T-PARC/TCS-08 Project Summary

Highlights, Accomplishments and Lessons Learned

Jim Moore and EOL staff
Many slides courtesy Pat Harr (NPS) and NPS Staff

T-PARC Summary Debriefing
9 December 2008
• August-September 2008 (plus 1 week extension)

• 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

• Downstream effects of Asian and Western Pacific high-impact weather on North America, Europe with research interests in
  • tropical and midlatitude predictability
  • tropical cyclones
    – Recurvature
    – Extra-tropical transition
  • intense extratropical cyclogenesis

• International Collaborators: U.S. (NSF, ONR), Germany, Japan, China, South Korea, Canada, France, U.K., Taiwan, ECMWF
Summary
T-PARC and collaborating projects constitute a GLOBAL OPERATION

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- Operations center, Monterey, CA
- Driftsonde center, Driftsonde release, Hawaii
- Aircraft locations, and aircraft operations centers
  - Guam
  - Okinawa, Japan
  - Taiwan
- 9 time zones across international dateline,
  3 countries (EOL operations only)
T-PARC/TCS-08 Typhoons

TY Nuri

TY Sinlaku

TY Hagiput

STy Jangmi
Operations by the numbers...

- **9 participating nations**
  - Canada, China, England, France, Germany, Japan, South Korea, Taiwan, United States

- **Over 500 aircraft mission flight hours**
  - 216 C-130, 179 P-3, 83 Falcon, 37 DOTSTAR

- **76 missions**
  - 25 Falcon, 23 C-130, 21 P-3, 7 DOTSTAR

- **7 airfields**
  - Andersen AB, Guam; NAF Atsugi, Japan; Kadena AB, Japan; Taichung Taiwan, Yokota AB, Japan; MCAS Iwakuni, Japan; Misawa AB, Japan

- **11 tropical circulation systems**
  - 4 typhoons, 1 TD, 1 ex-TS, 5 others

- **Over 1500 dropsondes and driftsondes released**
Tropical Circulation Systems by the numbers...

- During August – September, there were 12 total systems > TD intensity over the western North Pacific
  - 4 typhoons, 4 tropical storms, 4 TDs
- 51 TCS systems
  - With a few recycled a time or two
- 11 systems in which aircraft missions were flown
  - 4 typhoons, 1 TD, 1 ex-TS, 5 others
- 72% of all missions were flown on the 4 typhoon cases
  - 6 Nuri, 28 Sinlaku, 5 Hagiput, 15 Jangmi (54/75 = 72%)
Primary source of all products used during the field Campaign: observations (satellite, aircraft, etc.), NWP products.
Quickscat satellite derived winds overlay on MTSAT IR
26 Sept 08, 2152 UTC
TCS-08
Third flight into the Pre-TY Nuri (13W) tropical disturbance

18 August 2008

NRL P-3 flight track
WC-130J flight track
planned WC-130 flight track

Screen capture of real-time display during aircraft operations

Area of ELDORA radar coverage in the next slide
Circulation center

Potential initial eyewall formation

Typhoon Nuri 18 August 2008 (0142 - 0205 UTC)

Preliminary ELDORA Dual-Doppler Reflectivity (color, dBZ), wind vectors, and track (thick black)

From Michael Bell and Wen-Chau Lee, NCAR/EOL
NRL P-3 ELDORA operations in vicinity of STY Jangmi
27 Sept 08, 0400 UTC
From Michael Bell and Wen-Chau Lee, NCAR/EOL
TYSinlaku T-PARC/TCS-08 aircraft sampling strategy including forward deployment (9-21 Sept 2008)
3 plane ET mission (Slnaku) 17.09.08 ~05 UTC

Imagery from NRL and CIMSS
Falcon track from DLR flight facility
3 plane ET mission (Sinlaku) 18.09.08 ~ 05 UTC

Imagery from NRL and CIMSS
Falcon track from DLR flight facility
3 plane ET mission (Snlaku) 19.09.08 ~ 05 UTC

Imagery from NRL and CIMSS
Falcon track from DLR flight
Driftsonde Balloon track on Google Earth
23 Sept 08 0000UTC
T-PARC Driftsonde Soundings

Soundings from the lower Stratosphere

Temperature versus Altitude (4 drops) from 30km!

- Nominal Driftsonde Drop altitude
- Nominal Falcon and DOTSTAR drop altitudes
- Nominal C-130 Drop altitude
- Nominal P-3 Drop altitude
NRL P-3 Missions per Objective

- TC Structure, 5, 24%
- Extratropical Transition, 4, 19%
- TC Formation - Survey, 9, 43%
- TC Formation 3, 14%
DLR FALCON Missions per Objective

- Extratropical Transition, 10, 40%
- Tropical Water Vapor Export, 2, 8%
- General Targeting, 5.5, 22%
- TC Targeting, 7.5, 30%
Dropsondes:

- **WC-130**
  - 604 total
  - 564 good
  - AXBTs
    - 229 total
    - 191 good
- **NRL P-3**
  - 489 total
- **DLR FALCON**
  - 338 total
- **DOTSTAR**
  - 162 total
- **TOTAL:**
  - 1593 dropped (subject to QC)
Data from all aircraft and driftsonde transmitted to operational weather centers.
Preliminary Summary of Driftsonde Operations

• 13 Gondolas flown (38x13 = 494 sondes)
• 34 sondes ejected at launch
• 66 sondes not attempted to drop
• 394 sondes available to drop

• Good Drops: 252 64% (of 394)
• Failed to release: 117 29.7% (of 394)
• Questionable data: 26 6.6% (of 394)

Slide by Terry Hock, NCAR
Driftsonde Balloons 1 - 9

Driftsonde Balloons 10 - 16

Reduced westward distance in time
Driftsonde Flight Durations

T-PARC Driftsonde Flight Schedule

- Date: 8/15 to 10/2
- Flight #1 to Flight #16
- Flight Hours:
  - Total Flight Hours of all Balloons: 518 Hrs
  - Good Flights: 13
  - Good Sondes Dropped: 253

Slides by Terry Hock, NCAR
T-PARC TCS-08 Project Firsts

• **First operation of WC-130Js at 31,000 ft altitude except when penetrating a mature TC**
  – Dropped sondes and AXBTs from high altitude
  – Timed with passage of polar-orbiting satellites for satellite intensity validation

• **First systematic targeting operation in the WPAC**
  – Comparison of several methods from a variety of operational and research organizations
  – Multiple aircraft
  – ECMWF/UKMO Data Targeting System

• **First four plane operation in a WPAC TC**

• **First buoy drop in front of a WPAC TC**
  – Two TCs
  – First time a category 5 TC passed over buoys dropped in its path

• **First systematic observations of full extratropical transition process**
  – Multiple aircraft and land-based radar
  – Timed with satellite overpass
EOL T-PARC Firsts (A Truly Team Effort)

• EOL support in a global project setting across the Pacific Rim
  • Operations center in Monterey (FPS, CDS)
  • Drifsonde launch facility in Hawaii (ISF, DFS, CDS)
  • Aircraft coordination center in Guam (RSF, ISF, CDS, RAF, FPS)
  • Forward deployment of aircraft in Japan (5 Facilities)

• Successful relay of NRL dropsondes to the ground and onto GTS in near real time (ISF, CDS, RAF)
• Sampling of typhoons with ELDORA (RSF, TDF, RAF, CDS)
• Coordinated measurements with NRL and USAF 53rd Weather Wing (5 Facilities)
• Upgraded communications and data products allowed NRL independent sampling of 4 typhoons (RSF, RAF, CDS, FPS)
EOL T-PARC Firsts (A Truly Team Effort)
(continued)

- EOL/CNES driftsonde deployment in the west Pacific (ISF, DFS, CDS)
- Autonomous Driftsonde Facility Operations via web/satellite in quasi-real time) (CDS, ISF)
  - Designed for PI & student operators
  - “Control” release of sondes
  - Engineering data for system status/health monitoring
  - Tracking data display for scientific and ATC use
  - Sounding database on the web
  - Status of sending data to GTS & QC’ed data

- First EOL Project portrayed on YouTube (T-PARC cast)
Military Interactions

- EOL dependent on NRL and USAF staff to make arrangements; wouldn’t have succeeded without NRL, USAF and NPS involvement
- Excellent NRL flight support and local interactions
- Consider military liaison dedicated to project (e.g. Vance liaison in IHOP) when operating out of military bases
- More formal agreements with military ahead of time to avoid different interpretation of rules
- Involvement of NRL pilot(s) in planning activities ahead of campaign for consistency;
- Joint NRL/EOL risk assessment
- NP4 training in WA preferable to other locations; medical clearances slow
T-PARC Lessons and Considerations to Improve EOL Field Project Support

Staffing Support
- TiMREX & T-PARC series impacted preparations; added to staff fatigue in the field;
- Need to better monitor/adjust/react to changes in staffing needs and requirements
- Re-assess crew duty guidelines for non-NCAR operated aircraft based on job category, safety, day vs night time operations, number of flight hours per week etc.
- Standardize overtime and time in the field across facilities
- Consider how to better evaluate and assess staff fatigue
- More training opportunities for new/unfamiliar staff (test flights before and during project)
EOL Project Manager Duties and Responsibilities

- Better define responsibility & authority of PM in multi-facility deployment; similar to RAF PM role?
- Add level of supervision/accountability for staff in the field (coordinated with supervisors/facility managers)
- Need more flexibility reg. on-site staff tasking as need arises
- Define on-site coordination with PI and NRL crew early in process
- Significant (perceived and real) pressure on EOL crew to fly after weeks of no weather, instrument problems etc
T-PARC Lessons and Considerations
Additional EOL Discussions

Communications/Interactions

- Planning meetings ARE open to all EOL staff; minutes with action items posted to project website
- Disconnect between information in feasibilities/Ops Plan/EOL Project Book – revisit project with all parties (incl. PIs) involved shortly before field phase
- EOL to consider Elluminate-like communications tool (VOC)
T-PARC Lessons and Considerations to Improve EOL Field Project Support

NRL P3 and Instrumentation

- Revisit facility preparation timelines and support
- ELDORA excellent but complex system; suffered from shortage of essential staff during preparations and infield support
- Consider ELDORA ground test facility
- RAF instrumentation (ADS, in situ sensors) require upgrades
- Satellite communications worked well, increased bandwidth essential for TPARC
- Balance payload with need for operator seats
- Remote facility/instrumentation access; web interface software for facilities (e.g. driftsondes)
T-PARC Lessons and Considerations
Additional EOL Discussions

Operating in a global environment
- Flexibility in staff travel options during campaigns (open TAs, exception to travel policy, “big pocket book for PM”)
- International calling plans and cell phones for everybody in the field (incl. email access?)
- 24/7 contact/assignments during ops in different time zones essential.

Data
- EOL support for real-time data to the GTS
- Field catalog implementation was excellent
T-PARC Lessons and Considerations
Additional EOL Discussions

Logistics

- Access to base “relatively” smooth for a military installation
- Hotel arrangements fine
- Car rental (if not Hertz) requires UCAR contract involvement; oversight in planning
- Ops Center in Guam “underutilized” especially during daily planning meetings; consider mtg room at hotel in future
- CNES logistical arrangements insufficient
- Consider ways to increase travel flexibility during field deployments
TPARC Debriefing

Comments and Questions