4.2 CLOUDS

DASH

OBJECTIVES
The students
- Identify layered, heaped, combination, and precipitating clouds.
- Estimate and record the daily amount of cloud cover.

CLIMATE EDUCATION FRAMEWORK
- 3-5Weather.A.1 By measuring weather conditions (temperature, amount and kind of precipitation, amount and kinds of clouds, wind direction and wind speed), scientists learn how the weather changes from day to day, month to month, and during the year.

BACKGROUND
Knowing the names of clouds helps in thinking about them. At the beginning of the eighteen hundreds, the Englishman Luke Howard identified two basic groups of clouds—those that are *heaped,* called *cumulus clouds,* and those that are *layered,* called *stratus clouds.* Since then two more categories of clouds have been added— *combination clouds* with characteristics of both heaped and layered clouds and *precipitating clouds,* which produce rain, hail, and snow. See Figures 1 and 2. Altitude is a factor in classifying clouds. *Low clouds* are those whose tops are found between ground level and 3 km (2 miles) or have bottoms from 0 to 2 km. *Middle clouds* are those with tops between 3 km and 7 km (2 and 4-1/2 miles) or bottoms between 2 and 7 km. *High clouds* are those with tops above 7 km or bottoms from 5-15 km. See Table 1.

ALTITUDE	CLOUD TYPE			
	LAYERED	**HEAPED**	**COMBINATION**	**PRECIPITATING**
HIGH Tops above 7 km	Cirrostratus	Cumulonimbus* (non-precipitating)	Cirrocumulus	Cumulonimbus* Cirrus
MIDDLE Tops between 3 and 7 km	Altostratus	Swelling cumulus*	Altocumulus (non-precipitating)	Altocumulus
LOW Tops below 3 km	Stratus Fog	Cumulus	Stratocumulus	Nimbostratus
Table 1. Types of Clouds				

* All these clouds except cumulonimbus and swelling cumulus are found within the altitude range shown. Cumulonimbus clouds have their bases below 3 km and their tops above 7 km.
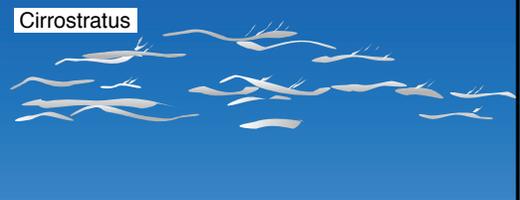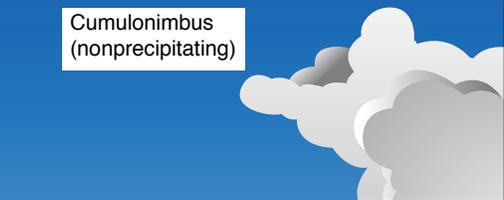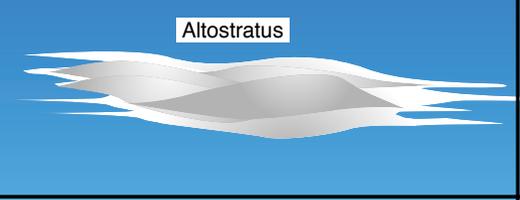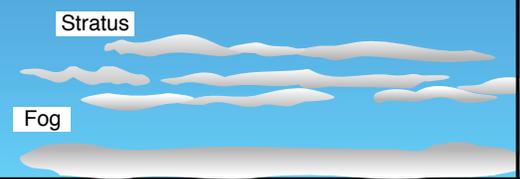
pcep

ALTITUDE	CLOUD TYPE	
	LAYERED	HEAPED
HIGH	Cirrostratus	Cumulonimbus (nonprecipitating)
7 Km		
MIDDLE	Altostratus	Swelling Cumulus
3 Km		
LOW	Stratus / Fog	Cumulus

Figure 1 Layered and heaped clouds

ALTITUDE	CLOUD TYPE	
	COMBINATION	PRECIPITATING
HIGH	Cirrocumulus	Cirrus / Cumulonimbus (precipitating)
7 Km		
MIDDLE	Altocumulus (nonprecipitating)	Altocumulus (precipitating)
3 Km		
LOW	Stratocumulus	Nimbostratus
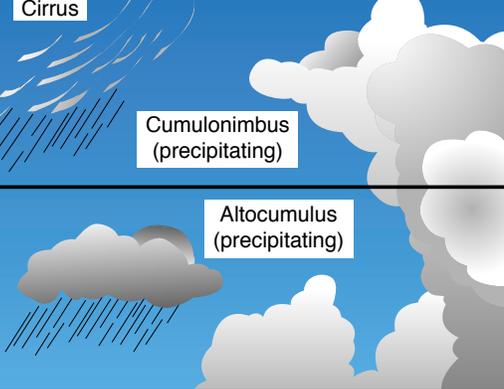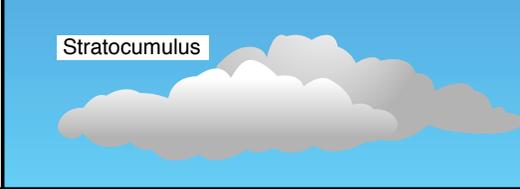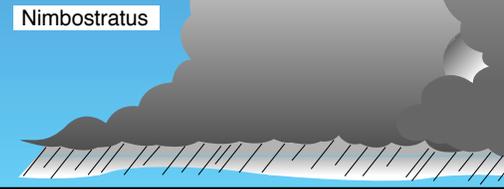
Figure 2 Combination and precipitating clouds

Fair-Weather Clouds

Common fair-weather clouds are
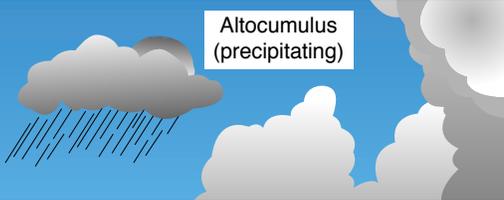- *Cumulus*—small fluffy, low-level clouds with bottoms and tops in the low range.
- *Swelling cumulus*—clouds with bottoms in the low range and tops in the middle range. They are taller-than-wide single clouds with dynamically moving cauliflower-like tops.

Common Storm Clouds

Typical storm clouds are
- *Nimbostratus clouds* are precipitating low-level layered clouds. They are thick dark-gray clouds with ragged edges.
- *Cumulonimbus clouds* are of two types—precipitating and non-precipitating. Both are towering clouds extending from the low range up through the high range (below 2 km to above 7 km). Because of their dynamic nature, cumulonimbus clouds may be non-precipitating one moment and precipitating the next. Storms that they generate are usually short-lived but often violent.

Less Common Storm Clouds

Following are some less common producers of precipitation:
- *Altocumulus clouds,* like cumulonimbus clouds, may or may not produce precipitation. When they do produce precipitation, it is usually light and spotty.
- *Cirrus clouds* are composed of ice crystals. Because they are formed at great height, these crystals seldom reach the ground. They usually evaporate as they fall.

Cloud Cover

Cloud cover is most often measured in eighths although some sources suggest tenths. In grade three the students began with just three descriptions, clear (no clouds), partly cloudy (some clouds), and mostly cloud covered. They next begin to estimate the amount of cloud cover. It was suggested that percentages or fractions be used if the students had been introduced to this concept in math. If not, they used such terms as few clouds (up to ¼ or 25%), partly cloudy (around ½ or 50%), mostly cloudy (¾ or 75%), and totally cloud covered (100%). In grade 4 the students will begin to use more standard descriptions. See Table 2.

Cloud Category	Day Description	Night Description	Definition
Clear	Sunny	Clear	No clouds in the sky
Few	Mostly sunny	Mostly clear	1/8 of the sky or less is covered
Scattered	Partly cloudy	Partly cloudy	2/8–1/2 of the sky is covered
Broken	Mostly cloudy	Mostly cloudy	5/8–7/8 of the sky is covered
Overcast	Overcast	Overcast	The sky is completely covered by clouds.
Table 2 Cloud Cover			

STUDENT ROLES
Meteorologist

MATERIALS
Drawing paper
Pencils
Compass
Thermometer
Cloud chart or other cloud identification resources
(Optional) Cotton, glue and poster paper
SP 4.1D DAILY CLOUD DATA
SP 4.2A FAIR WEATHER CLOUDS
SP 4.2B STORM CLOUDS

PRODUCTS
Cloud drawings and data

PROCEDURES

1. **Have the students review what they learned about different types of clouds in grade three. Use a discussion, class list or concept map.**
   Ask such questions as
   - What are the two basic types of clouds?
     ✔Cumulus and stratus.
   - What do they look like?
     ✔Cumulus are heaped or puffy.
     ✔Stratus are layered or stretched.
   - Are all clouds just stratus or cumulus? How are they different.
     ✔Some may appear as both stratus and cumulus. Color may vary.

2. **Take the students outside to observe the clouds on a sunny day to observe fair-weather clouds.**
   Have them
   - Draw the clouds that they observe in the sky. Use SP 4.2A FAIR WEATHER CLOUDS if desired.
     ✔Provide cloud names to label their drawings.
     ✔The most common fair weather clouds are *cumulus* and *swelling cumulus*.
     ✔Use cloud charts and other resources as needed to help with identification.
   - Include the date, time, temperature, cloud color, direction of cloud movement, size, and other distinctive features on their drawings.

3. **Help the students make generalizations about their observations of fair-weather clouds.**
   Ask such questions as
   - What is meant by *fair* weather?
   - What are some common features of fair-weather clouds?
   - What are some other or some occasional features of fair-weather clouds?

pcep

4. **Start a storm watch when stormy weather is predicted. Have the students describe clouds that pass overhead and make sightings several times during the day. (Cloud observations on a rainy day can serve as an introduction to some storm clouds.)**
   Have them
   - Draw the clouds that they observe in the sky. Use SP 4.2B STORM CLOUDS if desired.
     ✔Provide cloud names to label their drawings.
     ✔The most common storm clouds are *nimbostratus* and *cumulonimbus*. Less common are *altocumulus* and *cirrus* clouds.
     ✔Use cloud charts and other resources as needed to help with identification.
   - Include the date, time, temperature, cloud color, direction of cloud movement, size, presence of lightning, and other distinctive features on their drawings.

5. **Help the students make generalizations about their observations of storm clouds.**
   Ask such questions as
   - What is meant by *stormy* weather?
   - What are some common features of storm clouds?
   - What are some other or some occasional features of storm clouds?
   - What are the temperature changes and wind conditions that accompany stormy weather?

6. **Have the students review how cloud cover was measured and recorded in grade three. Discuss what procedures to use this year to determine and record daily cloud cover. See Table 2 in the Background.**
   Ask such questions as
   - What is meant by the term *cloud cover*?
   - How did you record the amount of cloud cover last year?
   - How is cloud cover reported by meteorologists in weather reports on TV or radio, in the paper, or on the Internet?
     ✔See Background information.
   - How can you determine the amount of cloud cover?
   - How could you record the amount of cloud cover?

7. **Have the students begin or continue to collect daily cloud data. Use SP 4.1D DAILY CLOUD DATA. Post a copy of Table 2 in the Weather Center.**

8. **Have the students write a working definition for clouds based on their current knowledge about them.**

EXTENSIONS
Have the students
- Use their drawings to make their own cloud charts.
- Make a Cloud Cover Chart based on Table 2 in the Background.
- Use cotton balls or similar to create a chart of different kinds of clouds.
  ✔Crushed or powdered charcoal can be used to color the cotton.

pcep

CLOUD COVER

Cloud Category	Day Description	Night Description	Definition
Clear	Sunny	Clear	No clouds in the sky
Few	Mostly sunny	Mostly clear	1/8 of the sky or less is covered
Scattered	Partly cloudy	Partly cloudy	2/8–1/2 of the sky is covered
Broken	Mostly cloudy	Mostly cloudy	5/8–7/8 of the sky is covered
Overcast	Overcast	Overcast	The sky is completely covered by clouds.

Complete the table below.

Date	Time	Other Observations
Temperature	**Wind Direction**	
Color(s)		

Draw the clouds you see on a sunny day.

STORM CLOUDS
SP 4.2B

Name:

Date:

Complete the table below.

Date	Time	Other Observations
Temperature	**Wind Direction**	
Color(s)		

Draw the clouds you see on as a storm is coming.