

GLOBE PROTOCOL

Noctilucent Clouds

PURPOSE

Understand, observe and describe noctilucent clouds (NLCs), also known as polar mesospheric clouds.

OVERVIEW

- Students will understand the environment and the conditions necessary for cloud formation in Earth's atmosphere.
- Students will observe the creation of clouds in a classroom laboratory setting.
- Students will investigate parameters associated with the formation of noctilucent clouds in Earth's atmosphere.
- Students will learn how to observe and document noctilucent clouds.

STUDENT OUTCOMES

- Students will learn the conditions that create clouds in the troposphere.
- Students will learn what conditions create noctilucent clouds, how they form far above the troposphere, and why they change over time.
- Students will gain observational experience by personally observing noctilucent clouds in the field or by archived images, web cams and satellite imagery.

SCIENCE CONCEPTS

Earth and Space Science

- Weather can be observed qualitatively.
- Weather changes from day to day and with the seasons.
- Weather and climate vary at local, regional and continental scales.
- Clouds are formed by condensation of water vapor in the atmosphere.
- Clouds affect weather and climate.
- The properties of the atmosphere vary with altitude.

Physical Science

- The solid, liquid and gas states of matter.

Geography

- Noctilucent clouds generally appear between 55 and 75 degrees north or south of the Equator.
- Human activities may play a role in the formation of noctilucent clouds.

SCIENTIFIC INQUIRY ABILITIES

[SPECIFIC ABILITIES WILL BE LISTED WHEN ACTIVITIES ARE CREATED]

- Design and conduct scientific investigations.
- Use appropriate mathematics to analyze data.
- Develop descriptions and explanations using evidence collected from research.
- Recognize and analyze alternative and interfering explanations.

- Communicate procedures, descriptions, and predictions.

TIME

Students may have field observing sessions during the summer months of about 30 minutes beginning about one hour before sunrise or 30 minutes after sunset. In the classroom, images of noctilucent clouds can be viewed and studied at various web sites.

LEVEL

Middle and Secondary School

FREQUENCY

Field observing sessions during local summer.

MATERIALS AND TOOLS

- Watch or clock
- Directional compass
- Computer with Internet access (for weather information and sunset times)
- Clinometer (to measure elevation of NLCs above the horizon)
- Pencil or pen
- Notebook
- Flashlight with red cellophane cover (to assist with night vision)
- Camera (optional but desired)
- Binoculars (optional)
- Weather instruments (thermometer, wind vane, anemometer) (optional)

PREPARATION

Classroom instruction (one or two sessions)

PREREQUISITES

- Cloud Protocol
- Aerosol Protocol (optional)