

The ORM Seven Layer Standard Atmosphere

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This note describes a layered model of the ORM site atmosphere based on experimental C_n^2 data lumped into seven layers (Nicholas Devaney). The model is used to provide values of Fried's parameter r_0 for the individual layers assuming the following seeing conditions (www.iac.es/eno/folleto.htm):

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|----|----------------------------|---|
| 1) | Annual mean seeing angle | $\alpha = 0.67''$ at $\lambda = 0.50 \mu\text{m}$ |
| 2) | Summer mean seeing angle | $\alpha = 0.61''$ at $\lambda = 0.50 \mu\text{m}$ |
| 3) | Summer median seeing angle | $\alpha = 0.54''$ at $\lambda = 0.50 \mu\text{m}$ |

Accumulated values of r_0 are calculated for the cases of $\lambda = 0.50 \mu\text{m}$ and $\lambda = 2.2 \mu\text{m}$ and distributed among the layers according to the seven layer model.

Formulae used

$$\alpha = 0.98 \frac{\lambda}{r_{0,\text{acc}}}$$

$$\frac{1}{r_{0,\text{acc}}^{5/3}} = \sum_{m=1}^7 \frac{1}{r_{0,m}^{5/3}}$$

$$\frac{1}{r_{0,m}^{5/3}} = p C_{n,m}^2$$

$$p = \frac{1}{r_{0,\text{acc}}^{5/3}} \bigg/ \sum_{m=1}^7 C_{n,m}^2$$

$$r_0(\lambda) = r_0(\lambda_0) \left(\frac{\lambda}{\lambda_0} \right)^{6/5}$$

Values are listed in the following table showing r_0 in m. Upper case values are for $\lambda = 0.50 \mu\text{m}$ and lower case values are for $\lambda = 2.2 \mu\text{m}$

Altitude(m)	500	1500	2500	7000	10000	15000	17000	Accumulated
$C_{n,m}^2 (m^{-1/3})$	3.20×10^{-13}	2.85×10^{-13}	5.62×10^{-14}	2.93×10^{-14}	2.43×10^{-14}	2.82×10^{-14}	4.87×10^{-15}	7.48×10^{-15}
Annual mean	0.250 1.48	0.268 1.59	0.709 4.21	1.05 6.22	1.17 6.96	1.07 6.36	3.06 18.2	0.15 0.89
Summer mean	0.283 1.63	0.303 1.75	0.803 4.63	1.19 6.85	1.33 7.66	1.22 7.01	3.49 20.1	0.17 0.98
Summer median	0.316 1.85	0.339 1.98	0.898 5.25	1.33 7.75	1.49 8.68	1.36 6.44	3.90 22.8	0.19 1.11