Fourth Capacity Building Workshop of the WMO/IOC Data Buoy Cooperation Panel (DBCP) for the North Pacific Ocean and Its Marginal Seas (NPOMS-4)

Application of Regional Ocean Observations for Increasing Society’s Understanding and Forecasting of Typhoons

www.jcomm.info/NPOMS-4
Action Requests

• Please Submit Your Presentations for Posting on NPOMS-4 Website
• Please Send at Least One Workshop Recommendation to Today’s Rapporteur Etienne Charpentier
• Please make sure Host has your name, affiliation and email address
• Other Items?
Draft Workshop Recommendations

• Workshop participants and Members/Member States of the NPOMS region are invited to participate in the DBCP activities, establish partnerships, and build on potential synergies (sharing observing platforms and instruments, deployment opportunities, training opportunities). The Technical Coordinator Champika (cgallage@jcommops.org) is acting as a focal point between all actors involved in buoy activities, and can provide technical assistance and support upon request.

• Efforts should be made in the region to augment the 973 metocean observing array (of China) with contributions from other countries, and to share the data in real-time (incl. 973 array data). Particularly important variables to measure are SLP and upper ocean heat content. Additional variables to measure include air relative humidity, sub-surface currents, and waves.

• Members in the NPOMS region to make use of (i) the DBCP barometer upgrade scheme and (ii) the DBCP-VOS drifter donation programme (drifter with SLP reporting from the deck of a ship) (the Technical Coordinator of the DBCP can provide technical assistance on how to benefit or participate).
Draft Workshop Recommendations (continued)

• NPOMS supports the DBCP efforts to make wave observations from drifters.

• NPOMS recognizes the importance of training on metocean observations requirements and metocean observing systems implementation, and supports the establishment of the NPOMS training centre at the Busan National University, Republic of Korea.

• NPOMS support the development of TPOS-2020 project, and is inviting it to take into account the observational user requirements for typhoon prediction.
Day 2 Report

Tetsuya Takemi
Disaster Prevention Research Institute, Kyoto University

7 talks in the morning, 4 talks in the afternoon
• Tetsuya Takemi (Kyoto Univ): Numerical modeling of tropical cyclones
  • Regional meteorological simulations of tropical cyclones in the Pacific region
    • Typhoon Haiyan (2013): Storm surge estimation, climate change effects
    • Cyclone Pam (2015): Assessment of wind and high wave in the Pacific islands
    • Typhoon Vera (1959): Look back on the past extreme events from long-term reanalysis data
  • Past extreme events as a worst-case scenario for natural hazard assessment

• Gerry Giliant Salamera (LIPI): Indonesia report
  • Roles of Banda Sea to air-sea interaction over Indonesia with the involvement of Indonesian Through Flow (ITF)
    • Upwelling strength: depending on ENSO phase
    • Rises ocean heat uptake: monsoonal wind-induced upwelling + ITF
    • Tropical depression
    • Determining outflow discharge of ITF to Indian Ocean
  • Absence of an adequate ocean observing system in Indonesian water
    • LIPI’s role in the ocean observation: Planned ocean observing system for upwelling
• Etienne Charpentier (WMO): Barometer drifter updates
  • Sea level pressure: essential climate variable (ECV); cannot be observed from space
    • as ECV in requirements for climate monitoring (GCOS)
    • One of the important parameters for surface measurements in Statement of Guidance for Ocean (SoG) applications
    • Required for NWP
  • DBCP Pilot Project on the impact of SLP from drifters on NWP
    • Assessment of the impacts of SLP buoy data on global NWP
  • Available technologies for measuring SLP
    • Space observations: surface wind $\rightarrow$ pressure field estimation; but not
    • Moored buoys: coastal & tropical regions; limited coverage
    • SVPB Lagrangian drifter: air pressure, SST measurements
      • Requires network approach with concerted deployment strategy
      • Requires cost-effective evolution: WMO programs and co-sponsored programs
• Sidney Thurston (NOAA): WMO/IOC Partnership for New GEOSS Applications (PANGEA)
  • PANGEA: A JCOMM Initiative to build resource sharing partnerships
  • Observe long-term trend of climate/ocean variables
    • Interactions: observations – climate prediction models – forecasts & analyses – Users
    • Global collaboration required → PANGEA concept
  • Significant progress in ocean observations in the past decade
    • Moored buoy array: Pacific, Atlantic, Indian Ocean
    • Enhance western Indian Ocean drifter array
    • Argo floats
  • NOAA’s efforts with India, Indonesia through PANGEA partnerships
    • Implementation of observing systems
    • Capacity building: workshops, Scholarships for PhD programs in US universities
  • Training center in Busan for NPOMS region
• Travis Miles (Rutgers): Observations of Hurricane Sandy from a glider mounted current profiler
  • East Coast ocean observations
    • Glider observations of sediment resuspension in hurricanes wakes
      • Well mixed in the water column
      • Ocean temperature decrease after the hurricane passage --Shear driven mixing
    • Rapid deployment of Glider in response to Hurricane Sandy on Oct 25th, 2012
      • Vertical mixing in the water column and ocean temperature decrease during the hurricane was clearly observed
      • Onshore forcing on the NYC coast
      • Diagnosis of shear mixing with bulk Richardson number
        • Before: Stable water column
        • After: Unstable
    • Storm glider deployment
• Joseph Cione (NOAA): Coupled air-sea observations in Hurricane Edouard (2014)
  • Observe upper ocean’s response to a hurricane, provide a comprehensive data for evaluating high-resolution coupled air-sea models
    • Aircraft, Global Hawk, Coyote; AXBT, AXCTD, AXCP, GPS SST, glider
  • SST: cooling by 3—3.5 degC along the hurricane track
  • Mixed layer: mixed-layer depth deepend after the hurricane
  • Under storm-induced cooling
    • 2 degC decrease around the TC center
    • 10-m air temp & humidity: asymmetric decrease of temp and increase of humidity around the TC center – Significant feature in the southwestern quadrant of TC core
    • SH & LH are higher in the southwestern quadrant, far from the TC center ➔ trigger for secondary eyewall?
  • Air-sea thermodynamic fields from buoys in 1975-2007
    • Strong baroclinic influences
    • Kinematic forcing in not co-located with thermodynamic forcing
    • Asymmetric temp & humidity structure around the TC core
• I I Lin (NTU): Damper in the El Nino – Typhoon relationships
  • Gaia hypothesis: Self-regulating ability to prevent things from going astray
  • El Nino impact on TC in WNP:
    • Longer distance/time over ocean – positive process
    • Reduction in heat content in western tropical Pacific; Upper ocean heat content drops
      • Typhoon-induced ocean cooling enhances and reduce flux – negative process
    • Typhoon intensity is higher (but not overly higher) during El Nino
    • Positive process is offset by negative process to control TC intensity from out of control
  • Tropical cyclone destructiveness (PDI: power dissipation index)
    • PDI decreases despite strong ocean warming in the past 20 years
    • Though ocean condition is even better, atmospheric condition is worsen.
      • Subtropical Pacific High strengthens – intensify shear, reduce vorticity supply
      • Negative impact from atmospheric side overpowers positive impact from ocean side
    • Reduction in PDI under global warming
• Luca Centurioni (Scripps): Targeted in-situ tropical cyclone observations from air-deployed drifters
  • HFIP
    • Improve model’s physics and resolution
    • Improve high-resolution data assimilation technology
    • Enhance observational strategy
  • Global Drifter Program maintains hurricane drifter array
    • Air pressure, SST, turbulence, ocean profiling
  • Operational deployment: Hurricane Isaac (2012)
    • Real-time data acquisition through GTS: SST decrease before hurricane
  • Typhoon Fanapi; ITOP
    • Drifters deployment along the TC track
      • Observe cold wake formation, near-inertial current
  • Development of compact ADOS
    • Smaller size in the new configuration, deployable with smaller aircrafts
    • Air pressure, sonic anemometer, SST; Add air humidity sensor
• Pudipeddi Murty (INCOIS): Ocean observation system at ESSO-INCOIS
  • Ocean observation system in India: Moored buoy, Argo, drifters, XBT/XCTD, R/V, current meter, Tsunami buoy, ...
  • INCOIS’s role: Central repository for the oceanographic data
    • National data buoy program
    • Moored buoy, coastal buoy deployment in the northern Indian Ocean
      • Applications: Monitoring cyclones; A successful case for Cyclone Phailin
    • Drifting buoys
    • Automatic weather stations onboard R/V
    • Wave rider buoys: real-time monitoring of wave heights
    • Coastal HF Radar network: measure waves & currents to about 200 km off the coast – capable to capture cyclonic signature on surface current
    • Ocean R/V
    • Tide gauge network: 26 gauges along the Indian coast, real-time surge monitoring

• Ocean Data and Information System
  • INCOIS Live Access Server
  • Satellite remote sensing data
• S.-K. Park (PNU)/B.-G. Lee (JNU): NPOMS Training Center
  • NPOMS Training Center in Pusan National University – Pilot project
  • First training course of the DBCP Capacity Building Task Team
    • Tropical cyclone – ocean capacity building
    • International students from NPOMS region
    • 17-22 August 2015
  • A vision of NPOMS Training Center
    • Establish training programs focusing on DBCP objectives
    • Promote the funding to sustain the center
    • Invite foreign lecturers (ocean & climate experts)
    • Open official website of the center
    • Expand NPOMS Center to DBCP Center
    • Focusing on typhoon & hurricane education
• X. Li (CMA): Oceanic observation and typhoon forecast in CMA
  • Ocean observation in CMA
    • Moored buoy
      • 31 buoys; deployed in coastal areas
    • coastal marine AWS
      • 400 AWSs
    • Shipping AWS
    • Drifting buoy (planned)
  • Typhoon forecast in CMA
    • Recent improvement
      • Enlargement of warning areas
      • Increase forecast frequency during 0—24 h
      • Include gale wind radii analysis in four quadrants
      • TC intensity certification based on DVORAK technique
    • Reduce typhoon track forecast errors in the past 5 years