The North American Monsoon Experiment (NAME)

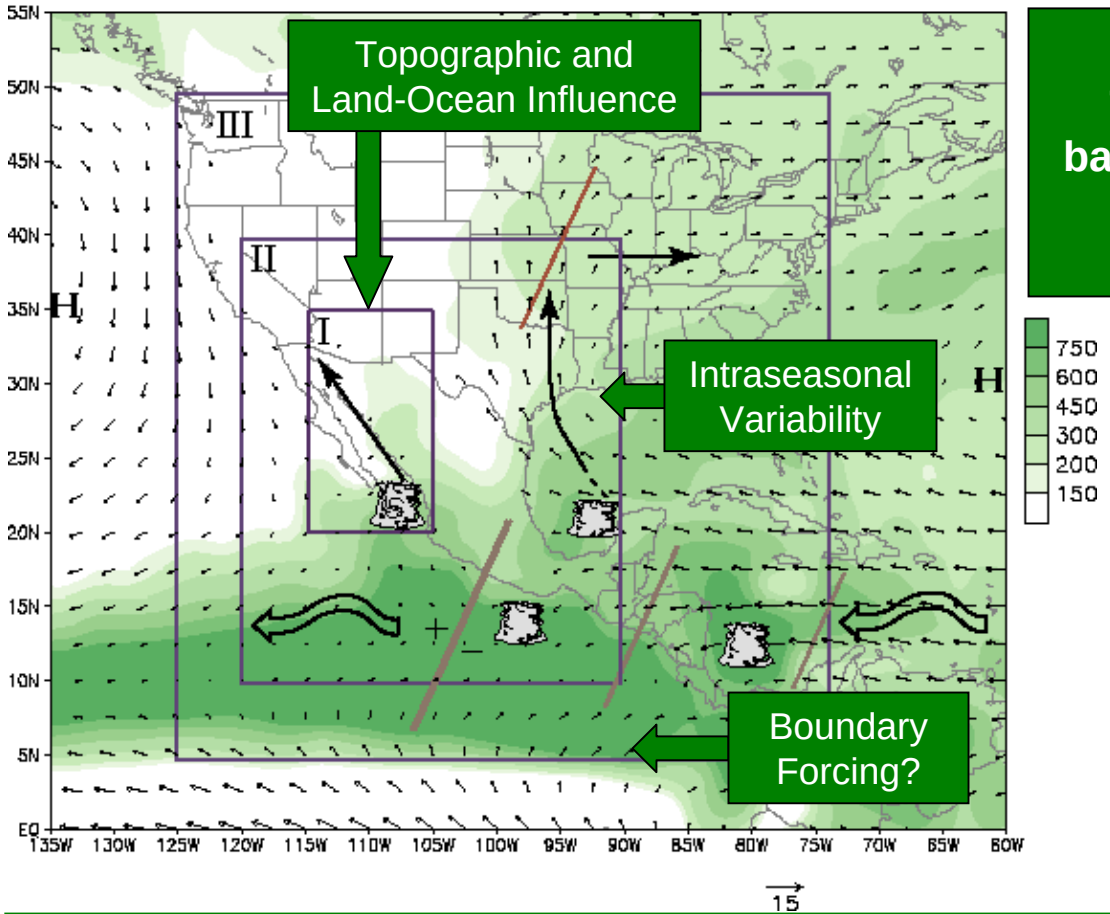
Walt Petersen, UAH/NSSTC

- What is it?
  - Hypothesis and Objectives
  - Programmatic interests
- NAME Field Campaign- Precipitation studies over complex topography
  - Forcing issues unique to the area and TRMM preview to precipitation processes
  - Platforms
- How might NAME benefit NASA missions-
  - GV and Precipitation studies
- NASA assets that would benefit NAME
  - Instrumentation and brain-power

http://www.joss.ucar.edu

NORTH AMERICAN MONSOON EXPERIMENT (NAME)

http://www.joss.ucar.edu/name/



HYPOTHESIS

The NAMS provides a physical basis for determining the degree of predictability of warm season precipitation over the region.

OBJECTIVES:

Better understanding and simulation of:

- **warm season convective processes in complex terrain (TIER I);**
- **intraseasonal variability of the monsoon (TIER II);**
- **response of warm season circulation and precipitation to slowly varying boundary conditions (SST, soil moisture) (TIER III);**
- **monsoon evolution and variability (TIER I, II, III).**

YEAR (2000+)	00	01	02	03	04	05	06	07	08
Planning	----------|								
Preparations			----------|						
Data Collection			- - - ----------IOP|						
Principal Research				----------|				
Data Management			----------|						

PROGRAMMATIC ENDORSEMENTS OF NAME

GEWEX/GAPP CLIVAR/VAMOS

INTERESTS

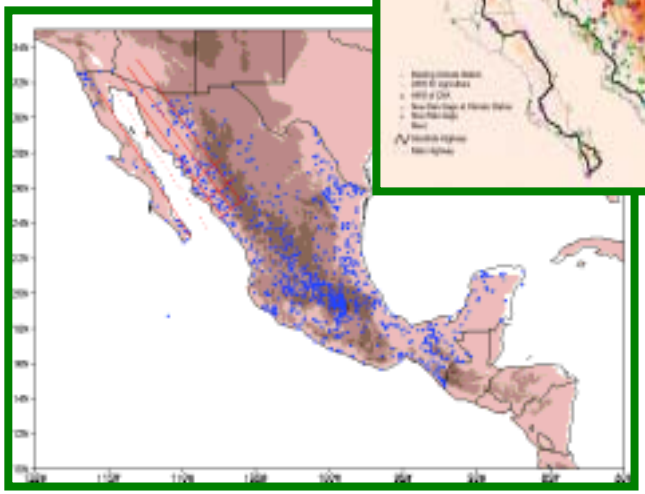
- **High resolution, gauge and merged satellite-gauge precipitation products (e.g. for LDAS, Regional Reanalysis and model validation studies);**
- **Improved understanding of summer orographic precipitation processes.**
- **The role of land in the onset and intensity of the monsoon;**
- **The role of NAMS in the variability of the water budget components over the US and Mexico;**
- **Better understanding and more realistic simulation of the continental-scale NAM and its variability;**
- **Demonstrate observed connections between the leading patterns of climate variability (e.g. ENSO, MJO) and the monsoon are captured in climate models;**
- **To develop partnerships between NAME observationalists and model development experts to improve the representation of key processes in coupled climate models;**
- **To advance the development of the climate observing system in southwestern North America and Central America.**

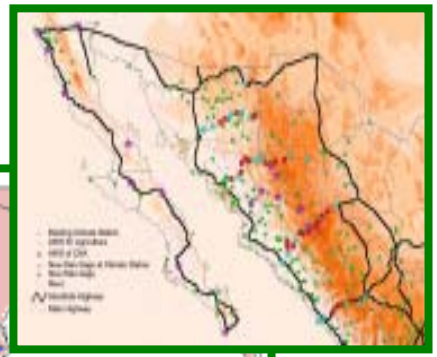
CLIMATE AND PRECIPITATION VARIABILITY

ALL COMPLIMENTARY TO NASA-ESE STRATEGIC GOALS

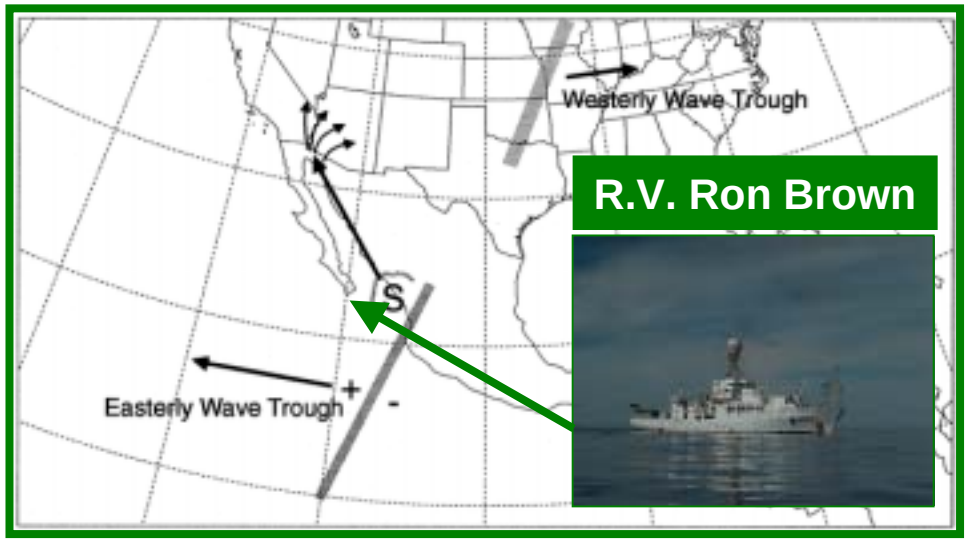
NAME FIELD CAMPAIGN

Enhanced Precipitation Gauge Network



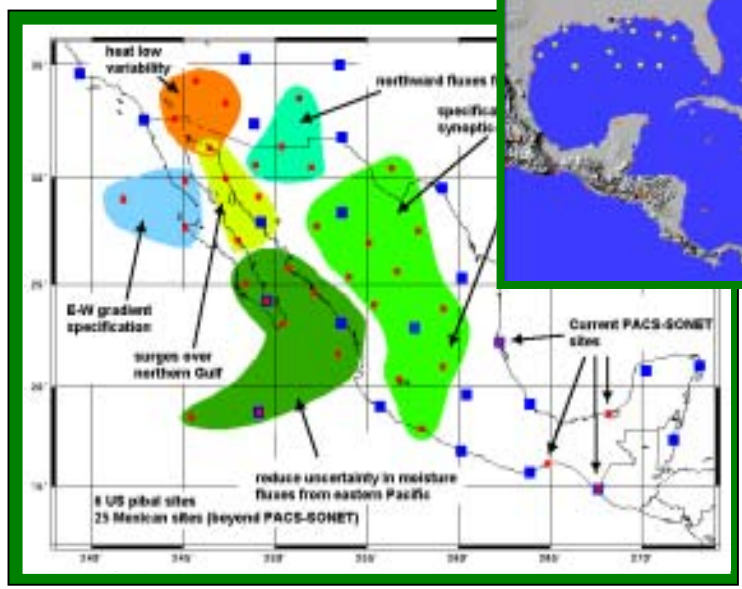


Radar/Profiling/Radiosondes



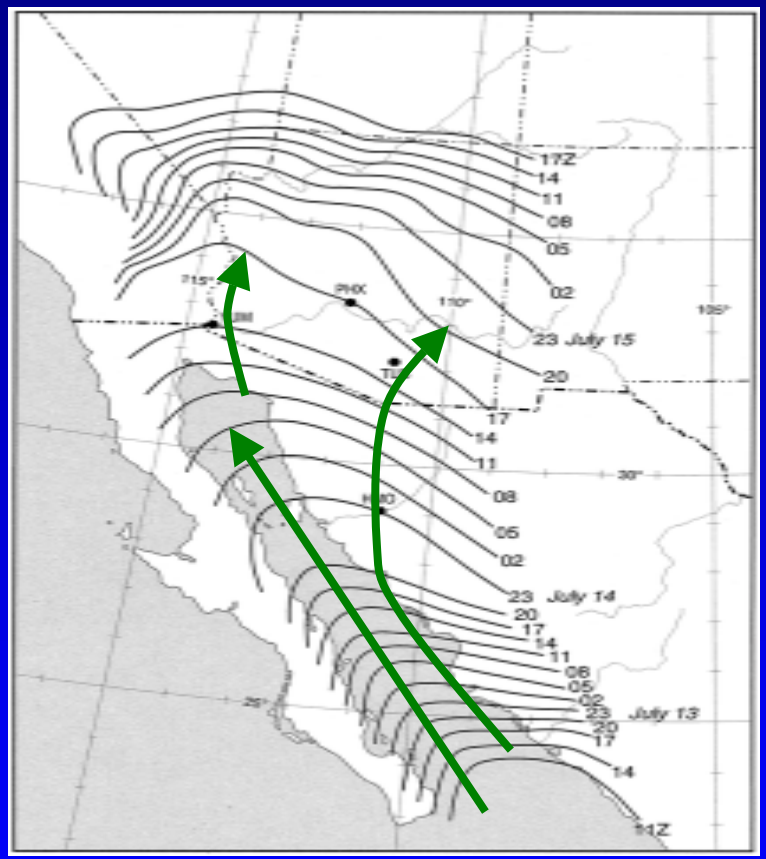
R.V. Ron Brown

Radiosondes/PIBALS

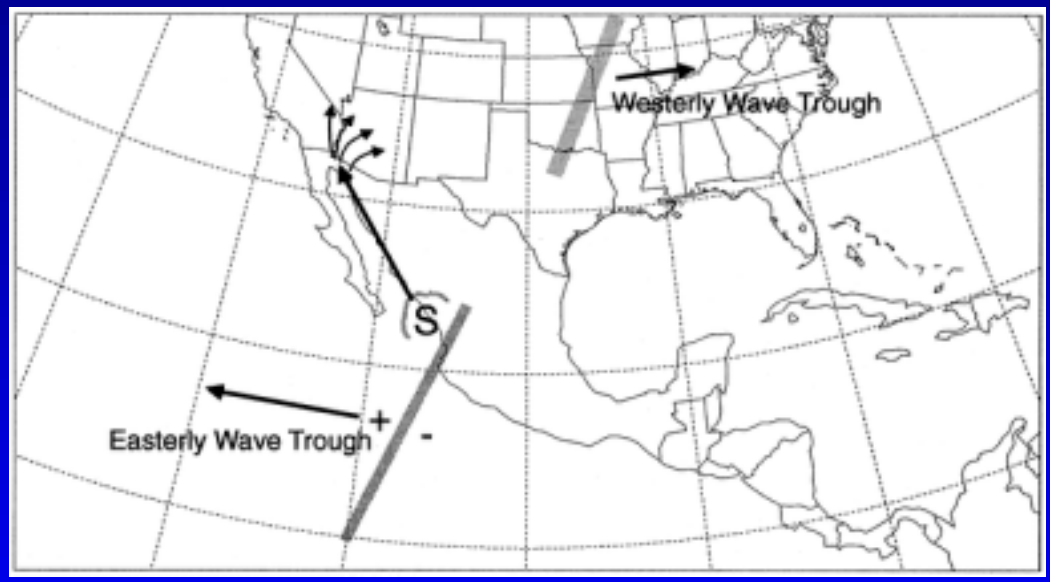


Tier-1 NAMS Meso/Synoptic Scale Interactions with Convection

Gulf Moisture Surges and GC Jet



Trop. E. Waves/Mid-lat interaction



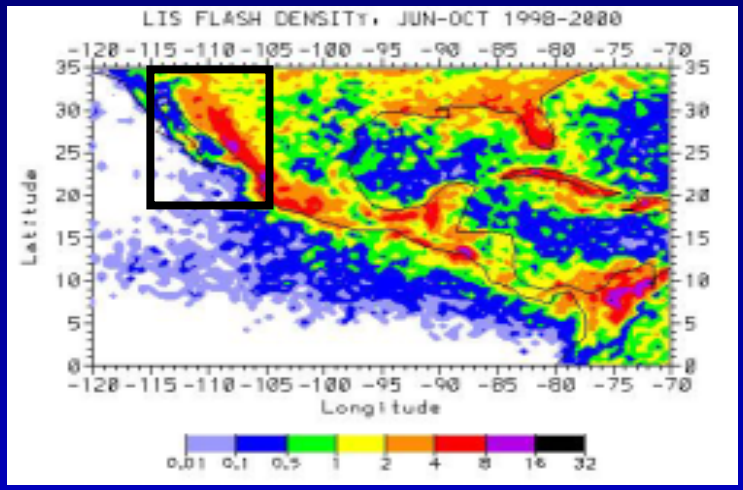
Significant forecast problem

Moisture sources?

Mid-latitude-tropical interaction?

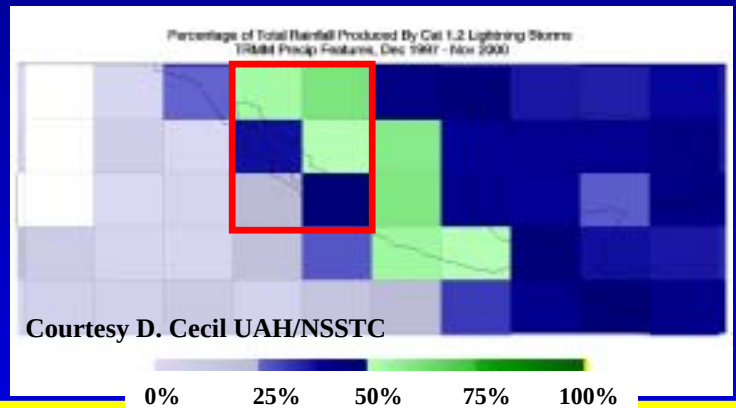
Figures from Fuller and Stensrud (MWR, 2000) and Brenner (MWR, 1974)

Precipitation Processes: A preview from TRMM

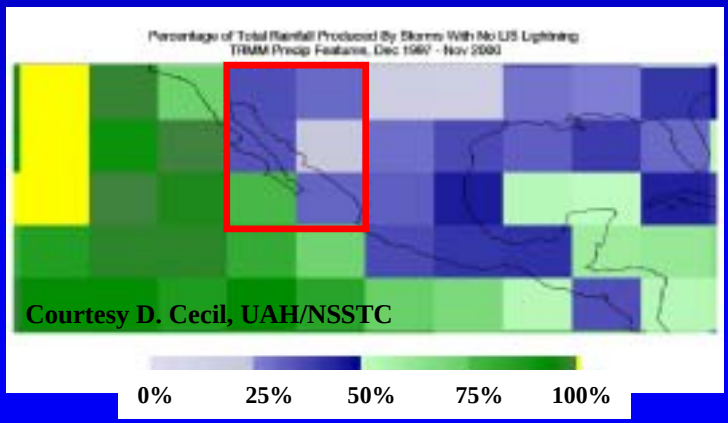


TOPOGRAPHY AND ROBUST ICE PROCESSES

- One of the most electrically active areas in the world



- 50-75 % of Rainfall associated with lightning-producing storms over SMO



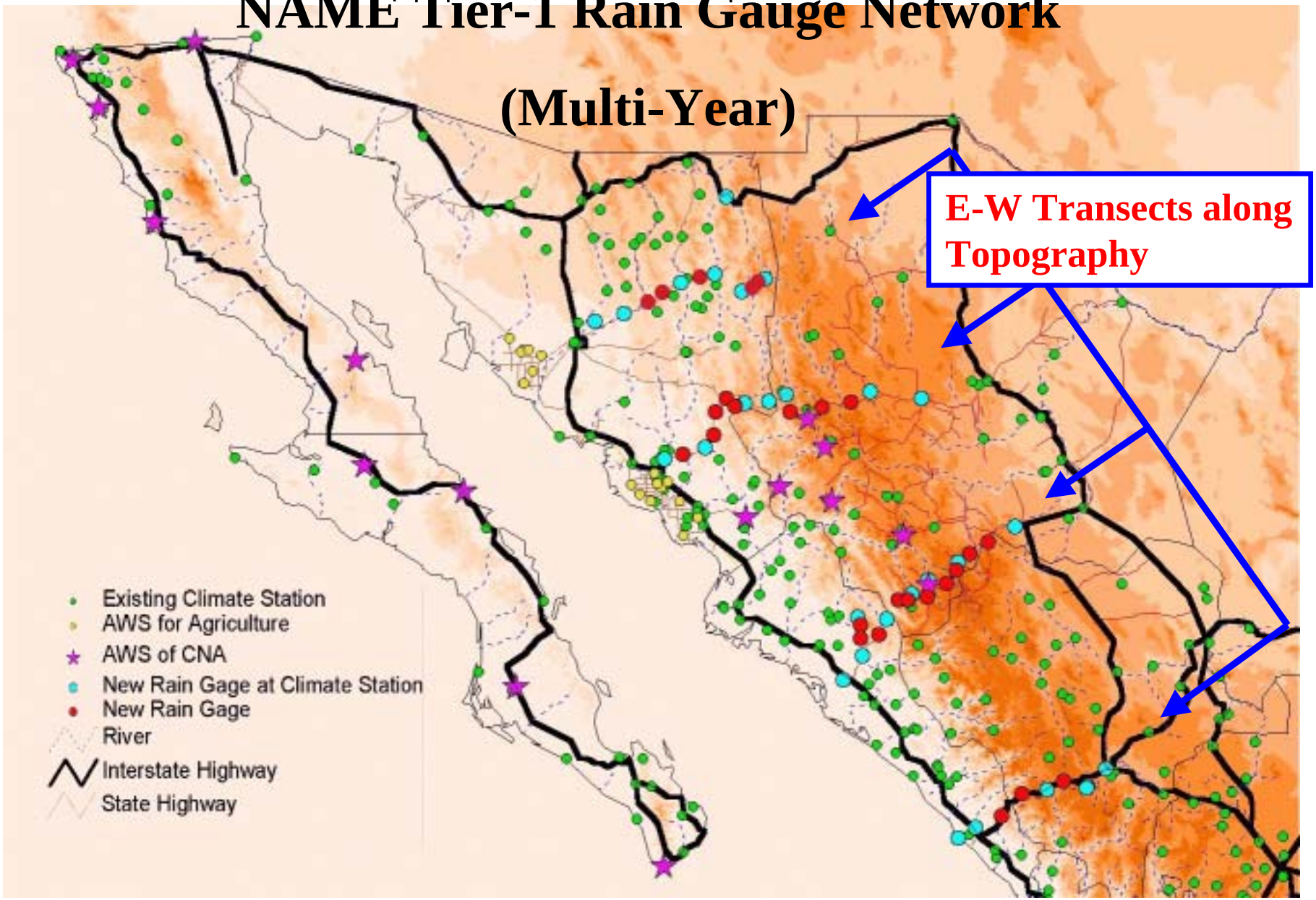
- 28-33 dBZ @ -30ºC; 0.7-2.2 Flashes/min
  - — Comprise 3.3% of sample but 50-75% of the rainfall!!

Rationale for Tier-1 Field Campaign

- **DESCRIBE AND UNDERSTAND:**
  - Diurnal cycle of precipitation in complex terrain
  - 4-D structure of precipitation and precipitation processes
  - Regimes associated with intra-seasonal variability, including the influences of moisture surges and jets
  - Influence of surface fluxes and topographic blocking on convection
- **ALL CRITICAL FOR BUDGET STUDIES AND MODEL VALIDATION**

NAME Tier-1 Rain Gauge Network

(Multi-Year)



Soundings, Radar, Profiler, and Lightning Network: Contributions to NAME Field Campaign

- Statistical description of daily convective rainfall, precipitation processes, forcing mechanisms over Sierra Madre Occidental, east and west slopes, Gulf of California coastal plain, and southern Gulf region.

- Clarify the relationship of convection on east and west slopes of SMO to water vapor transport from the Gulf of Mexico and the Gulf of California.

- Observe the development and propagation of southerly surges and associated low-level jets in the Gulf of California within the broader context of the synoptic scale. Assess influence on/by convection.

- Diagnose heat and moisture budgets and provide regional-scale dataset for CRMs/Regional models

Tier-1 Field Campaign Instruments

UHF wind profilers (some with Radio-Acoustic Sounding System (RASS) capabilities) provide winds through ~ 6 km plus virtual temperature soundings to ~ 2 km. NOAA/AL and ETL.

Virtual Integrated Sounding Systems, VISS (co-located SMN sounding + UHF profiler)

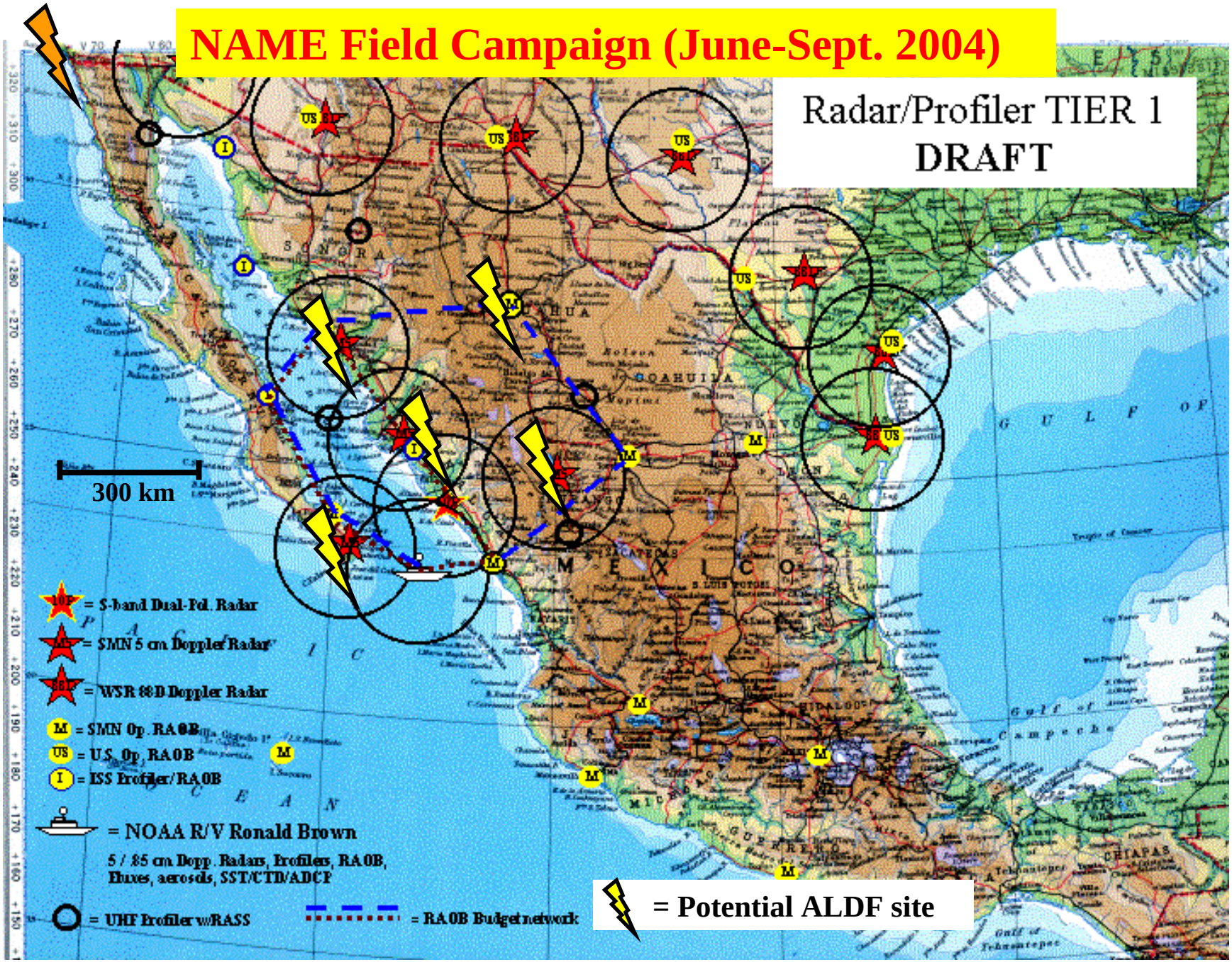
NCAR Integrated Sounding Systems, ISS, (UHF profiler + RASS + rawinsonde); ISS and VISS will provide continuous wind profilesin the low-to-mid troposphere along with full tropospheric thermodynamic and wind soundings.

SMN 5 cm Doppler radars: Upgraded by NOAA/NCAR; Precipitation amount, structure and variability, airflow.

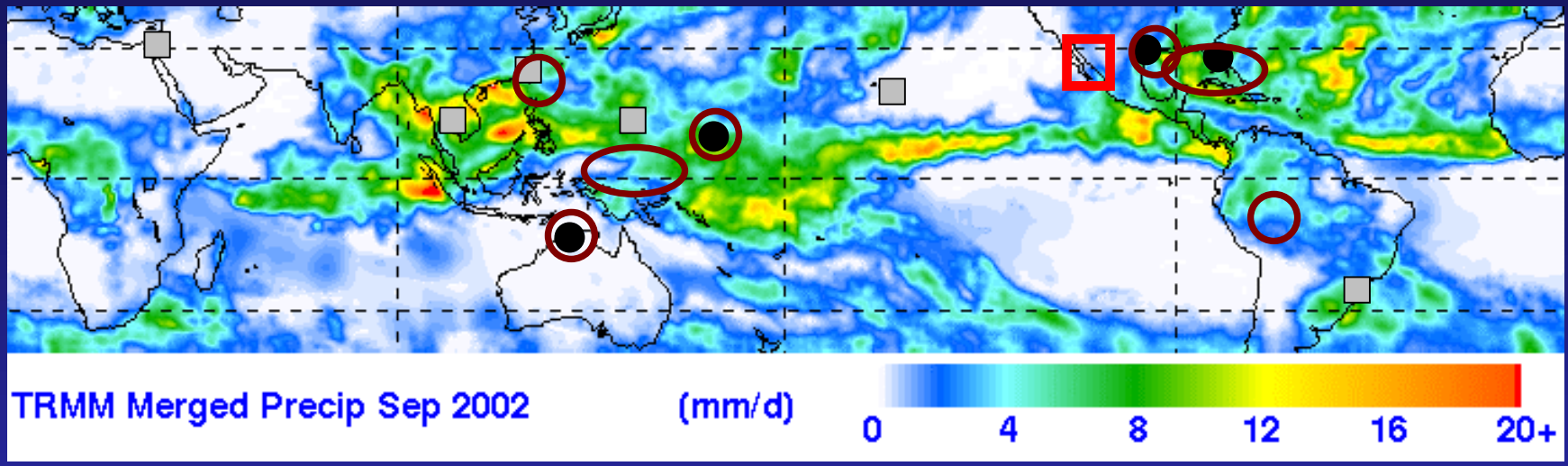
10 cm Doppler-polarimetric radar (NASA N-POL, NCAR S-POL); providing DSDs, accurate rainfall estimates, microphysical structure of convection, airflow patterns

NOAA R/V Ron Brown shipboard platform (UHF profiler, soundings, C and Ka-band Doppler radars, heat fluxes). Ship placed strategically in the entrance to the Gulf of California

NSSTC/MSFC 5-station ALDF lightning network (diurnal cycle of convection; spatial distribution of convection; precipitation processes)


NAME Field Campaign (June-Sept. 2004)
Radar/Profiler TIER 1
DRAFT
300 km
= S-band Dual-Pol. Radar
= SMN 5 cm Doppler Radar
= WSR 88D Doppler Radar
= SMN Op. RAOB
= US Op. RAOB
= ISS Profiler/RAOB
= NOAA R/V Ronald Brown
5 / 10 cm Dopp. Radars, Profilers, RAOB, fluxes, aerosols, SST/CTD/ADCP
= UHF Profiler w/RASS
= RAOB Budget network
= Potential ALDF site

Great Ground Validation and Process Studies!!!!



TRMM GV Data Site

TRMM "Product" site

TRMM Supported/Related Field Campaigns

(Physical Validation)

……But, there is a "Topography Gap"……..

NAME Tier-1

BENEFITS TO NASA

- **GV Over Complex Topography- covers gap in GV for satellite missions (e.g. TRMM and Aqua) enables testing/further devlopment of GV concepts for future missions (e.g., GPM)**
- **Infrastructure**
  - **NOAA-OGP resources: upgrade/maintenance of SMN radars; rain gauge installations; participation of R/V Ron Brown;**
  - **UCAR-JOSS: NAME Project Office (NOAA-OGP) http://www.ucar.joss.edu/name.html**
  - **NCAR: SMN radar engineering, training for SMN radar network, S-pol; ISSs etc.**
  - **UAH/NSSTC/MSFC- 5-station ALDF lightning network**
- **Satellite Ground Truth and Physical Validation; Convection/Precipitation Processes**
  - **Precipitation structure/variability (Doppler/dual-Pol radar, profilers, rain gauges)**
    - **Spatial, temporal variability of rainfall in complex terrain**
    - **Broad area DSDs, 3-D hydrometeor ID and microphysical processes**
  - **Temperature and humidity profiles**
  - **Heat and moisture budgets over nested sounding arrays**
  - **Robust large-scale forcing dataset for CRMs (e.g., GCEM/GPROF) and regional models- key to improving land-based passive microwave rain rate retrievals.**

NASA Assets that could benefit NAME

- **N-pol: S-band dual-polarized radar (precipitation studies). A true "national resource" if problems with antenna can be worked out.**
- **TOGA Radar: C-band Doppler radar (could be placed for dual-Doppler studies and enhanced precip. coverage during IOP).**
- **Aircraft:**
  - **ER-2 (AMPR/EDOP) Precipitation studies over higher orography, tops of deep convection; high altitude dropsonde capability;**
  - **UAV (continuous operation)- high altitude dropsonde capability; Lightning package as in ACES; other payloads?**
- **Additional sounding stations (e.g., expanded coverage for budget studies and real-time data assimilation)**
- **Satellite dataset support (NAME subsets)**
- **Field campaign "know how" and analysis "brain-power"**