

Coastal Urban Microclimate Observatory

Complete Setup Instruction Manual

PHASE 0 — SITE PLANNING (Most Important Phase)

Before buying anything, ensure proper site selection.

- Open sky exposure (minimum 120° clear horizon).
- Natural ground (soil or grass) for temperature sensor placement.
- No nearby AC exhausts.
- No reflective walls within 5 m of temperature sensor.
- Structurally safe mast location for 10 m installation.

Incorrect temperature sensor placement will bias the entire dataset.

PHASE 1 — EQUIPMENT SPECIFICATION

Core Instruments (Research Minimum)

Wind (10 m height)

- Ultrasonic anemometer (marine grade).
- 1-second gust resolution.
- True North alignment capability.
- Mounted at 10 m above ground.
- Clear radius ideally 10x obstacle height (document compromises).

Temperature & Humidity

- Aspirated radiation shield (active ventilation preferred).
- Mounted 1.5–2.0 m above natural soil.
- Grass or bare soil below (not concrete).

Rain Gauge

- High-resolution tipping bucket (0.1–0.2 mm).
- Installed 30 cm above ground.
- Perfectly level with open sky exposure.
- No trees, roof edges, or splashing surfaces nearby.

Pressure Sensor

- Resolution 0.1 hPa.
- Indoor mount in stable temperature room.
- Not inside AC airflow.

Optional (Strongly Recommended)

- Pyranometer (solar radiation).
- Soil temperature probe (5 cm depth).
- Soil moisture probe.

PHASE 2 — MAST INSTALLATION (Critical for Wind Accuracy)

- Marine-grade stainless steel or galvanized mast.
- Corrosion resistant for coastal conditions.
- Guy wires in 3–4 directions, securely anchored.
- Lightning grounding rod connected.
- Align wind sensor to True North (GPS or solar method).
- Document magnetic declination used.

PHASE 3 — SENSOR SITING RULES

- Wind at 10 m height with obstacle interference documented.
- Temperature at 1.5–2 m above natural surface with radiation shield.
- Rain gauge level base with bubble level verification.
- Annual rain gauge calibration check.

PHASE 4 — DATA LOGGING SYSTEM

- 1-minute resolution minimum.
- Timestamp in UTC only.
- Record temperature (°C), humidity (%), wind speed (m/s), gust (m/s), direction (°), rainfall (mm), pressure (hPa), solar radiation (W/m²).
- Local SD storage.
- Weekly cloud backup.
- Monthly manual archive.
- No unexplained data gaps.

PHASE 5 — CALIBRATION PROTOCOL

- 7-day temperature cross-check with nearest official station.
- Rain gauge measured water volume calibration test.
- Pressure comparison with official sea-level pressure.
- Document all adjustments.

PHASE 6 — METADATA DOCUMENTATION

- Latitude and longitude (6 decimal precision).
- Elevation (m above sea level).
- Sensor heights.
- Surface type.
- Distance to coastline.
- Urban density description.
- Instrument models.
- Calibration dates.
- Maintenance log.

With metadata, the dataset becomes publishable and scientifically valid.

PHASE 7 — OPERATION PROTOCOL

- Daily visual inspection and debris check.
- Monthly mast and cable corrosion inspection.
- Yearly rain gauge recalibration and shield cleaning.
- Firmware updates and sensor validation.

PHASE 8 — DATA QUALITY CONTROL

- Flag impossible spikes.
- Identify sensor dropouts.
- Detect wind direction freezing.
- Check rainfall during dry sky events.
- Never delete anomalies silently; annotate clearly.

PHASE 9 — DATA UTILIZATION

- Analyze sea breeze onset variability.
- Track night minimum temperature trends.
- Measure heat index peaks.
- Calculate pressure drop rates.
- Study rainfall intensity bursts.

After 2–3 years, microclimate analysis can be prepared for publication.

PHASE 10 — SAFETY (Coastal Critical)

- Install surge protection.
- Ensure proper grounding.
- Use waterproof connectors.
- Use UV-resistant cables.
- Conduct annual corrosion inspection.

Coastal salt severely damages poor-quality fittings.

FINAL NOTE

If maintained correctly for 3+ years, this observatory will produce a high-resolution coastal urban climate dataset including cyclone micro-pressure signatures and sea breeze boundary layer characterization suitable for scientific publication.