Keep Your Eye on the Sky - Clouds and Weather

Student Worksheet #1: The Clouds Below

Name:

How do meteorologists predict and forecast our weather? Meteorologists use weather instruments to measure weather factors such as temperature, humidity, wind speed and direction, and air pressure. All of these can be measured on the Earth's surface (Surface Readings), but how do they get the images from space? The answer is satellites! Use this Web site: http://cimss.ssec.wisc.edu/satmet/modules/sat_basics/orbits.html to learn the two types of weather satellites used to produce the day and night cloud images that indicate the weather below.

1. Define satellite:

2. What does POES stand for?

3. What does GOES stand for?

4. What is the difference between POES and GOES?

5. How high above the Earth does each of these satellites orbit?

Click “Continue” to go to the next page (Geostationary Orbit)

6. Draw a diagram of a geostationary orbit:

7. Why is a geostationary satellite orbiting over the equator?

8. List the four geostationary satellites and their views of Earth:

   - _____
   - _____
   - _____
   - _____

9. How high above the Earth does each of these satellites orbit?

Click “Continue” to go to the next page (Polar Orbit)

10. Draw a diagram of a geostationary orbit:

11. Explain the orbital path of polar satellites: Note: In reference to satellites, the term “swath” means the path covered by one satellite as it orbits from pole to pole.

Click “Continue” to go to the next page (Satellite Remote Sensing Instruments)

12. Define radiometer:

13. What is the function of the two imagers on weather satellites?

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(a) Amphipods were exposed to test sediments, and the number of animals alive after 10 days' exposure was used as an indicator of toxicity;

(b) Clam larvae were exposed to water that had been mixed with test sediments and then filtered to remove sediment particles; normal development and survival after 48 hours' exposure were used as criteria of toxicity;

(c) Microtox® bacteria were exposed to chemicals extracted from sediments using dichloromethane (an organic solvent); and

(d) Chemical analyses were conducted to determined the concentration of a wide variety of potential contaminants, including heavy metals and various organic compounds.

Use internet research and/or library resources to answer the following questions:

1. What is a Microtox® test, and what does EC50 mean?

   _____

   _____

   _____

2. Define:
   Effects Range-Low (ERL)

   _____

   _____

   Effects Range-Median (ERM)

   _____

   _____

PAH

Table 1 summarizes information on contaminants in Long Island Sound known to come from various sources.

Table 2 summarizes some of the results from the sediment study. Toxicity data for tests of sediments from each site are compared to similar tests using sediment from a control area that were known to be non-toxic to the test organisms. Toxicity data in Table 2 are given as a percentage of the positive response in the relevant control test. A positive response may be survival (amphipods and clam larvae), normal development (clam larvae), or intensity of bioluminescence (Microtox® bacteria). So a value of 75 means that the number of organisms that survived exposure to a test sediment was 75% of the number of organisms that survived exposure to the control sediment. A value greater than 100 means that more organisms survived exposure to the test sediment than the number of organisms that survived exposure to the control sediment.

Contaminant concentration data are presented as Hazard Factors. These factors are related to previously determined values of ER-L and ER-M. An HF of 0 means that the concentration is less than the ER-L for that contaminant. An HF between 0 and 1 means that the concentration is between the ER-L and ER-M for that contaminant, so an HF of 0.5 means that the concentration is halfway between the ER-L and ER-M. An HF greater than 1 means that the concentration is equal to the HF multiplied by the ER-M. So an HF of 2 means that the concentration is twice the ER-M; a concentration of 3 means that the concentration is three times the ER-M, and so forth.

3. Which of the sources in Table 1 contributes the most potential contaminants?

_____

_____

_____

4. What do the data in Table 1 suggest about contaminants in Industrial Discharges?

_____

_____

_____
_____

5. Data in Table 1 suggest that Wastewater Treatment Plants account for a large proportion of oil and grease, phosphorus, chlorinated hydrocarbons, and some heavy metals. Why?

_____

_____

_____

6. What are the major contaminants associated with Urban Runoff? What are some possible sources of these contaminants?

_____

_____

_____

7. Why was more than one type of toxicity test used in this study?

_____

_____

_____

8. Why are toxicity tests needed in addition to chemical analyses of potential contaminants?

_____

_____

_____

9. Which of the four toxicity tests seems to be most sensitive to contaminants?

_____

_____

_____

10. What do the data in Table 2 suggest about the relationship between toxicity and concentrations of potential contaminants?

_____

_____

_____

Table 1

Estimates of Annual Loadings for Selected Pollutants to Long Island Sound from Seven Major Sources
(from Farrow et al. 1986)

Pollutant	Percent of Total Loading from Major Sources [a]						
	A	B	C	D	E	F	G
Total Nitrogen	37.6	2.1	<0.1	7.3	3.7	0.1	49.2
Total Phosphorus	66.2	0.1	0.1	7.9	0.5	<0.1	25.2
Heavy Metals							
As	51.7	<0.1	1.7	8.1	3.4	<0.1	35.1
Cd	28.2	<0.1	<0.1	5.1	<0.1	<0.1	66.7
Cr	18.9	4.2	0.4	7.1	8.0	0.4	61.0
Cu	31.9	3.4	5.2	7.2	1.2	0.2	50.9
Fe	4.9	<0.1	<0.1	15.7	34.8	2.2	42.4
Hg	25.4	0.6	0.1	7.3	<0.1	<0.1	66.6
Pb	14.7	2.3	<0.1	43.0	<0.1	<0.1	40.0
Zn	22.6	2.9	1.6	12.8	1.9	0.1	58.2
Oil & Grease	66.6	0.4	0.3	32.7	-	-	-
Chlorinated Hydrocarbons	90.3	1.3	-	5.4	3.0	-	-
Fecal Coliforms	1.0	<0.1	-	47.3	-	-	51.7
Sludge	100	-	-	-	-	-	-

[a] A= wasterwater treatment plants
B= industrial discharges
C= power plants
D= urban runoff
E= Cropland runoff
F= forestland runoff
G= upstream sources

(-) indicates no estimates made for this pollutant in the catergory.