15)
(a)
fDAPAR (RLD c.) / fDAPAR (shortgrass c.)
Clear day (ρ_s = 0.15)
Cloudy day (ρ_s = 0.15)
(b)
fDAPAR (ρ_s = 0.25) / fDAPAR (ρ_s = 0.15)
Shortgrass canopy (Clear day)
RLD canopy (Clear day)
(c)
fDAPAR (ρ_s = 0.25) / fDAPAR (ρ_s = 0.15)
Clear day (Shortgrass canopy)
Cloudy day (Shortgrass canopy)
(d)
PAI
1.2
1.15
1.1
1.05
1
0
0.5
1
1.5
2

Figure 12

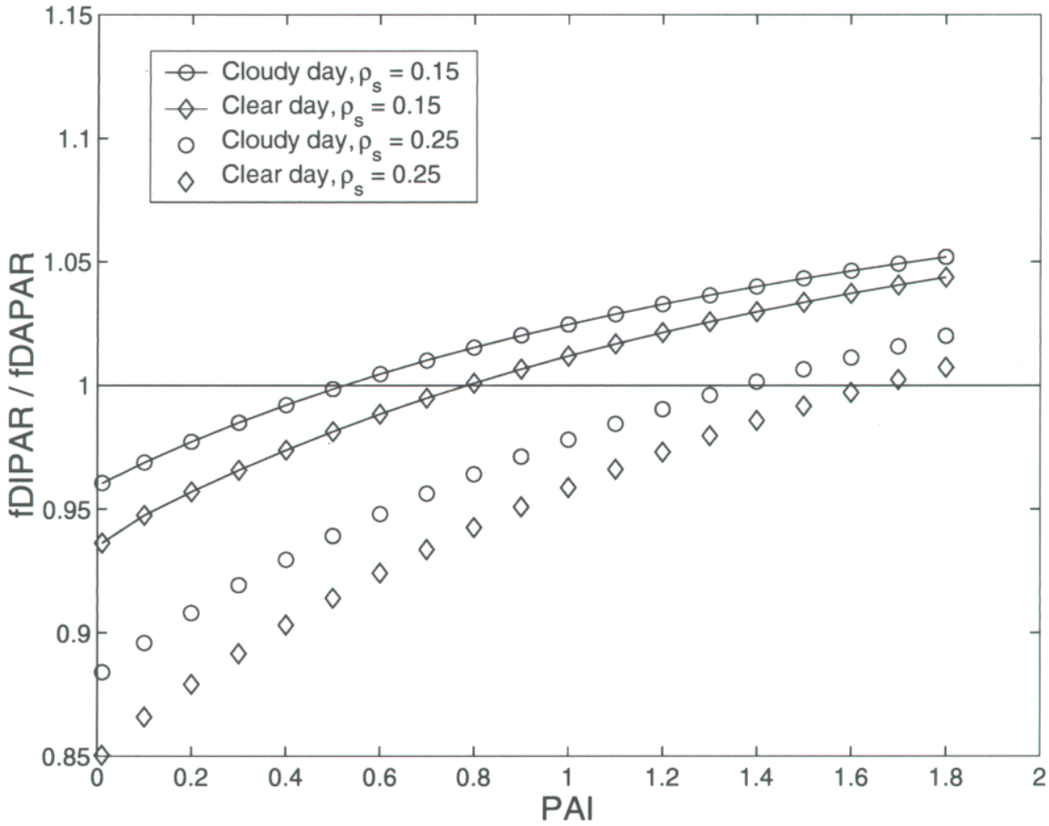

Cloudy day, ρ_s = 0.15
Clear day, ρ_s = 0.15
Cloudy day, ρ_s = 0.25
Clear day, ρ_s = 0.25
fDIPAR / fDAPAR
PAI
1.15
1.1
1.05
1
0.95
0.9
0.85
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

Figure 13