**Name:** **Date:**

# Activity 3.5.1
# Doppler Radar in a Shoebox "Reflectivity Mode"

## *Objectives:*

To create a model to simulate storm tracking by modern weather radar.

To transform a concealed 3-dimensional shape into a full-color, 2-D image using a color key corresponding to that used by professional meteorologists.

To use the model to distinguish between areas of storm intensity (precipitation levels) and internal air circulation.

To use the model to predict the direction and movement of a storm system.

## *Materials, per student team (for both Activity 3.5.1 and 3.5.2):*

- 1 shoe box with lid
- Tape
- Glue
- Assorted materials of varying hardness (rocks, styrofoam, cardboard, marshmallows, foam rubber, crumbled aluminum foil, Play Doh, etc.)
- Metal coat hangers (cut and bent straight), knitting needles or wooden skewers
- Awl, leather punch or other sharp object to punch holes in the shoe box lid (caution in appropriate use)
- Crayons or colored pencils
- Activity 3.5 Worksheet (grid for box lid)

## *Procedure for Activity 3.5.1 — Reflectivity Mode:*

1. Tape or glue a copy of the grid pattern to the top of each lid. Using an awl, leather punch, or other sharp object, punch a hole in the center of each 1 cm x 1 cm square on the grid paper.
2. Different types and intensities of precipitation within a storm produce different and characteristic echo patterns on weather radar, with severe hail providing the hardest echo, and light rain a gentler "bounce." To represent this, arrange the materials in the box with the hardest items (e.g., rocks ) at the center of the model storms and the softest items (e.g., marshmallows ) at the outer edges. It would work best (in this simulation) to build model storms out of materials representing four different degrees of hardness. Of course in reality there are many more gradations of precipitation than represented in this model.
3. Since storms can line up along fronts—in the case of thunderstorms, "squall lines"—do not limit your model to the center of the box. All of the materials should be firmly secured to the bottom of the boxes. Once secured, tape the lid on the shoebox and trade it for one built by another team.

4. On the second copy of the grid, one team member should label directions north, south, east and west. (You can also draw in and label the locations of various cities in your county or region, to add a dimension of reality to the simulation. It would be useful to have a local map available for reference. This would allow you to factor in the scale of both your region and the storm.)
5. Begin on the box lid at grid square (1,1) and continuing through (1,2), (1,3), etc. One team member should stick the probe (made of a knitting needle, cooking skewer, or straightened piece of metal coat hanger) into each hole and lower the probe (simulating a pulse of radar energy) until it either encounters part of the model storm or the bottom of the box. It may help to make a reference mark on the probe, level with the lid of the box, to indicate when the probe is touching the bottom.
6. Use the following number and color hardness key to represent radar echoes of various intensities within the model storm:

   No echo, 0, no color
   Softest material, 1, green
   Firm, 2, yellow
   Moderately hard, 3, tan
   Hardest material, 4, red

   One team member should probe the "sky" surrounding and above the model storm and call out the hardness number at each location: another teammate should write in the number in the corresponding squares on the second grid sheet.
7. After completing row 1, repeat the process for each of the other rows of squares on the grid sheet. Finally, shade in the squares on the second grid sheet with the appropriate colors corresponding to the numbers.
8. Upon completion of the simulation, your team should have a grid sheet showing the location of a storm and regions of various precipitation intensities.
9. Over or near which city is the storm occurring? What cities are in the path of the moving storm? Remember, large scale weather systems in the U.S generally travel from west to east.
10. Unveil the "storm" and compare reality (the model storm in the box) with what your "radar" has detected.
11. Compare and contrast your student storm models to actual weather radar reflectivity mode images found on the Internet.