Overview of the 2008
THORPEX Pacific Asian Regional Campaign
(T-PARC)

David Parsons
Sensitivity of Large 72-hr Forecast Errors to Initial Conditions in Two Winters

Shading is the sensitivity calculated using the NOGAPS forecast and adjoint models. Contours are mean 500 mb ht. For January & February

(Courtesy of Rolf Langland, Melvyn Shapiro)
THORPEX Pacific Asian Regional Campaign (T-PARC)

- A field campaign in the summer – early winter of 2008 as part of an increased research focus on Pacific processes/initial conditions and their impact on downstream forecasts

- Initial motivation from Asian and North American Regional Committees with hopes for some significant EU participation

- Asian societal impacts from heavy rainfall, typhoon and extratropical transition (ET) with research interests in:
  - tropical cyclone formation
  - intensification
  - Motion/track
  - decay and/or ET

- North American societal impacts from downstream effects of Asian and Western Pacific high-impact weather with research interests in:
  - tropical and midlatitude predictability
  - tropical cyclones,
  - ET
  - intense extratropical cyclogenesis
THORPEX Pacific Asian Regional Campaign (T-PARC)

General T-PARC Components

- **Tropical** --- advance knowledge and improve prediction of tropical cyclones and related heavy rainfall and the impact of these systems on downstream flow -- Aug -- Sept 2008

- **ET** -- advance understanding and improve prediction of the Extratropical Transition (ET) of tropical cyclones and the impact of ET storms on downstream flow -- Aug -- Sept 2008

- **Winter** -- advance understanding and improved prediction of how the flow characteristics over east Asia, the western and central North Pacific control the regional and downstream occurrence of high impact weather -- Dec 2008 -- Feb 2009

- The tropical and ET components are influenced by vision of WMO/TMRP
T-PARC Experiments and Collaborative Efforts

- Upgraded Russian Radiosonde Network for IPY
- NOAA G-4 and Air Force C-130s
- DLR Falcon
- TIBET Exp
- SCS Exp
- Asian/Indian Monsoon
- Typhoon Landfall
- DOTSTAR
- DriftSonde
- Palau
- Palau
- Air Force CC-130s
Disturbances in the monsoon trough over the western North Pacific
Background/Motivation

Increase in forecast uncertainty over tropical and midlatitude regions often occurs due to tropical cyclones and the movement of tropical cyclones into the midlatitudes

TY Tokage, October 2004
Tracks from the JMA ensemble prediction system

Tracks supplied by Dr. T. Nakazawa
Western WA Flood (Seattle 1-day record)

CA Wild Fires (downslope winds)

BC’s flood of the Century (18.5”)

Region of tropical cyclones
Canadian and Pacific NW Flooding
THORPEX Pacific Asian Regional Campaign (T-PARC)

Tropical facilities and collaborative efforts

- NRL P-3 with ELDORA Doppler radar and dropsondes
- Chinese dropsonde aircraft and other measurements in vicinity of South China Sea
- DOTSTAR targeting aircraft
- Japanese and Korean contributions
- Driftsonde from Hawaii
- Tibetan sounding network
- Real-time TIGGE and NAEFS, satellite capability
- Possibly AF C-130s
Typhoon Tokage, After Killing Almost 100 People, is Worst in Japan in 25 Years; Japan’s 10 Typhoons in 2004 are Record for Worst Ever (Oct. 2004)

Tokyo, Japan (HDW) October 23, 2004 - Typhoon Tokage ravaged Kyoto and Tokyo on Japan’s main islands, potentially killing almost 100 people. This typhoon is reported to be the worst since 1979, making it the worst in a generation. Japan has suffered through 10 typhoons this year, which makes this the worst typhoon season by far in Japan’s history. The 2004 season has also been the worst hurricane season on record for the State of Florida within the United States, and the worst typhoon season for the country of China within Asia. Researchers are still trying to determine exactly what made this one of the worst seasons globally for cyclone activity. The picture above, taken by a NASA satellite, shows Typhoon Tokage devastating the Japanese main islands. Typhoon Tokage was originally expected to weaken, according to the Joint Typhoon Warning Center (JWTC), as it tracked into cooler sea surface temperatures and sucked drier air into itself, but the storm maintained much of its strength as it moved through the ancient Japanese capital of Kyoto, and the modern Japanese capital of Tokyo. This typhoon was originally expected to lose power and spare major Japanese cities from the calamities of other typhoons that have hit Japan in this worst of Japanese typhoon seasons. Typhoon Tokage, however, caused great flooding and heavy rains, and many people are still missing. (http://www.hdweather.com/typhoon/typhoon_361.htm)

Total Damages in public infrastructure (agriculture, Road, etc) by Typhoon and Heavy Rainfall in Japan this year are US $10 billion.

Typhoon Tokage insurance claims are estimated at 88.5 billion Yen ($839 million).

U. S. projects nationwide hurricane damages in 2004 at $850 million.
ETs are Common in the T-PARC Region With Decreased Hemispheric Predictability

Forecast Skill Bifurcation

From Jones et al., 2003: Wea. And Forecasting
A “plume” of increased std. dev. In the GFS ensemble prediction system propagates downstream of the extratropical transition forecast position.
Reduction of forecast error - 500 hPa

Mean reduction over Europe, averaged over 29 forecasts (2 weeks)
black: experiments with lidar, gray: experiment with 100 dropsondes
THORPEX Pacific Asian Regional Campaign (T-PARC)

ET facilities and collaborative efforts

- NRL P-3 with ELDORA Doppler radar and dropsondes
- DLR Falcon with Doppler lidar, water vapor lidar and dropsondes
- Japanese and Korean contributions
- Tibetan and Russian sounding networks
- Real-time TIGGE and NAEFS; satellite capabilities
- Relevant tropical measurements
Errors and Forecast Sensitivity

Figures provided by Matsutani (NCEP), and Reynolds (NRL)
Explosively Deepening Cyclone

Formation:
Over the Land and Ocean

Maximum Deepening:
Higher Latitude than 35° N in Latitude
Over the Ocean

October 1994 – March 1999
Total: 224 cases

Courtesy of Yoshio Asuma (Hokkaido University)
High Impact Weather Predictions on the West Coast of North America: Of the forecast failures associated with lows, what are the central pressure and cyclone position errors?

Ave SLP error = 3.4 mb  
SD = 8.7 mb  
Absolute error = 7.5 mb

Ave position error = 453.8 km  
SD = 260 km
Expected forecast error reduction in verification region (VR) due to adaptive observations around any grid point.

NCEP/UM ENKF based on 111-member 2007012800 COMBINED ensemble. Best flight tracks: 28 19 35
Winter Facilities

- NOAA G-4 with dropsondes over the western Pacific
- Enhanced Russian and Tibetan radiosonde networks
- US Air Force C-130s from the Operational Hurricane Hunters over the central Pacific
- NOAA P-3 in eastern Pacific
- 1 flight ALTAR (UAV)
- Possible other aircraft
- Real-time TIGGE, NAEFS and satellite capabilities
Proposing Institutions

North America
- **US Research Institutions**: NCAR, NOAA/NCEP, NOAA/NWS, Naval Research Lab, NASA/Goddard
- **Mexico**: Various
- **Canadian**: U McGill, MSC and Others

Asia
- **China**: Chinese Academy of Meteorological Sciences, Chinese Meteorological Administration plus members of the Academic Community in China
- **Japan**: Japan Meteorological Agency, Japan Marine Science and Technology Center (JAMSTEC), Kyoto U, Nagoya U, Tohoku U, Tsukuba U, U of Tokyo
- **Korea**: Potential participants might be from Korean Meteorological Administration, Cheju National U, Ehwa Womans U, Kongju National U, Kyungpook National U, Seoul National U, Yonsei
- **Vietn Nam**: Hanoi School of Public Health, others?
- Collaboration with an expanded DOTSTAR program

Europe
- **Germany**: U of Karlsruhe, Institut für Physik der Atmosphäre, DLR
- **Met Centers through TIGGE** -- (ECMWF, Meteo France, Met Office, etc)
- **EUCOS**
- **Academic community**

Also US-Russian cooperation on extra Russian soundings is being investigated
Challenges and Status

US weather agencies have an approved straw-plan for significant US participation in all components of T-PARC, but proposals by individual investigators have not yet been approved (Due in April).

Challenges:

Integration of national efforts into a coherent international program (is there a need for international steering and science committees under THORPEX or WWRP?)

Integration of exciting new efforts into T-PARC (monsoon, societal aspects, etc) and links to collaborative efforts that are not part of the experiment

Moving from a science concept to an experimental plan (likely not the last planning meeting), ops center, archives to be designed

Tests will start in 2007, do we want special data saved, dry runs etc