UNITED STATES MARINE CORPS

LESSON PLAN

CYCLOSTROPHIC WINDS

INTRODUCTION:

1. Gain Attention. Normally winds from a cyclonic storm or tropical storm are too powerful for other winds to blow around them. Those winds would be pushed away or sucked into and pushed back out by the storm. But on rare occasions this does not happen.

2. Overview. During this period of instruction, the student(s) will be taught the concept of a cyclostrophic wind and what causes them to occur.

3. Introduce Learning Objectives.

a. Terminal Learning Objective. Without the aid of, but in accordance with the period of instruction, physically identify a cyclostrophic wind on a given atmospheric chart.

b. Enabling Learning Objective(s). With the aid of references,

(1) Define and discuss the forces that act to create a cyclostrophic wind.

(2) Provide an example of a cyclostrophic wind.

4. Method/Media. This period of instruction will be taught using the lecture method with aid of QMMCBT-001 "Introduction to the Dynamics of the Atmosphere".

5. Evaluation. The student(s) shall be evaluated by successfully completing the Terminal Learning Objective.

TRANSITION. Thus far, one should be familiar with the different types of atmospheric forces that affect air parcels within the atmospheric. The next type of wind is unique because it can only affect low pressure systems.

Body:

1. Defining a Cyclostrophic Wind. A cyclostrophic wind is a wind that occurs when the pressure or contour gradient forces (PGF/CGF) are balanced by the centrifugal force (Cef).

a. This type of wind can only occur in association with low pressure systems. Recall that the pressure gradient force acts opposite centrifugal force where there is cyclonic curvature. This is why the cyclostrophic wind can only occur in association with low pressure systems.

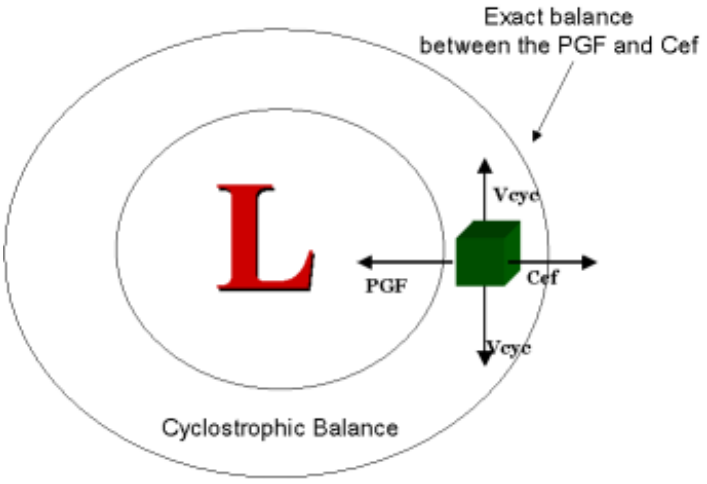

Figure 1 - Cyclostrophic balance around cyclonic curvature.

b. In areas of anticyclonic curvature, the pressure gradient force and centrifugal forces act together directing the flow outward and away from the center of higher pressure (see figure 2).

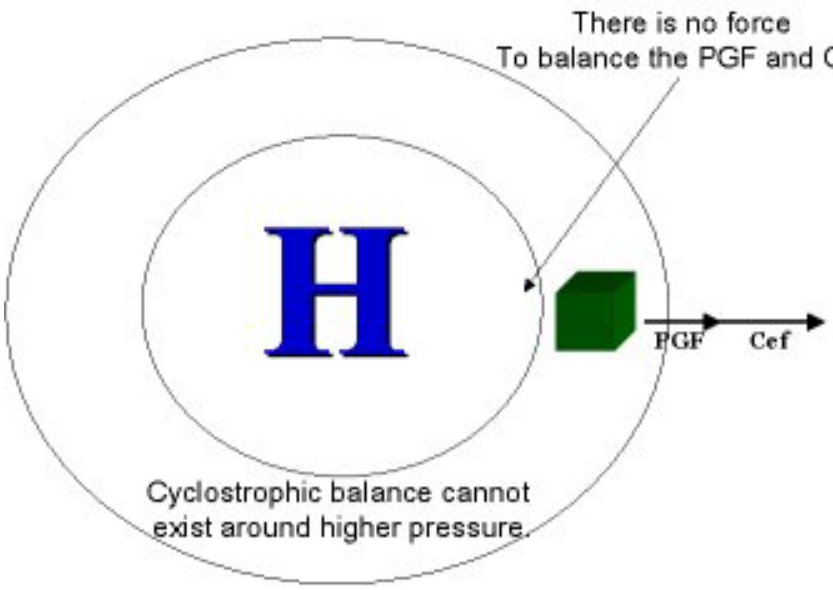

Figure 2 - Cyclostrophic balance cannot exit around anticyclonic curvature.

c. Cyclostrophic winds are generally only associated with smaller scale systems where the Coriolis force is non-existent. Coriolis force does not have as much, if any, influence on small scale short-lived systems.

d. Dust devils, tornadoes, and water spouts are some examples of cyclostrophic winds where there is an intense PGF and small radius of rotation resulting in a very large Cef. The actual flow may be either cyclonic or anticyclonic in these systems.

OPPORTUNITY FOR QUESTIONS:

1. Questions from the Class. At this time, are there any questions concerning the content you just learned?

2. Questions to the Class.

   a. QUESTION. Where would you most likely find a cyclostrophic wind?

   b. ANSWER. Cyclostrophic winds most common near the equator where the Coriolis force is at its weakest or in small scale systems where there is a strong PGF balanced by a strong Cef.

SUMMARY: During this period of instruction, the student(s) was introduced to the concept of a cyclostrophic wind, the forces that act to create it, and the type of systems they are typically observed in.