

Will it be pouring tomorrow?

Subject: Mathematics

Grade Level: 9th – 11th

Rational or Purpose: This lesson is designed to broaden students' perspective on the application of probability. Students should already know the basic concept of probability, as simple as the probability of getting heads in coin toss. They will understand how probability applied in weather and climate and affect our daily life.

Materials:

Flood charts

Weather forecast template (optional)

Lesson Duration: 40 minutes

TEKS Objectives:

111.32. Algebra I (a) (1)

111.33. Algebra II (a) (1)

Background Information:

When we look at the weather forecast, sometimes it indicates that there will be a certain percentage of chance of raining the following day. The way meteorologists obtain the probability is by running numerous calculations in their super computer. The computer will follow models and simulate possible scenario. After the calculations, meteorologists will be able to tell how likely it will be sunny, rainy, or stormy in the future. As you should know, weather is always changing, and sometimes very rapidly. The accuracy of the probability decreases as the forecast period lengthens. For example, hurricane tracking is of interest of many agencies (both public and private). When there is a hurricane, different agencies may publish different forecasting hurricane paths corresponding to their models. Sometimes there is no general consensus between the agencies. However, their forecast can help government and people to prepare for possible hurricane strike.

In climatology, we gather the weather information of at least 30 years to conclude the climate of a particular location. Therefore, it consists of many statistical calculations. At Beijing, China, as officials are preparing for the Olympics 2008, they realize that raining could be a problem for events in the uncovered gymnasiums. They look at the climate of Beijing and conclude that there is a 30% - 45% of raining in August. To resolve the raining problem, they decide to use silver iodide, if necessary, to interrupt the water vapor condensation process.

Activity

To familiarize students with the topic, teacher can project a weather forecast website in the front of classroom. It will be best if the forecast consists of any rainy, stormy, or snowy weather because it will state the chance of raining, etc. (If your region will not rain in the following week, you may either postpone this activity or use weather forecast of another city to meet the same purpose.)

For some students, they may have a perception that weather forecast is never accurate. Teacher is welcome to help students to elaborate why they think weather forecast is always inaccurate.

Teacher will lead students to think about some weather phenomena that involve probability. Examples are earthquake, flood, hurricane, etc. Teacher has the freedom to pick any phenomenon to expand with the students. In here, flood situation will be used as an example of activity.

In hydrogeology, a duration curve, or flood frequency discharge diagram, is used to indicate the probability of raining at different level. The way of representation of probability here is not by percentage, but by the years of occurrence. Usually, the very severe flood occurs rarely. Such flood may be said as a “hundred-year flood” because it only happens once in a hundred year, i.e. very slim chance. One of the applications of this flood chart is for government to decide what should be done to best protect the safety of people. Another application of it is for insurance company to assess the cost of house insurance. If a house is located in a region that may suffer flood in a high frequency, the home owner should expect a higher-than-average insurance cost for the house.

If teacher would like to use earthquake as an example for the students, teacher should prepare data and charts of past earthquake events of a certain location. For hurricane, teachers should prepare data on hurricane visit frequency and hurricane strength.

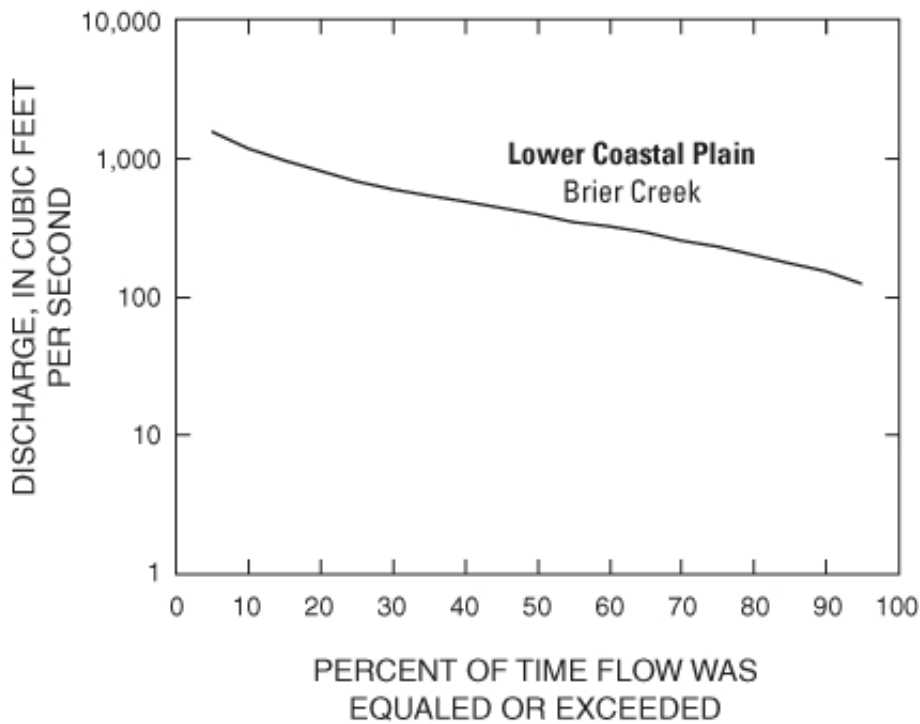
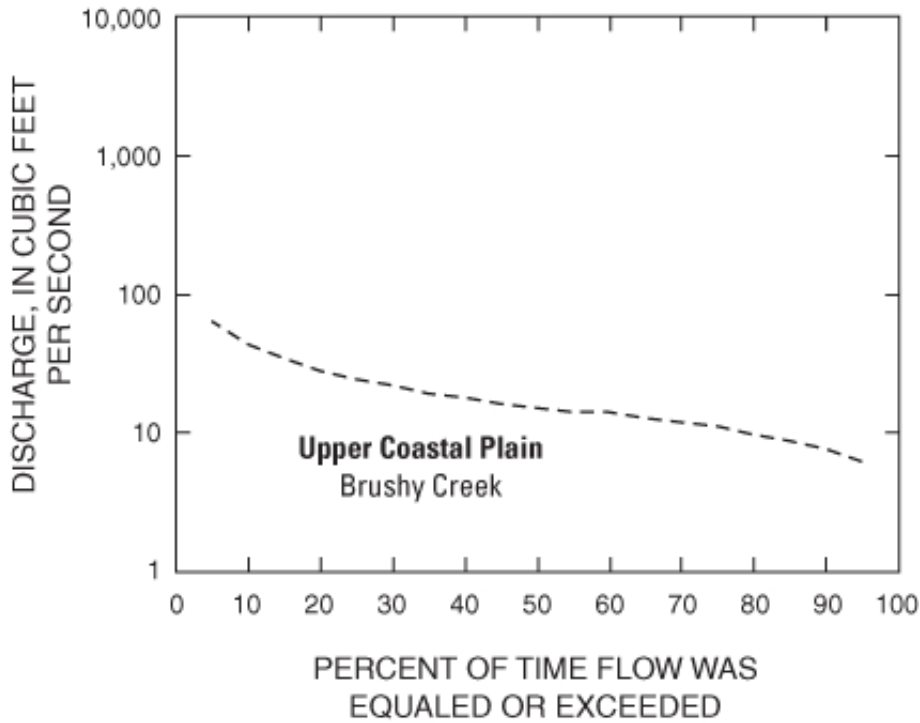
Procedure

1. Project a weather forecast in front of students. It will be best to have chances of rain, storm, or snow in the forecast. Teacher will assess students' knowledge on weather forecast or application of probability on daily life.
*** Teacher may ask students to create their own “reasonable” weather forecast by using any weather station forecast as a template.*
2. Students must have correct concept on the practical use of probability before moving on. Teacher will display a duration curve to students. Students can spend 3 – 5 minutes to analyze the chart. Encourage students, in groups, to think about what this chart is used to represent. If they believe they have come up with the correct way to interpret the chart, ask them to test their interpretation with other flood charts.

3. Students are encouraged to volunteer explaining their interpretation of the chart. If time allows, every group will have a chance to interpret their duration curves. Then, teacher can ask students to compare which location has a greater probability of suffering different severity of flooding.
4. Now students understand how probability incorporates into daily such as weather and climate. After comparing different duration curves, students should know that it is very important to know the climate before owning any properties. People living in area with more occurrence of severity weather are subject to a higher risk of property loss. To protect the properties, there are two simply ways: either not live there or buy insurance for the house.
5. Practically, insurance company evaluates the risk of your property and comes with the premium charge for protection. This applies to any (car, house, property, health, etc) insurance. Students are welcome to share their knowledge on any type of insurance in the class.
6. To conclude the activity, teacher should remind students that it is always better to learn more knowledge and know how to apply it practically in daily life. For example, in today's activity, if students can retain this knowledge until they grow up, this may save both their home insurance money and their precious lives and family from severe weather.



Duration Curves Diagram for Students



Sources: USGS Scientific Investigations Report 2004-5265

