Recent Field Exercises: Observations in Support of Operations and Research

Earth System Observation and Analysis

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Introduction

Observations are the lifeblood of both scientific and operational advances

- Field exercises directly answer the Technology and Mission Support Goal of the NOAA Research 5-yr plan: "*Ongoing research is necessary to improve the performance of existing in-situ and surface-based observing systems*."
- Fields exercises provide critical performance tests of existing operational or near-operational observing systems, thus helping fill **the gaps in our observational systems.**
- Scientifically-focused exercises are needed to fill **gaps in our meteorological understanding** (as in examples below).
- Key scientific objectives are weather-relevant phenomena (atmospheric rivers; LLJs; severe weather events; heavy rainfall events.

TEXAQS, NEAQS — 2004, 2006

- Contibute to NOAA 5-yr goal to *provide information to air-quality decision makers*
- ***Key scientific finding: performance of numerical models can be enhanced with prediction of chemical species as in WRF-Chem***
- Observations provide baseline values that help to assess numerical predictions
- Observations have large potential impact on future chemical data assimilation in NWP

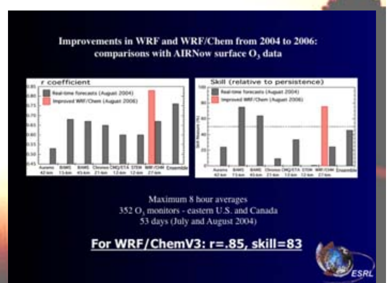

Fig. 1 demonstrates that WRF model predictions improve with chemistry added.

IHOP — 2002

- Operational objective: Determine if better-resolved moisture flux fields for the LLJ in analyzed input fields will improve forecasts of LLJ and QPF
- Science objectives: Fill in **gap in our knowledge of water vapor above the surface** by combining airborne lidar and dropsonde observations with conventional observations
- Collaboration: SPC, NSSL, NCAR; also internationally DLR, MeteoFrance
- ***Key scientific accomplishment: High-resolution LIDAR and droposonde moisture flux observations in LLJ's***

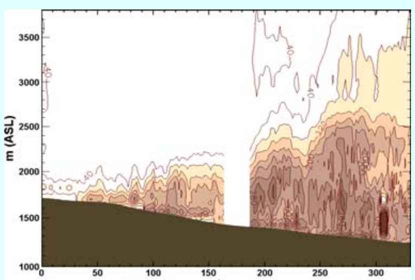

Fig.2. Lidar-based northward horizontal moisture flux (v x q) orthogonal to a vertical LLJ section. Units are $gkg^{-1}ms^{-1}$. Flux contour intervals are 40 $gkg^{-1}ms^{-1}$.

THORPEX-SCATCAT — 2004

- Scientific objective: Provide observations and modeling results to better understand, measure, and predict turbulence
- Key operational objectives: Provide guidance for forecasting upper-level turbulence in regions of frontal convection; and estimate the role of gravity waves for turbulence development in global model forecasts
- ***Key Scientific Result: Gravity wave contribution to turbulence episodes can be predicted by parameterizations in operational models***
- Collaborations: FAA, NCAR, THORPEX
- Impact: FAA has adjusted algorithms that set regulations in response to SCAT-CAT findings

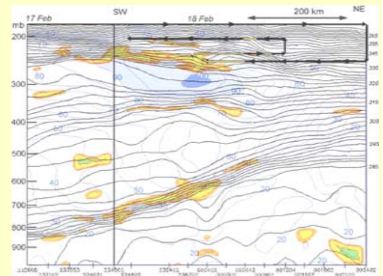

Fig. 3: Dropsonde releases can capture upper-level frontal features related to turbulence events.

Summary and Key Accomplishments

- Field missions have resulted in advances toward the critical NOAA 5-yr goals to *"Investigate and test new technologies to make improved measurements of environmental parameters ……."* and to *"Improve water resources forecasting capabilities".*
- ***In general, exercises have contributed to the solution of long-standing scientific problems: prediction and measurement of low-level moisture; convective initiation; water management in severe terrain; and air quality-weather interactions.***
- **Other field exercises supporting the ESRL mission:**
  - *California Landfalling Jets Experiment (CALJET)*
  - *Global Air-Ocean In-Situ System (GAINS)*
  - *Hydrometeorological Testbed (HMT) American River Basin (ARB) Experiment (HMT-ARB)*
  - *Measurements of Humidity in the Atmosphere and Validation Experiments (MOHAVE)*
  - *Pacific Landfalling Jets Experiment (PACJET)*
  - *Temperature and Air Quality Experiment (TAQ)*
  - *Unmanned Aircraft Systems (UAS) missions*
  - *Weather In-situ Deployment Optimization Method (WISDOM)*

Table of Acronyms

ARM/CART – Atmospheric Radiation and Measurement/ Cloud and Radiation Testbed
DLR – Deutsche Forschungsanstalt für Luft-und Raumfahrt
FAA – Federal Aviation Agency
GPS – Geographic Positioning System
IHOP – International Water (H_2O) Program
LLJ – Low-Level Jet
NCAR – National Center for Atmospheric Research
NEAQS – North East Air Quality Study
NSSL – National Severe Storms Laboratory
QPF – Quantitative Precipitation Forecast
SCATCAT – Severe Clear Air Turbulence Colliding with Aircraft Traffic
SPC – Severe-Weather Prediction Center
TEXAQS – Texas Air Quality Study
THORPEX – The Observing System Research and Predictability Experiment
UAS – Unmanned Aerial System
WRF – Weather Research and Forecast Model