Reference Material (Tables 1 and 2) to be used for the Session 2 Workshop

Session 2 Workshop: Assessment of the Tropical Cyclone R&D Activities in Contributing to the Operational Priorities of the Tropical Cyclone Forecasting and Warning Centers

Table 1. Operational Priorities of the Tropical Cyclone Forecast and Warning Centers (NHC & CPHC, and JTWC)

NHC & CPHC Priority[1]	JTWC Priority[1]	Operational Need[1]	Linkage to Research Needs
1	**1**	Guidance for tropical cyclone intensity change, with highest priority on the onset, duration, and magnitude of rapid intensification events. Similar guidance is also needed on when rapid over-water weakening (such as had been observed in recent Gulf of Mexico hurricanes) will occur.	A1a-f, B1-B3, B6, B7
2	**2**	Improved capability to observe the tropical cyclone and its environment to support forecaster analysis and model initialization.	B1, C1-C3
3	**5**	Statistically-based real-time guidance on guidance for track, intensity and precipitation (e.g., multi-model consensus approaches), provided to forecasters in probabilistic and other formats.	B5,B6
4	**6**	Enhancements to the operational environment to increase forecaster efficiency, by expediting analysis, forecast, coordination, and/or communication activities.	C1c
5	**7**	Additional operational guidance on coastal inundation (e.g., storm surge and waves).	A4, A5, B2, B3, B6
6	**8**	Improved and extended track guidance. Identification, and then reduction of, the occurrence of guidance and official track outliers, focusing on both large speed errors (e.g., accelerating recurvers and stalling storms) and large direction errors (e.g., loops), and on specific forecast problems, including interactions between upper-level troughs and tropical cyclones, track forecasts near mountainous areas, and extratropical transition.	A2, B1-B3, B5-B6
7	**3**	Guidance for tropical cyclone genesis that exhibits a high probability of detection and a low false alarm rate, and/or provides probability of genesis.	A3, B1-B3, B5-B7
8	**9**	Operational analysis of the surface wind field (including maximum sustained winds) in tropical cyclones. This also includes methods for forecasting the wind field over elevated terrain and high-rise buildings.	B1, B2, C1-C3
9	**4**	Guidance for changes in tropical cyclone size/wind structure and related parameters, including combined sea heights.	A1a-g, B1-B7
10	**10**	Guidance on the operational utility and relative merits of high-resolution model output compared to lower resolution ensemble model output.	B6, B7
11	**11**	Guidance for tropical cyclone precipitation amount and distribution.	A4, B1-B7
12	**12**	Improved utility of microwave satellite and radar data in tropical cyclone analysis.	B1, C1c
13	**13**	Improved techniques for estimating the intensity of tropical cyclones passing over and north of sea-surface temperature gradients (e.g., in the eastern North Pacific Ocean and the Atlantic Gulf Stream).	C1
14	**14**	Quantitative guidance tools for seasonal tropical cyclone forecasts for the Atlantic and North Pacific basins, using statistical and/or dynamical methodologies.	A6,B2, B6

[1]From JHT FY09 Announcement of Federal Funding Opportunity (http://www.ofcm.gov/wg-tcr/reference/JHTFY09_Full_text_AFFO.pdf)

Table 2. Research Needs in Atmospheric and Ocean Science

Research Topics	**Type of Research** B = Basic; A =Applied
A. General Research	
1. Intensity and Structure Changes. a. Environmental scale processes (e.g., dry air, midlevel easterly jet, and suspended mineral dust from Saharan Air Layer; vertical shear of horizontal wind; easterly wave disturbance; TUTT and monsoon trough influences). b. Vortex scale processes (e.g., eyewall replacement and rainband development, vortex mixing and resilience). c. Convective scale processes (e.g., convective bursts, vortical hot towers). d. Turbulent and microphysical scales (e.g., momentum and enthalpy fluxes; cloud microphysics; radiation; e. Upper ocean processes and structure (e.g., oceanic heat content; currents; waves; SST; mesoscale features). f. Landfall effects (e.g., surface flux changes; topographic and land surface effects). g. Extratropical transition. h. Predictability limits.	B,A
2. Track. a. Convective and vortex structure (e.g., asymmetries) b. Land interaction. c. Multi-vortex interactions. d. Predictability limits.	B,A
3. Tropical cyclone formation. a. Convective processes. b. Mesoscale processes (e.g., stratiform precipitation, vorticity structure). c. Environmental processes. d. Tropical transition.	B,A
4. Precipitation. a. Environmental interaction. b. Microphysical processes (hydrometeor production and conversion, fallout, aerosol impacts). c. Topographic effects.	B,A
5. Coastal and inland inundation (i.e., surge, waves, flooding). a. Surge wave and ocean bottom interaction. b. Wave breaking and set up.	B,A
6. Predictability of seasonal tropical cyclone activity.	B,A

Table 2 (continued). Research Needs in Atmospheric and Ocean Science

Research Topics	Type of Research B = Basic; A =Applied
B. Model Development Topics	
1. Data assimilation (e.g., technical approach, high resolution data, new data sources/instrument, vortex initialization, atmosphere and ocean initialization; techniques to evaluate the uncertainty and representativeness of observations and use of observations for initializing NWP models).	A
2. Global and regional model development/improvements (e.g., resolution, nesting, coupling to ocean; coupling with hydrology/inundation models).	A
3. Relative importance of physical processes in global and regional models on track, intensity and structure, and precipitation. a. Atmosphere-ocean boundary layer for coupled air-sea-wave problem; momentum (wave-induced drag) and enthalpy fluxes (sea spray complexity). b. Upper ocean processes and structure (e.g., oceanic heat content; currents; waves; SST; mesoscale features). c. Land surface coupling: sensitivity of Land Surface Model, radiation. d. Microphysical processes (e.g., hydrometeor production and conversion, fallout, aerosol impacts, radiation). e. Convective processes (e.g., latent heating, momentum transfer, mixing).	B, A
4. Verification for three dimensional, high-resolution regional models for all phases of the tropical cyclone life cycle; varying atmosphere/ocean environment.	A
5. Diagnostic techniques to further increase the utility of global and regional models in forecasting tropical cyclone track, intensity structure, precipitation, and genesis.	A
6. Development of advanced, probabilistic guidance (e.g., ensembles); optimal ensemble construction and configuration; value of high-resolution deterministic forecasts vs. ensembles.	A
7. Studies to optimize resolution and scale dependent parameterization.	B, A
C. Observations and Observing Strategies	
1. Observing strategies/capabilities to improve analyses and forecasts of tropical cyclones (e.g., formation, track, intensity, structure, inundation). a. Where to take observations for initialization of tropical cyclone vortex and environment. b. Alternatives and tradeoffs for observing tropical cyclone and their environment (OSE, OSSE, cost/benefit). c. Information systems (e.g., data fusion, visualization).	A
2. Required observations to support model diagnostics and verification (e.g., IFEX, TCS-08, CAMEX III/IV. TCSP, RAINEX, NAMMA).	A
3. New and/or improved observational technologies.	B,A