

High-Resolution Climate Monitoring on a Mountain Island: The Saguaro National Park Pilot Study

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Project Background

- NPS-Sonoran Desert Network I&M exploring climate monitoring strategies as part of the Natural Resource Challenge and Park Vital Signs Monitoring
- Ecosystem Monitoring Framework for the Sonoran Desert recognizes the need for climate monitoring and has assessed needs through an expert working group
- Are existing park-level climate monitoring systems effective for natural resource management activities?
- Saguaro National Park excellent location for pilot study (diversity of management issues, steep environmental gradients, protected area)



Project Design

- Evaluate how climate information is used by different users at Saguaro National Park (meetings, informal interviews)
- Catalog all different research and management activities at park; climate data used or needed?
- Work with park staff to design and develop a temporary climate monitoring network (Which variables? Where? Why?)
- Develop climate data mining and visualization tools with guidance from park staff
- Determine how data from new network is being used (formal surveys, interviews)
- Evaluate utility of network for long-term monitoring



Climate Information and Park Level Management



- Hydrological monitoring
- Wildfire management
- Wildlife studies
- Invasive species management
- Air quality management
- Education



Monitoring Strategy

- Coupling high-resolution climate monitoring with ecological monitoring
 - Datalogging weather stations (10 min sampling)
 - Vegetation sampling (monthly to seasonally)
- Broad approach – many variables at many sites
- Coordination with other natural resource management activities and research projects



Weather Station Specifications

- Wind speed/direction (10 minute average speed, gust)
- Rainfall (0.01 tip)
- Air Temperature
- Relative Humidity
- Atmospheric Pressure
- Solar Radiation (300-1100 nm)
- Photosynthetically Active Radiation (400-700 nm)
- Soil Moisture (10 cm depth)
- Soil Temperature (10 cm depth)



Vegetation Sampling



- Modular plots (4,10m x 10m)
- Percent canopy cover

- Three height classes (<0.5m, 0.5-2m, >2m)
- Monthly to seasonal sampling

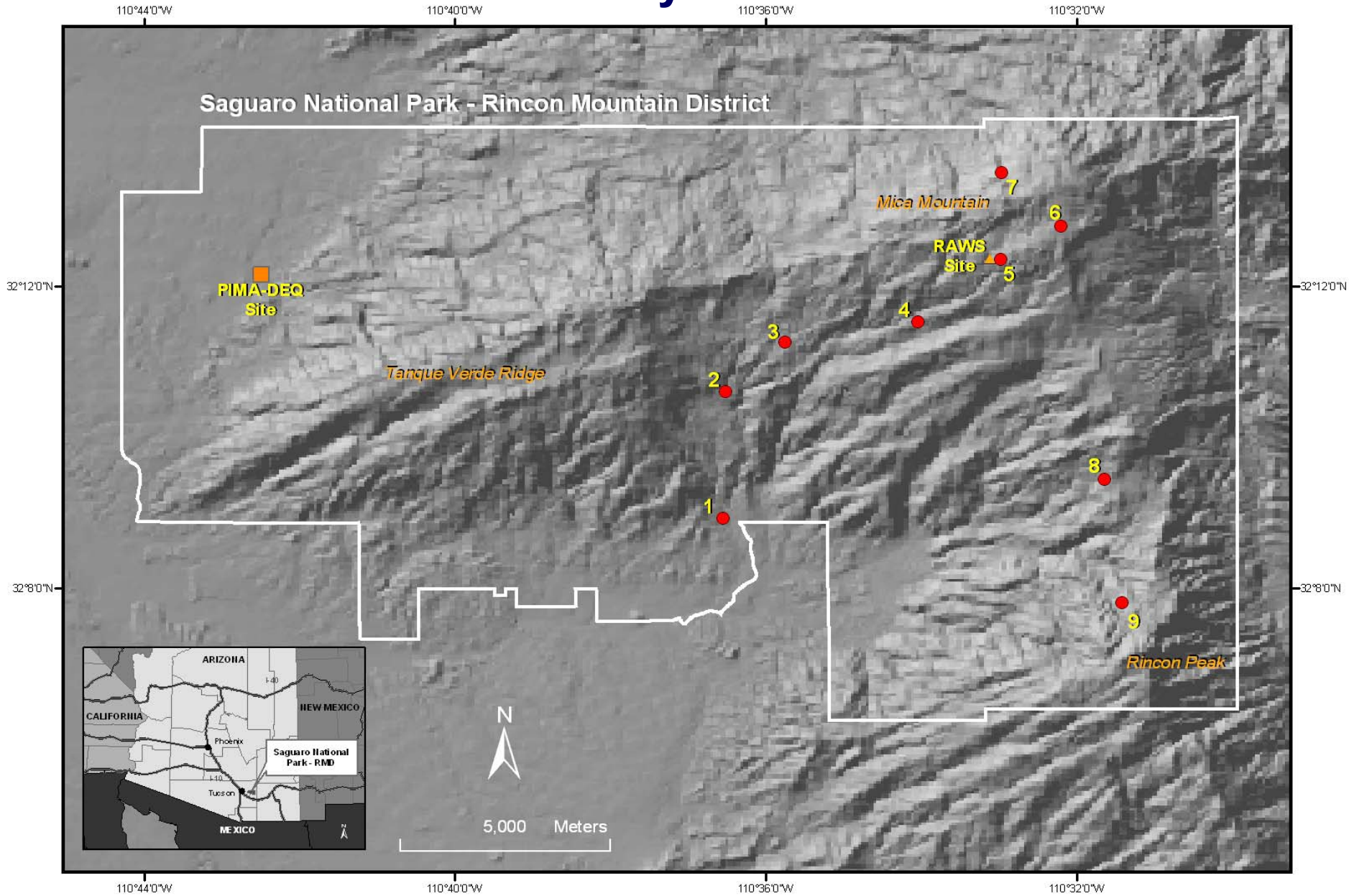


Additional Site Monitoring

- Specialized meteorological measurements
 - shaded surface temperature at ground level
 - soil moisture profiling
- Repeat Photography
- Dendrometers
- Snow



Study Area



Monitoring Sites

Station	Installation	Elevation	Aspect	Ecotone/Community Type
1 - MADRAN	September 2003	1052 m (3450 ft.)	S	Upper Sonoran Desert Scrub
2 - SHIDAG	December 2003	1402 m (4599 ft.)	S	Madrean Evergreen Woodland/Chapparal
3 - GRASHA	February 2004	1607 m (5500 ft.)	Level	Madrean Evergreen Woodland
4 - MANZAN	May 2004	1980 m (6500 ft.)	S	Pinyon/Juniper Woodland
5 - RAWSDN	February 2004	2417 m (7929 ft.)	S	Ponderosa Pine Forest
6 - MICMEA	March 2004	2325 m (7627 ft.)	Level	Ponderosa Pine Forest/Open Meadow
7 - NORSLO	March 2004	2430 m (7972 ft.)	N	Mixed Conifer Forest
8 - HAPVAL	May 2004	1923 m (6309 ft.)	W	Pinyon/Juniper Woodland
9 - RINPEA	May 2004	2166 m (7106 ft.)	N	Mixed Conifer Forest



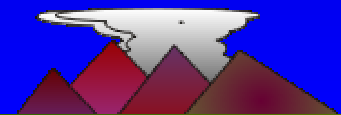


Madrona Ranger Station (1052m), Upper Sonoran Desert Scrub





Along Madrona trail (1402m), Madrean evergreen woodland/chapparral





Mica Meadow (2325m), Open meadow/Ponderosa pine forest





North slope of Mica Mountain (2430m), Post-fire/mixed conifer

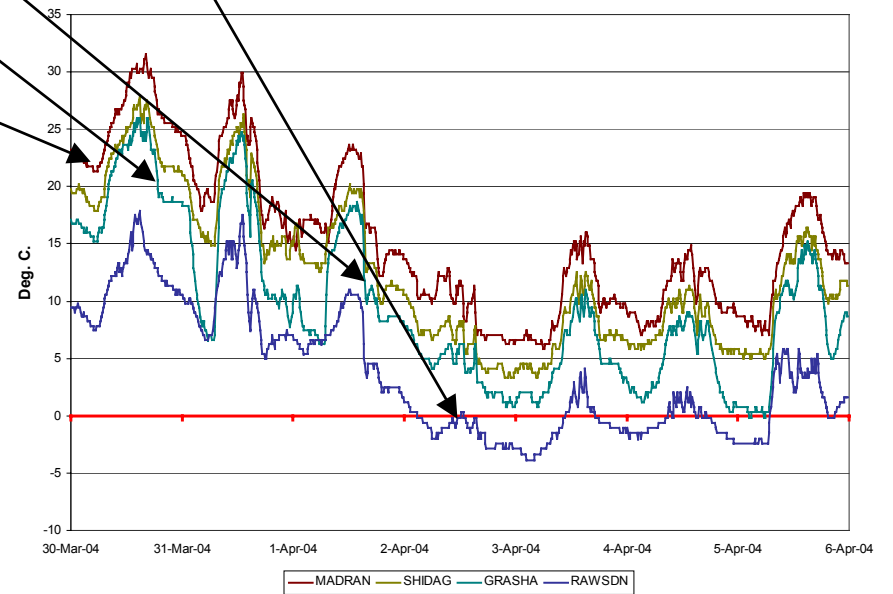
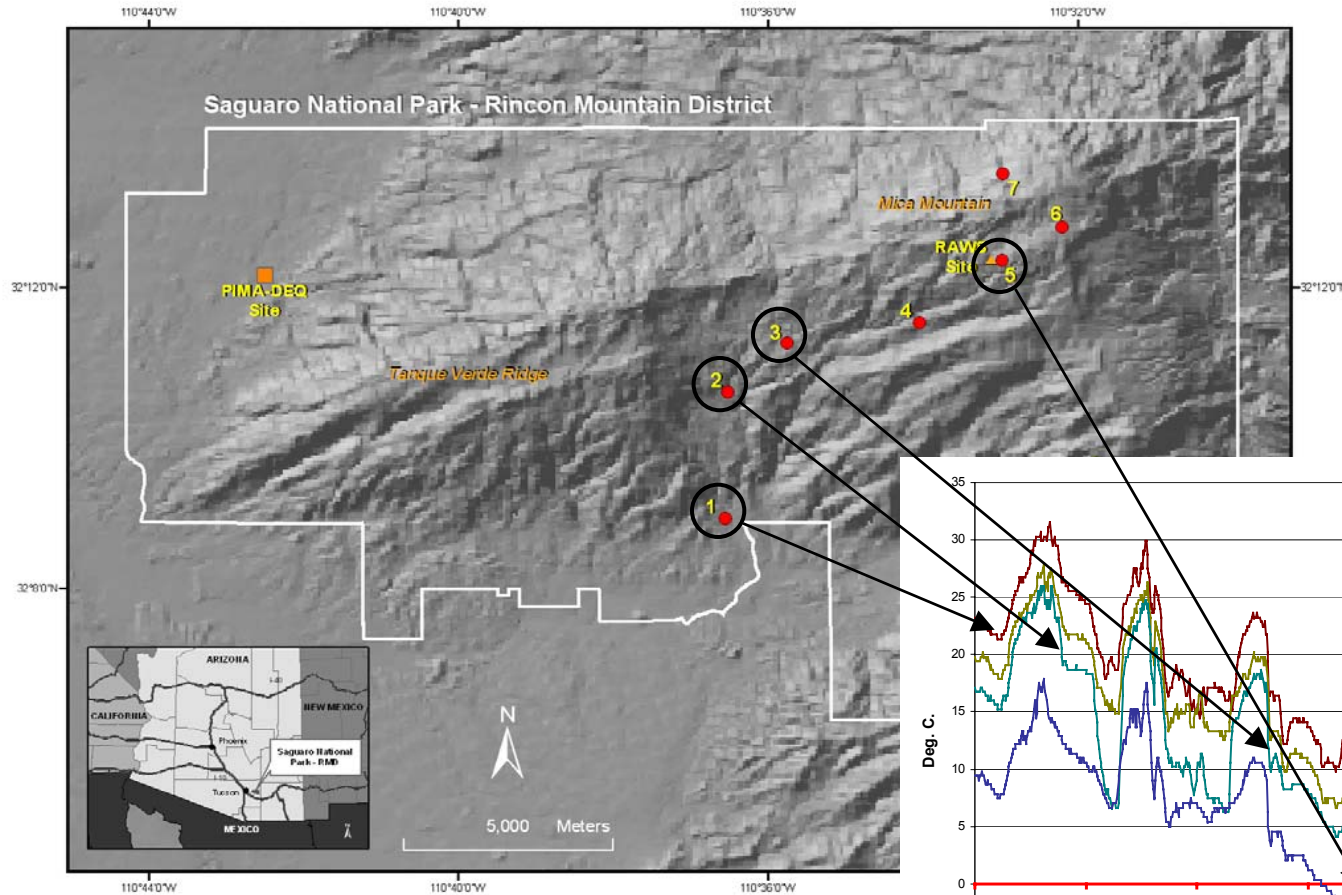




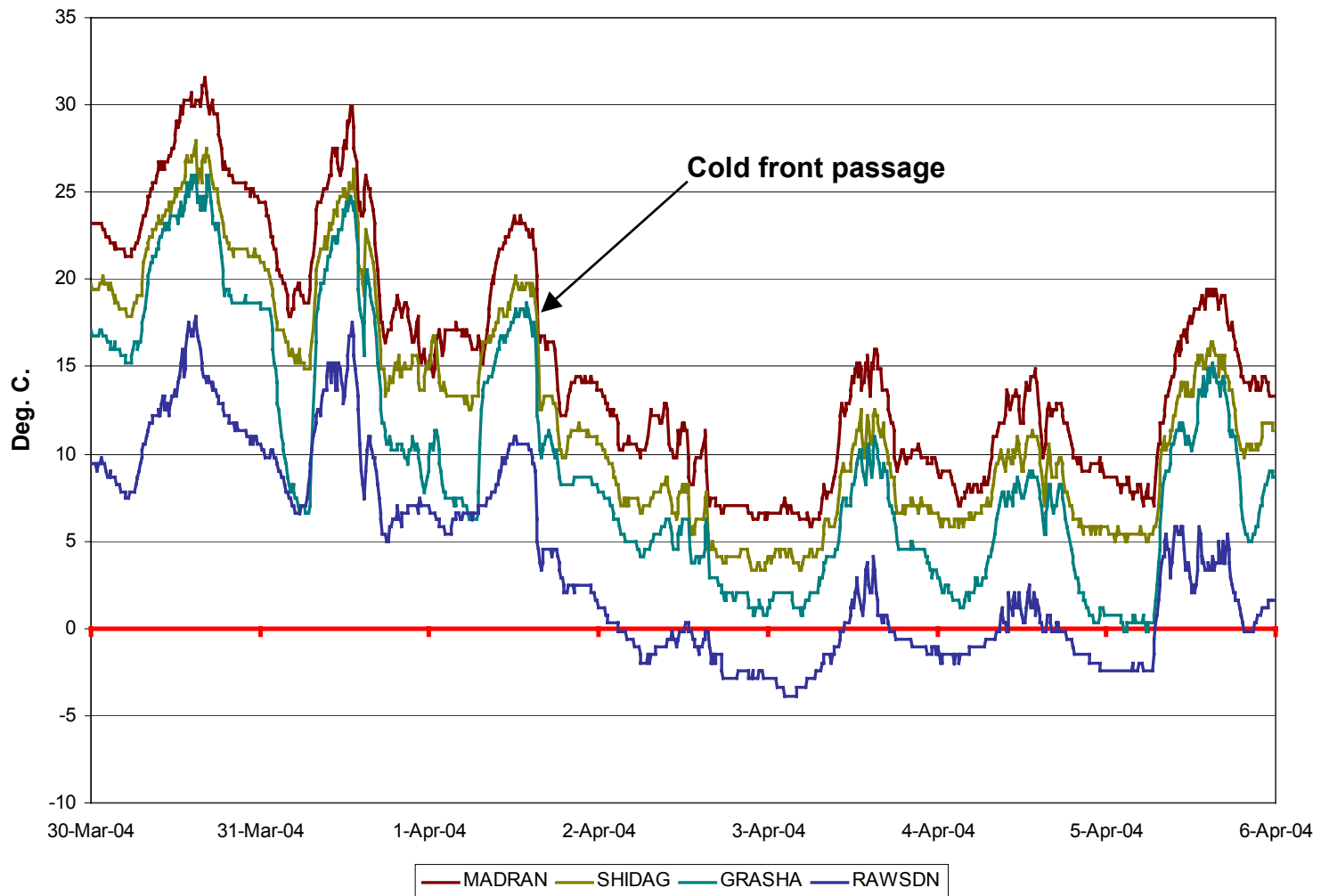
RAWS comparison site (1052m), open meadow/Ponderosa pine forest



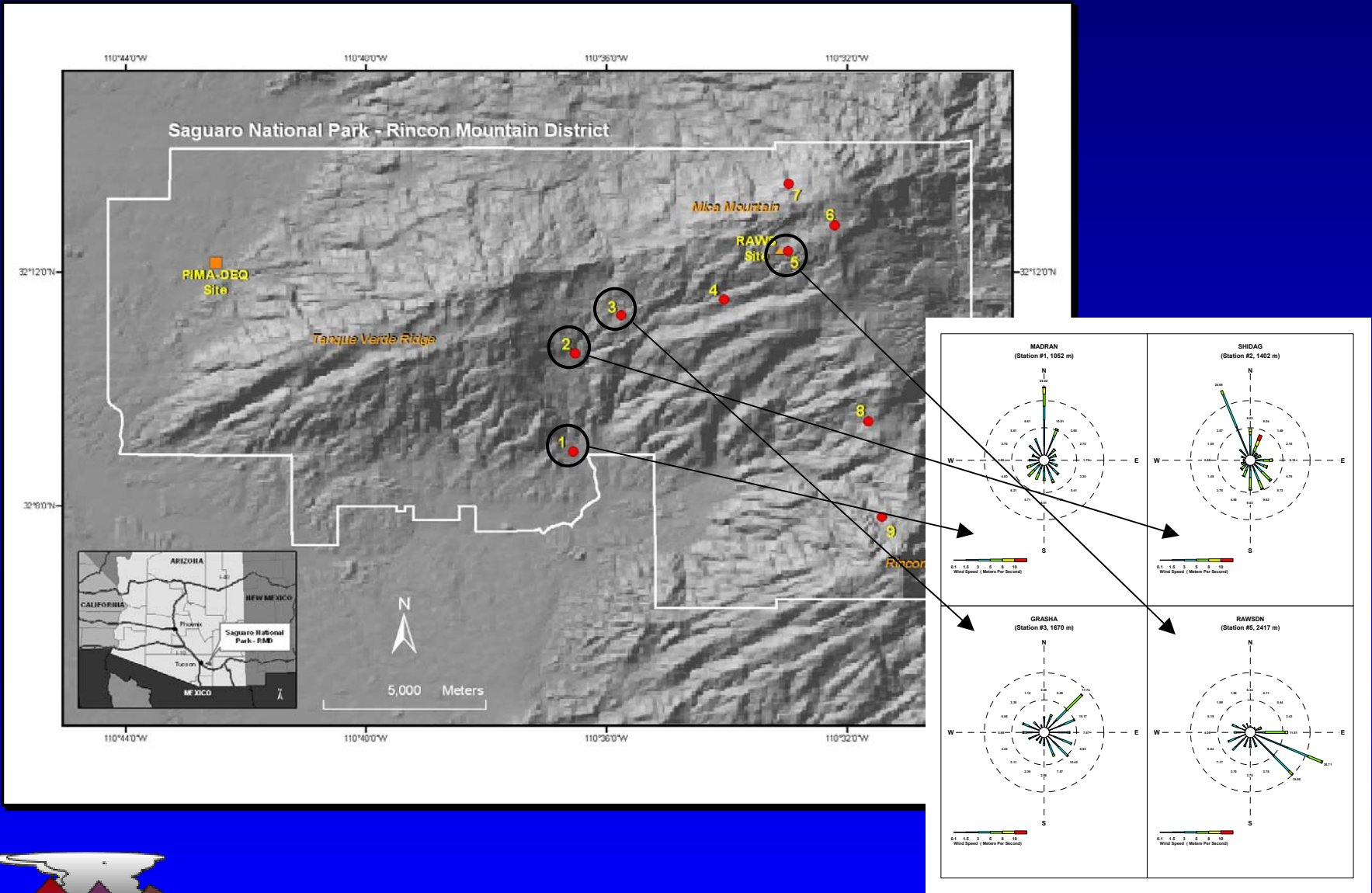
Preliminary Data: Air Temperature



Winter Storm, Late March 2004



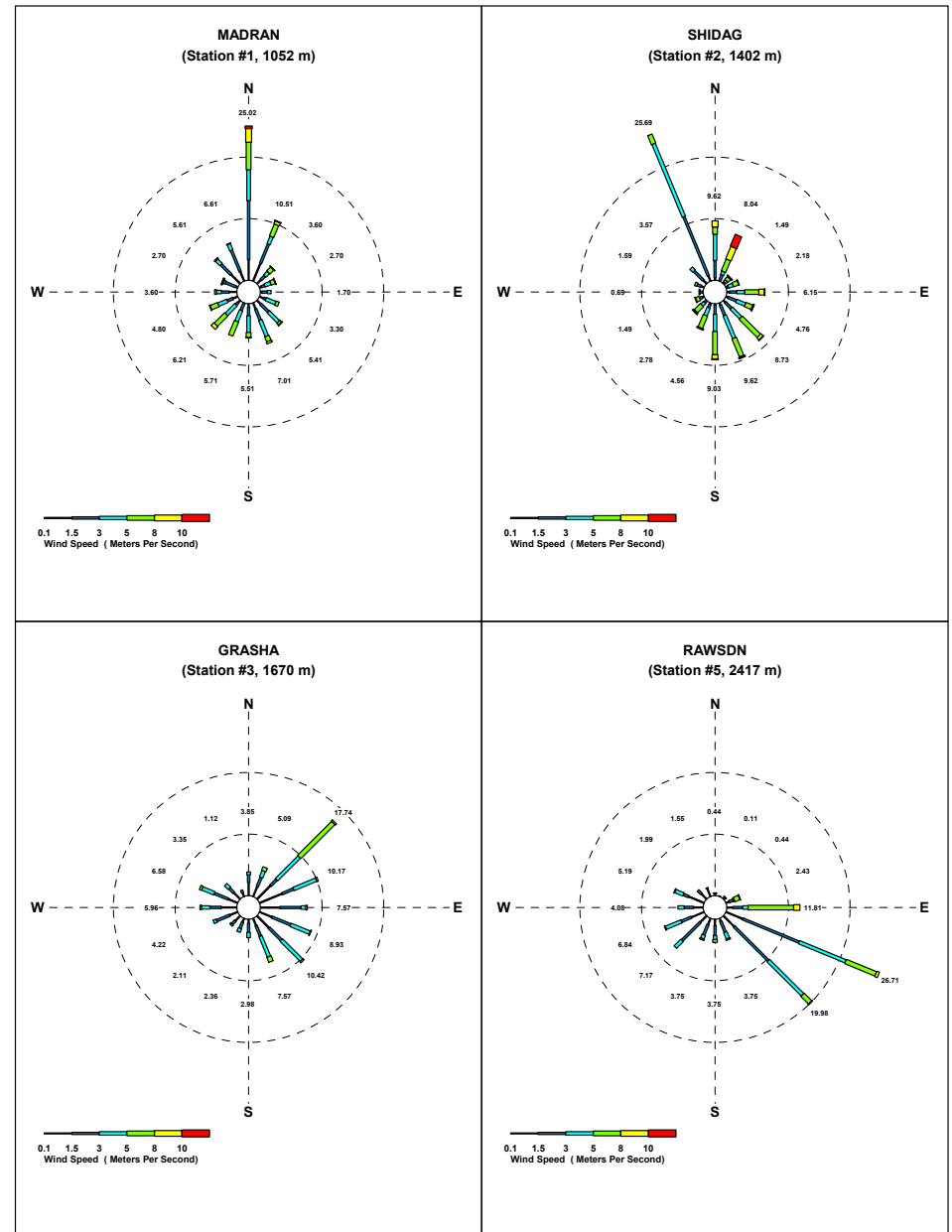
Preliminary Data: Temperature



7-day Wind Climatology

March 30-April 6, 2004

- Complex wind flows across study area
 - MADRAN, SHIDAG, & GRASHA all dominated by drainage flows
 - RAWSDN at top of drainage, but different wind regime
- Important to wildfire and air quality management (wildfire suppression, prescribed burns)



Future Steps

- Continue data collection and site maintenance through Fall 2005(?)
- Development of Java based data mining and visualization tool
- Pursue funding to establish sites for long-term ecological research
 - Upgrade weather stations for real-time data access
 - Establish base funding for field technicians dedicated to site maintenance and data collection
- Develop outreach component



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