Weather in the West: A new perspective to weather education in a science center.

Jason C. Shafer
Dept. of Meteorology, University of Utah, Salt Lake City, Utah

Joseph D. Andrade
Dept. of Bioengineering, University of Utah, Salt Lake City, Utah

1. INTRODUCTION

Our weather experiences are based upon what we observe where we live, work, and play. In Utah and the adjoining regions, dramatic topography creates sharp contrasts in weather and climate over short distances. For example, it can be mostly sunny in the valley, while a blizzard rages in the nearby mountains. Weather in the West will offer a unique perspective to observing, questioning, and thinking about weather at the Utah Science Center. Weather in the West will allow visitors to explore how and why the mountains, valleys, basins, and lakes of the western United States affect their weather.

The Utah Science Center (USC) will be a new center for environmental awareness and education in an objective, informal, non-threatening, and open environment. The USC sees itself as the first "third generation" science center in that it will take visitors to new levels of interactivity. The USC has three main themes: (1) You are the experiment; (2) Energy, including the flow of energy in the atmosphere; (3) Home or Planet Earth and its environments and changes. The USC will open in spring 2007 in Salt Lake City and expects about 400,000 visitors a year (www.utah-sciencecenter.org).

Corresponding Author Address: Jason Shafer, Meteorology Dept. Univ. of Utah, 135 S 1460 E RM 819, Salt Lake City, UT 84112; Email: jshafer@met.utah.edu

2. OBJECTIVE

Our objective is to help develop more aware, educated, empowered citizens. This will be accomplished by inspiring visitors to observe and to be curious about how weather works, with a focus on the unique weather of the western United States. This will be accomplished by offering an engaging perspective that visitors can relate their weather experiences to. Leonardo da Vinci once said, "All knowledge is based on perspective." We feel that one of the greatest challenges to this project is providing visitors adequate perspective to connect their real world experiences so that they can have a tangible experience that is accurately connected to atmospheric principles and processes. Weather in the West exhibits will attempt to do this through a number of activities.

3. ACTIVITIES

Activities in the USC will consist of main floor interactive exhibits, demonstration carts, and small "theatre" demonstrations. In addition, special supervised activities in basement laboratories will be available.

Weather in the WEST will feature three phases of development. The core concepts of Weather in the WEST and their flow interac-

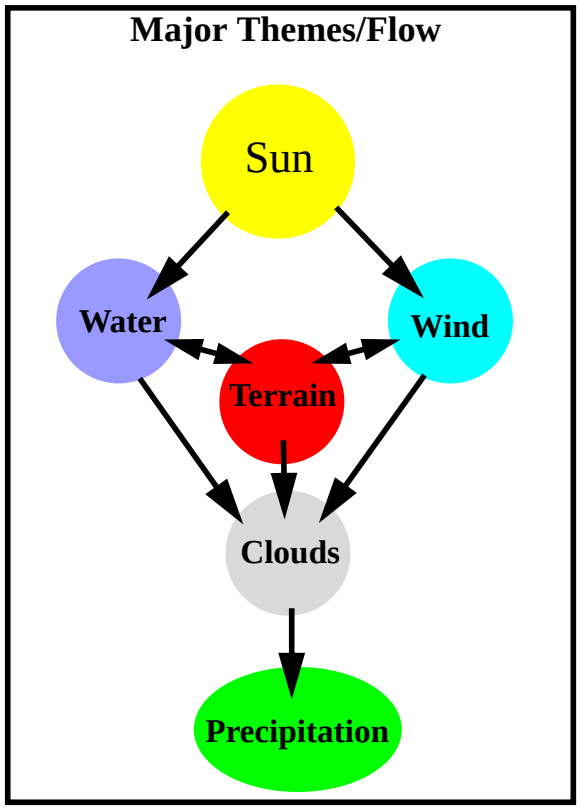

Figure. 1. Major themes and flow of Weather in the West.

tions are shown in Fig. 1. We will focus largely on how and why terrain (Fig. 2) affects components of weather across the western United States. Weather in the West is being designed, funded, and developed in 3 phases. Phase I and

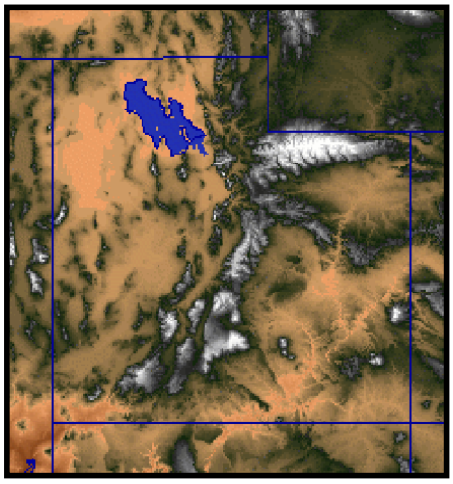

Figure 2. Complex terrain over Utah.

parts of II will be implemented upon opening; Phase II will be available 1-2 years later, and Phase III the following year.

Phase I Activities

- *Water Tower Barometers:* Two giant water barometers will bring pressure concepts to life. Visitors will see atmospheric pressure changes in one barometer and make their own changes in another barometer.
- *Electric Atmosphere*: Lightning and thunder are created by visitors.
- *Weather Central:* A *Weather Hawk* weather station (www.weatherhawk.com) collects weather observations outside and transmits them to an interface on the exhibit floor. Figure 3 shows a similar set up during a recent exhibition of Leonardo on Wheels (www.theleonardo.org/onwheels) the traveling portion of USC.
- *Wind power and you:* Connects the wind you can create with your power generation potential. We will create a windmill that can create electricity, using Leonardo da Vinci's windmill design. This may be combined with wind cannon.
- *Wind Cannon:* Human-powered wind cannon that allows visitors to create wind. Vis-

Figure 3. Weather Central Exhibit of the Leonardo on Wheels traveling science center.

itors will be able visualize, feel, and measure the wind they create.

- *Pressure, wind, and mountains:* Interactive computer-based exhibit will allow visitors to explore atmospheric pressure and wind at various elevations across Utah. Instrumentation at nearby ski areas will be exploited for this purpose.
- *Explore your weather*: Interactive computer-based exhibit will allow visitors to experience weather at various locations across the western United States. This exhibit will use web cams (e.g., Fig. 5) and data from MesoWest (www.met.utah.edu/mesowest) throughout the western United States.

Phase II Activities

- *Weather Tug-of-War*: Allows two visitors to generate a pressure gradient and produce fluid flow or wind. This will be constructed from a transparent tube connecting two chambers. The visitors can modify the pressure in these chambers while an anemometer or ball value within the tube moves.
- *Mountains, winds, and clouds*: Will use pictures (e.g., Fig. 4), time-lapse videos, and fluid flow chambers to show how mountains can affect wind and clouds.
- *Mountains winds*: visitors will be able to explore winds created or enhanced by terrain over the western United States. This will involve short explanatory video segments along with visualization of such winds.
- *Water all around you*: This will show how much water is in the air and clouds around you. Measurements from the GPS Integrated Precipitable Water network will be exploited.
- *Water Hog:* Details people's annual consumption of water versus what falls at their home. This will be accomplished by having two transparent tubes that fill up with water. The demand and supply of water across various regions of Utah will be highlighted.

Figure 4. Lenticular cloud over a cumulus ove the Wasatch Mountains.

Phase III Activities

- *Create a Cloud*: A warm cloud chamber allows visitors to create a cloud. Visitors will change the pressure and temperate of a moist chamber to produce or destroy a cloud.
- *Make it Snow*: A cold cloud chamber allows visitors to create a cloud and then make it snow. A storage freezer and video magnification will visualize the small snow flakes showing how the "Greatest Snow on Earth" is created.
- *Weather Lab*: Provides weather information for visitors to analyze and ultimately forecast their weather. It will use a series of wall-mount computer displays.
- *Can you beat the forecaster*? Visitors will make their own forecasts, and compete with each other, local meteorologists and personalities. Visitors will get to keep a print out, and a database will store visitors' numbers.
- *Natural Disaster*: Visitors will be able to create and explore avalanches, flash floods,

and other natural disasters over the western United States.

Within each of these phases, we will rotate through seasonal exhibits. For example, *Mountain Winds* may show how a cold pool/ inversion develops in the winter, or how monsoon thunderstorms develop over mountains in the summer.

We will strive to connect all of these activities to something that is tangible and real to visitors' participation in these exhibits to make their experiences meaningful. For example, many of the exhibits will feature live web cameras (e.g., Fig. 5) from various locations. These images will be shown alongside nearby

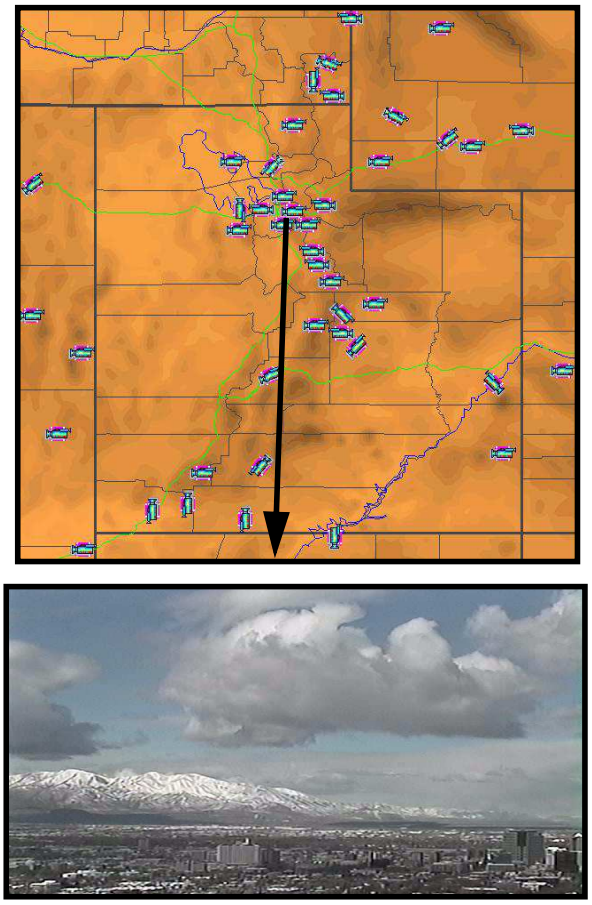

Figure 5. Web Camera map and example image

weather observations. In addition to these live images, we will likely use a suite of canned images that portray the evolution of clouds during major weather events.

4. SUMMARY

We feel that there is a tremendous potential for educating people about weather and their physical environment in a science center environment. Our approach to doing this involves connecting visitors' experiences to real weather in an interactive, entertaining, and mildly competitive atmosphere. We end by requesting your help with this project. We would like to share experiences and form links with other science centers and institutions. Your participation and input are especially needed in the following topics:

1. What activities could most effectively demonstrate the links between terrain and weather/climate?
2. What's the most effective way to connect one's personal weather experiences to fundamental atmospheric principles and processes?
3. Are you interested in being a partner?

Send your input to Joseph Andrade (see below) or Jason Shafer (see first page).

Joseph D. Andrade Ph.D.
Department of Bioengineering
University of Utah
Utah Science Center
c/o 949 Millcreek Way
Salt Lake City, UT 84106

Email: joeandrade@uofu.net
www.utahsciencecenter.org

ACKNOWLEDGEMENTS

We thank the members of the USC Weather Team, especially Christine Watson-Mikell, Jodi Saeland, Jim Steenburgh, and

Mike Anderson. We thank Jay Newlin at the Science Museum of Minnesota, Lis Cohen at the Museum of Science Boston, and the Mount Washington Observatory for helping our project by sharing their ideas and experiences. We also acknowledge in kind and grant support from Weather Hawk (www.weather-hawk.com), Utah State Office of Education, and the Utah Energy Office.