Mapping the Jet Stream

Background information:

The jet stream is a relatively narrow band of strong winds found in the upper part of the atmosphere called the troposphere- approximately 10 to 15 kilometers above the ground. The location of the jet stream in the middle latitudes of the Northern Hemisphere is situated directly over the polar front - the boundary between the polar easterlies (cold air) and the prevailing westerlies (warmer air). This cold air/warm air boundary at the polar front sets the stage for winds that strengthen with increasing altitude until they reach a maximum strength near the upper troposphere. In fact, wind speeds in the jet stream can top 160 km/hr (100 mph).

The jet stream in the middle latitudes travels in an easterly direction across North America. Westbound aircraft understandably avoid the jet stream because it is a head wind, whereas eastbound flights seek to benefit from it as a tailwind.

Like the polar front, the jet stream undergoes important seasonal shifts. It strengthens in the winter as the polar easterlies move southward. Conversely, it weakens in the summer when the polar easterlies move northward and the temperature differences between the easterlies and westerlies is less. The average summer location of the jet stream is across southern Canada while the average winter position is across southern United States. These positions are long-term averages; the jet stream actually weaves over a considerable range of latitude from week to week, and even from one day to the next. As a rule, when the jet stream is south of your location, the weather tends to be relatively cold and when the jet stream is north of your location, the weather tends to be relatively warm.

Procedures:

1. Using Table 1, copy the high altitude wind speeds for each corresponding city. Write the speed fairly small, just under the "call" letters for the city.
2. Once you have all the wind speeds on the map in the correct location, connect the locations with the same wind speeds with a thin pencil line. These lines are called isotachs. (iso = same; tach = speed) ** Isotachs can never cross each other for if they did, it would indicate that there are two different wind speeds in the same location.
3. When all isotachs have been drawn (so all cities have been connected to some other city), you are now ready to draw the jet stream. Starting at the west coast, lightly sketch a "tube" like structure that follows the strongest wind paths. The strongest winds should be inside your "tube" while the slower winds fall on the outside of the "tube".
4. All of the locations north of your jet stream are experiencing cold temperatures whereas locations to the south would be experiencing warmer temperatures. The location of the jet stream influences the temperature, wind direction, and precipitation that a particular area will experience.

Analysis Questions:

1. What is a jet stream?

2. Where is the jet stream located?

3. How fast can winds in the jet stream get?

4. What direction does the wind in the jet stream travel?

5. Why do westbound airplanes avoid the jet stream?

6. Why does the jet stream get weaker in the summer?

7. This winter, where will the jet stream most likely be found?

8. Describe what temperatures will occur north and south of the jet stream?

Table 1 : **Station**	**Call letters**	**High altitude wind speed (km/hr)**
Albuquerque, NM	ABQ	60
Cape Hatteras, NC	HAT	60
Caribou, ME	CAR	60
Duluth, MN	DLH	60
Glasgow, MT	GGW	50
International Falls, MN	INL	50
Kansas City, MO	MKC	80
Miami, FL	MIA	50
Nashville, TN	BNA	80
New Orleans, LA	NEW	60
New York City, NY	JFK	60
Pittsburgh, PA	PIT	80
Rapid City, SD	RAP	70
Salt Lake City, UT	SLC	60
San Francisco, CA	SFO	50
Sault St. Marie, Ontario	SSM	50
Seattle, WA	SEA	50
Shreveport, LA	SHV	70
Tucson, AZ	TUS	50
Vald'Or, Quebec	VO	50