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Winter Outdoor Sun-Basking (Dhoop) Conditions in Islamabad

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1. Purpose and analytical approach

This assessment quantifies wintertime outdoor sun-basking (Dhoop) suitability in Islamabad using an hour-by-hour evaluation of meteorological and environmental conditions. Two consecutive winter seasons, December–January 2023-24 and December-January 2024-25, are analyzed.

Minute-resolution AWS observations were aggregated to hourly values and combined with daily total cloud cover (oktas). Each hour was evaluated using a Dhoop Index (1–5), where lower values represent unfavorable conditions and higher values represent optimal sun-basking comfort. The index integrates air temperature, relative humidity, wind speed, cloud cover, $PM_{2.5}$ concentration, rainfall occurrence, and solar elevation angle computed specifically for Islamabad. Nighttime hours, when solar elevation is negative, were explicitly down-weighted to avoid artificial comfort classification.

An hour is classified as ideal when the Dhoop score is ≥ 4.1.

2. Overall seasonal comparison

The seasonal summary table shows that both winters exhibit nearly identical sun-basking potential. Roughly one-fifth of all winter hours qualify as ideal in each season, with only marginal inter-annual variation.

Season	Total hours	Ideal Dhoop hours	% of season	Typical ideal window
Dec 2023 – Jan 2024	1488	312	21.0%	10:00–14:00
Dec 2024 – Jan 2025	1488	305	20.5%	10:00–14:00

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Winter apricity in Islamabad is climatologically stable rather than episodic. Year-to-year variability is minimal, indicating that outdoor comfort planning during winter can rely on predictable seasonal behavior rather than isolated weather events.

3. Monthly distribution of ideal hours

The monthly table highlights a consistent pattern across both winters, with January slightly outperforming December in terms of ideal sun-basking hours. This reflects reduced fog persistence, marginally higher midday temperatures, and more frequent post-disturbance clearing in January.

Month	Ideal hours
Dec 2023	148
Jan 2024	164
Dec 2024	152
Jan 2025	153

4. Distribution across Dhoop score classes

The score-class distribution reveals a strongly polarized winter comfort structure. A large share of hours fall into the lowest category due to nighttime conditions, fog, or heavy cloud cover. However, when favorable conditions occur, they tend to produce high-quality comfort (scores 4–5) rather than marginal usability.

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Score	Interpretation	Hours
1	Very poor (night, rain, heavy cloud)	889
3	Usable / marginal	105
4	Good	349
5	Ideal	145

5. Time-of-day clustering of ideal conditions

The time-of-day table demonstrates that ideal Dhoop conditions are tightly concentrated between 10:00 and 14:00 local time. Early morning hours remain limited by low solar elevation and fog, while late afternoon comfort declines rapidly as solar angles decrease.

Hour (local)	Relative suitability
06:00–08:00	Poor to marginal
09:00	Improving
10:00–14:00	Peak ideal hours
15:00–16:00	Gradually declining
After 17:00	Poor

6. High-quality apricity episodes

The table of best individual days shows that ideal conditions frequently occur in multi-day clusters, rather than isolated single days. These clusters typically follow western disturbance passages and are characterized by clearing skies, suppressed fog, and light winds.

Dec 2023 – Jan 2024
- 18–19 Dec 2023: ~7 ideal hours/day
- 1–8 Jan 2024: repeated 6–7 hour days
- 14–19 Jan 2024: 6-day cluster averaging 7.2 hours/day

Dec 2024 – Jan 2025
- 29 Dec 2024 – 1 Jan 2025: ~7 hours/day
- 8–11 Jan 2025: up to 9 ideal hours/day
- 24–26 Jan 2025: stable multi-day apricity

7. Dominant controls on winter Dhoop conditions

Analysis of index behavior indicates the following hierarchy of controls:
1. Solar elevation, a fixed geometric constraint
2. Cloud cover, where even small increases significantly reduce comfort
3. Wind speed, which strongly modulates perceived warmth
4. Air temperature, secondary and often offset by direct sunshine
5. $PM_{2.5}$, affecting air quality perception more than thermal comfort

Light haze or shallow fog does not necessarily negate comfort if sunshine penetrates cloud layers and winds remain weak, validating the use of flexible rather than overly strict comfort thresholds

8. Practical planning guidance

Based on two consecutive winter seasons, a clear operational rule emerges:

Outdoor sun-basking activities in Islamabad should be planned between 10:00 and 14:00, particularly in January, on days with cloud cover ≤ 3 oktas and light winds.

From a seasonal perspective, users can expect approximately 300–315 ideal hours per winter, occurring in repeatable multi-day clusters with minimal inter-annual variability.

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