Tropical Desk Daily Discussion Guide

The Tropical Desk daily training routine includes a half-hour discussion considered a key component of the training. The discussion aims to understand collectively the current state of the atmosphere and, upon the analysis, sketch its expected evolution over a four day period. The discussion methodology covers an analysis of the current situation, a verification of previous forecasts and a forecast discussion highly based on model output and its interpretation. When relevant to the forecast, waves in the trades are initialized and their positions estimated using data from different global models.

Topics covered and tools used

1. Analysis of the current situation.

1.1. Water vapor satellite data loops (IR3).

Water vapor data are used for the analysis of features at 300-400 hPa. This analysis helps to depict mid/upper tropospheric systems such as ridges, open troughs, cutoff lows, jet streams, mid/upper dry air intrusions, mid/upper moisture plumes, thunderstorms, potential areas with upper divergence and the general movement of the mid/upper troposphere.

1.2. Infrared-4 satellite data loops (IR4).

Infrared-4 data is then used to complement the analysis, as they reveal different types of cloud regimes, convective processes and several other tropospheric features. These data are closely related to the temperature of surfaces and cloud tops. Knowledge of the thermal structure of the troposphere thus allows inferring cloud top heights from IR4-estimated cloud top temperatures. Complementing the cloud top height analysis with cloud morphology and behavior, cloud types can be inferred. IR4 data also allow the analysis of surface and low-tropospheric features when these are not masked by high clouds. They are useful to find surface boundaries such as fronts, shear lines and the Inter Tropical Convergence Zone (ITCZ); to assess the presence and potential extension of subsidence inversions; to estimate the position of upper jets; to find mountain waves and to estimate the degree of associated turbulence; and to assess topography and interactions with the troposphere including estimations of surface temperatures when skies are clear. They also help the forecaster to identify and follow waves in the trades, but this should be complemented with visible satellite imagery and other tools if available.

1.3. Visible satellite data loops.

Visible satellite data are limited by daylight but are often available at higher resolutions than infrared data. They are essential to identify surface features that are not evident in infrared loops and to analyze fine scale interactions that can result in important triggers for convection and precipitation. This includes, for example, the development and location of streamers in small islands, diurnal breeze fronts, outflow boundaries, etc. These data are essential to identify and follow perturbations in the trades, visualize atmospheric interactions with the topography, identify low clouds and gravity waves, and to refine the identification of cloud features by complementing the analysis with infrared data.

1.4. Blended Precipitable Water Analysis.

Is a satellite derived analysis that is used to quantify moisture content and identify areas of subsidence.

1.5. Atmospheric soundings.

Soundings are used to assess the most current vertical structure of the atmosphere, and to determine if model analyses are properly representing the observations. They are useful to determine the position different systems with respect to the station, such as waves in the trades, the Inter Tropical Convergence Zone, fronts and shear lines among others. They are also useful to determine the height and strength of subsidence inversions, column stability via different indices and features in the temperature and dewpoint profiles, among other important atmospheric details.

1.6. Surface Observations.

Surface observations are analyzed when considered necessary.

1.7. Initialization of waves in the trades.

During the May-October period, waves in the trades are identified using visible satellite imagery. These data are used to determine the position of the wave, aided by wave positions previously forecasted, by the understanding of atmospheric systems influencing the waves and interactions with orography.

2. Forecast verification.

The forecast from the previous day(s) is (are) verified to assess forecast skill and to consider pertinent adjustments to the forecasted rainfall amounts/areas. Verification is done by overlaying the forecast over IR4 satellite data and over rainfall amounts observed during the forecast period on the NAWIPS workstation.

3. Forecast Discussion.

3.1. Evaluation of model data.

Output from the Global Forecast System GFS model is used as the primary source of information to sketch the weather forecast, although data from the UKMET and the ECMWF model is also revised, especially for the fields of precipitable water, 850 hPa winds and precipitation. The evolution of the following fields is usually explored:

3.1.1. Flow, upper jets and vorticity at 250 hPa. These data are explored to understand the evolution of features in the upper troposphere. Special attention is placed on the evolution of upper troughs, regions of upper divergence associated with upper ridges and on the identification of regions of upper divergence associated with upper jets.

3.1.2. Flow and vorticity at 500 hPa. Emphasis is placed on the location of troughs and ridges. Troughs can be the reflection of upper troughs or waves in the trades, or both. Troughs in the mid troposphere often enhance convection. Mid-level ridges are important as these are usually associated with subsidence inversions and fair weather.

3.1.3. Flow and vorticity at 700 and 850 hPa. These fields are very useful to find and follow perturbations in the trades. Some waves such as TUTT-induced and positively tilted waves will tend to have a stronger signature at 700 hPa.

3.1.4. 1000-850 hPa thickness and 1000 hPa stream line analysis. These fields are used during the winter and transition months to identify surface fronts and shear lines that enter the forecast area.

3.1.5. Precipitable water and 850 winds. These fields, revised together, are very useful to evaluate the distribution of moisture and the low-level transport. Larger values of precipitable water and cyclonic winds often help to find perturbations in the trades. Low values of precipitable water can be often linked to subsidence inversions and fair weather.

3.1.6. The Galvez-Davison Index GDI. The GDI, applied to GFS forecasts, is used for the diagnosis of stability as it is the stability index that works best across most of the Tropical Desk domain. The GDI reveals the potential for thunderstorms versus the potential for shallow convection or just fair weather.

3.1.7. Model precipitation. Model precipitation is analyzed and to gain some final insight on the expected distribution and intensity of forecasted precipitation. This is done by exploring the evolution of 24-hr precipitation amounts of the GFS, ECMWF and UKMET models.

3.2. Ensemble forecasting.

GFS model precipitation ensembles are explored to evaluate forecast confidence. The clustering versus divergence of ensemble members, shown as small versus large standard deviation, is a good indicator of high versus low forecast confidence.

3.3. Wave position forecasting.

The forecasted positions of the waves in the trades initialized in section 1.7 is determined by evaluating wave positions in GFS and ECMWF 700 and 850 hPa forecasts. For each wave, the forecasted positions are recorded for 12-hour intervals for each of the four fields. Once finished, final wave position forecasts are determined based on the analyzed model position consensus and on observed and theoretical wave propagation velocities.