Eight Stable Urban Environment Characteristics

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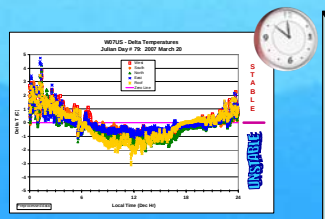
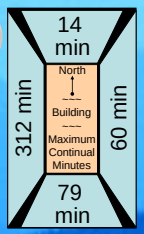
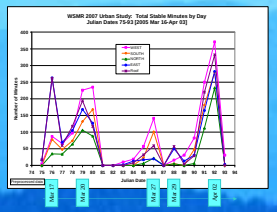
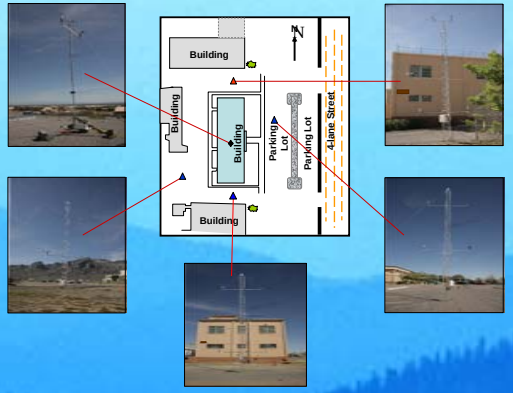
General Characteristics

- Stable environments occurred on all sides of a building.
- Average duration of consecutive stable minutes was 6–8 min.
- Extreme durations for consecutive stable minutes ranged 14–312 min.
- Extreme stable case durations favored the non-windy environments.









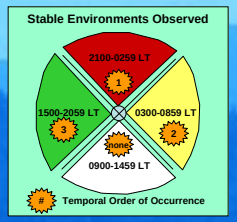
Temporal Characteristics

- Most populated stable environment period: Midnight, ±3 h.**
- Second most populated stable environment period: Sunrise, ±3 h.

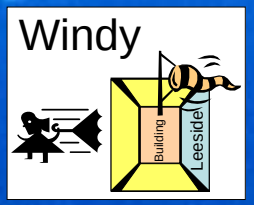
**Preliminary findings from subsequent research indicate that the most populated period may be refined to 0000–0300 LT.

Field Study	Sunrise 0300–0859 LT	Daytime 0900–1459 LT	Sunset 1500–2059 LT	Night Time 2100–0259 LT	Total (%)
W03US	44	0	0	56	100
W05US	44	0	6	50	100
W07US	28	0	6	66	100

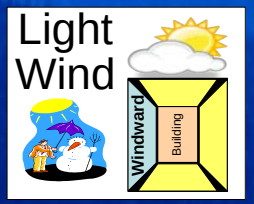
Inter-*Study* Comparison: Temporal distribution, in percentage, of stable conditions around the subject building.



Spatial Characteristics



- During windy conditions, the building leeside was favored for a stable environment.
- The open leeside environment (also, a building wake area) suggests an increased potential for radiative cooling with respect to the other "enclosed" building sides.



- During non-windy conditions, the building windward was favored for stable conditions.
- Heat from the radiating building lacks the airflow necessary to send the heat away from the building. Therefore, all sides but the windward, integrate the added heat into the vertical profiles and report less stable conditions than the non-building-influenced Fetch side.

Percentage* of Stable Min by Tower	*W03US*	*W05US*	*W07US No Roof Data Included*	*W07US Roof Data Included*
East	36	49	27	21
South	31	14	23	18
West	23	11	35	27
North	10	26	15	11
Roof	N/A	N/A	Not Included	23

An Inter-*Study* Comparison.

Note: If an entire *Study* reported stable conditions in only one tower, the number entered for that tower would be 100%.

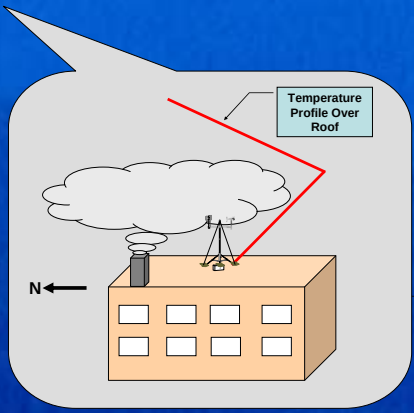
Summary

- Urban atmospheric stability patterns impact health, tools, operations and strategic planning. By identifying repeatable urban stability patterns, improvements to each impact area can be achieved.
- In this paper, the stability conditions for field studies *WSMR 2003 Urban Study (W03US), WSMR 2005 Urban Study (W05US)* and *WSMR 2007 Urban Study (W07US)* were reviewed, with a focus on characterizing the atypical stable urban environments.
- While no spatial patterns proved consistent among the field studies, there was consistency between seasonally similar field study atmospheric environments. For example, the spatial distribution during the climatologically windy field studies showed a preference of stable conditions on the leeside of the subject building. One possible explanation: the open leeside (and building wake) environment suggests an increased potential for radiative cooling with respect to the other "enclosed" building sides.
- Light winds (the climatologically atypical conditions of *W07US)* favored the windward or building's Fetch side. The proposed explanation for these contrasting results suggested that the heat from the radiating building lacked the airflow necessary to send the heat away from the building. Therefore, all sides but the Fetch integrated the added heat into the vertical profiles and reported less stable conditions than the non-building-influenced Fetch side.
- Inter-*Study* stable case evaluations showed an amazing consistency in the average case length. On average, the consecutive minutes of a stable environment were between 6–8 min. The maximum case durations reported by the field study towers ranged from 14–312 min.
- The temporal distribution of the stable environment was extremely consistent between the three *Studies*. The first preferred time period for occurrence was 2100–0259 LT (Nighttime). The second preferred was 0300–0859 LT (Sunrise). In two of the *Studies*, the third preferred was 1500–2059 LT (Sunset). No *Study* reported stable conditions during the Daytime period (0900–1459 LT).
- In conclusion, the eight stable urban environment characteristics observed were:
  1. The most populated period for stable environment occurrence was midnight, ±3 h.**
  2. The second most populated period for stable environment occurrence was sunrise, ±3 h.
  3. During windy conditions, the building leeside was favored for a stable environment.
  4. During non-windy conditions, the building windward (Fetch) side was favored.
  5. The average duration of consecutive minutes for stable conditions was 6–8 min.
  6. The extreme durations for consecutive stable minutes, as defined by the individual tower data, ranged from 14–312 min (312 min = 5 h 12 min).
  7. Extreme stable case durations favored the non-windy environments.
  8. The roof with a heating vent generated a stable environment.

**Preliminary findings from subsequent research indicated that the refined most populated period was 0000–0300 LT.

General Observation

- The roof with a heating vent generated a stable environment.
- On the northwest corner of the roof was a heating vent. The roof tower placement was such that under normal climatologically windy conditions, the heating vent's exhaust would be carried away without impacting the roof tower.
- Light winds occurred during *W07US*.
- Without the anticipated air velocities to carry the heat away from the building, the roof's atmosphere gained a warm air pocket that was picked up by the upper level sampler. The net result was that a stable roof environment was reported.



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