

SUGGESTED REFERENCES

- *Faster Than a Speeding Storm*
<http://www.psc.edu/science/Droeg/droeg.html>
- *NASA's Computational Technologies Project*
<http://ct.gsfc.nasa.gov/>
- *NOAA's National Center for Environmental Prediction*
<http://www.ncep.noaa.gov/>
- *UCAR Fact Sheet (on hail)*
<http://www.ucar.edu/communications/factsheets/Hail.html>
- *The Mesoscale Alpine Programme*
<http://www.map.meteoswiss.ch/>

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5 - 8

Earth & Space Science

Structure of the Earth System

Science in Personal & Social Perspectives

Natural Hazards

Grades 9 - 12

Earth & Space Science

Energy in the Earth System

Science & Technology

Understandings about Science & Technology

*Source: *National Science Education Standards, 1996, National Academy Press*

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SCIENCE SCREEN REPORT

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SYNOPSIS

Severe weather happens all over the world. Our scientific understanding of processes that contribute to various weather systems has come very far in recent years. With advances in technology, forecasters have made us safer and helped to protect our property.

This issue examines storm prediction techniques. It demonstrates how researchers collect and analyze data contributing to certain weather. In the Alps of Switzerland and Northern Italy, scientists with the Mesoscale Alpine Program, otherwise known as MAP, are studying the different pressure systems and air masses to determine the likelihood of flooding. Researchers also study the interactions between gases in the air and their effects on our environment. The program looks at factors contributing to rarer hailstorms, and how scientists are using newer radar technology to forecast the weather.

CURRICULUM UNITS

- EARTH SCIENCE
- ENVIRONMENTAL SCIENCE
- GENERAL SCIENCE
- METEOROLOGY
- PHYSICAL SCIENCE

RUNNING TIME

16:18

BACKGROUND

The Alps in Switzerland and Northern Italy sometimes fall victim to extreme rain storms, causing widespread damage. With experts telling us to brace ourselves for more such powerful storms, we ask: What's going on with the world's weather?

Equipped with countless pieces of measuring equipment, some weather research planes are used in the world's largest climate research project: The Mesoscale Alpine Program, otherwise known as MAP. When MAP was created, more than 200 scientists from thirteen countries set out to discover the origins of, and processes involved in alpine weather systems. Researchers launched a massive operation, measuring severe storms from both the air and ground.

In collecting data, they hope to find an explanation for one of the greatest causes of the long-lasting heavy precipitation: the interaction between wind and precipitation systems.

In the future, scientists hope to be able to use the collected data combined with a computer model to calculate the process of the threatening flood before the first drops of rain have even fallen.

Researching the weather is not only collecting data and calculating models, it is also about researching details. Botanists explore the effects of greenhouse gases on fully-grown trees. They research the influence of a heightened concentration of carbon dioxide on the water balance where trees and plants absorb carbon dioxide and water, and give off water through their leaves. The hypothesis is that the more carbon dioxide there is in the air, the less water the leaves put back into the atmosphere, which means there is less water to be absorbed through the roots. And at times of heavy rainfall, this temporarily leads to ground saturation, and increases the potential for flooding.

The program also uncovers the details behind hailstorms. In order to protect against very sudden hail storms, scientists need to be able to give short-notice and accurate forecasts. Many factors contribute to the origin of these destructive little lumps of ice. The storm first needs to contain "embryos", which are tiny particles on which the moisture in the air sits and then freezes. These lead to many different types and sizes of hail.

Trained pilots fly into storms in the alpine skies to influence storm clouds in a bid to protect agricultural areas from hail. They fly headlong into the winds of the coming hailstorm, igniting burners which release chemicals into the storm clouds. The chemical substances are then designed to behave like artificial hail, which essentially means that science is actively manipulating the process of hail creation.

CRITICAL THINKING EXERCISES

1. Have students create a backyard weather observation station, and record results over a set period of time. The observation station can include temperature (basic thermometer), atmospheric pressure (barometer), moisture (rain gauge), humidity (sling psychrometer) and winds (anemometer and wind vane).
2. Discuss with the students how weather affects their daily lives at different times of the year? (What types of clothes do they wear, outdoor activities, etc.)
3. Many different regions of the earth commonly experience distinct severe weather systems. Research the factors that contribute to certain areas being more prone to systems such as tornadoes, hurricanes, drought, etc.

ADVANCED ORGANIZERS

Prior to showing this program, students should have some understanding of the following benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 1: The Nature of Science Section C - The Scientific Enterprise

Know by Grade 8

- Computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data, prepare research reports, and share information and ideas with investigators all over the world.

Benchmark 4: The Physical Setting Section B - The Earth

Know by Grade 8

- The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. Water evaporates from the surface of the earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back out into the ocean.

Section C – Processes that Shape the Earth

Know by Grade 8

- Human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and intensive farming, have changed the earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life forms.

**Benchmarks can be found at www.project2061.org/tools/bencho/bolintro.htm*

VOCABULARY

Botanist

Cold front

Embryos

Greenhouse

Low Pressure

Silver iodide

CAREER POSSIBILITIES

- CARTOGRAPHER
- EARTH SCIENTIST
- ENGINEER
- GEOLOGIST
- SEISMOLOGIST
- VOLCANOLOGIST