INFRARED IMAGERY

VISUAL AIDS FOR SNOW SCIENCE EDUCATION

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Abstract: Thermography or infrared imaging, has emerged as a method by which to study snow. Two independent articles were presented at ISSW 2010 as to its suitability. It is possible to make striking images that are saturated with temperature data. Every pixel has an associated temperature measurement. Images can be used in visual aids that explain changes in snowpack. During winter 2010/2011, a Flir P660 camera was used to capture thermal images of snow study walls. Features of this camera that are important to making the best thermal images are high resolution (640 x 480 pixels), a view finder that allows the thermographer to achieve good focus in a high glare environment and robust software for enhancing images and extracting data.

Educational illustrations that emphasize temperature differences of snow are developed from a high quality thermal image by choosing a color palette that suits the image, defining regions of interest within the image and then extracting and graphing the temperature data from that region.

The Flir P660 has helped us to capture useful images. The visual aids based on thermal images are valuable for teaching some concepts of snow metamorphism. We present examples of these teaching aids while continuing to build a portfolio of images for use in snow science education.

KEYWORDS: infrared imaging, thermography, visual aid, snow

1. Introduction

Infrared cameras can see and measure temperature differences in snow. Two independent articles presented at ISSW 2010 (Brusseau et al., 2010) (Shea 2010), described the relative accuracy of the measurements and some factors that affect accuracy. Environmental factors as well as the camera itself contribute to the quality of temperature measurements and resulting images. We chose a Flir P660 camera for the winter 2010/2011 efforts, with the goal of producing a portfolio of images that help to explain, visually, conditions known to affect snow metamorphism. We also sought to capture images of other interesting snowpack conditions.

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2. Methods

We used the Flir P660 imager. This camera has a resolution of 640 x 480 pixels. With each pixel capturing a temperature measurement, a total of 307,200 measurements are available per image. The P660 has an eyepiece viewfinder, similar to a video camera, that allows the thermographer to achieve good focus in the high-glare snow environment. We typically placed a small, shiny (reflective) object in the subject field to ensure focus was optimal.

Study walls were excavated as quickly and cleanly as possible. With the camera on a tripod, facing the wall, images were captured. Images were later downloaded to a desktop computer. Flir Examiner® software was used to study the images and to build educational illustrations.

3. Results

Different color palettes, available in the software, emphasize or de-emphasize features in an images. A visual aid is built by first choosing a palette that suits the image, then defining regions of interest and graphing the data from those regions. Displaying the image and graph next to each other makes it easy to understand many snowpack conditions. Layers, heating/cooling and temperature gradients are some of the conditions that can be illustrated effectively. All raw data remains unaffected as the steps of producing the illustrations are performed with the software.

4. Conclusions

The Flir P660 has helped us to capture images that would not be possible with a lesser camera. Some images show good examples of snowpack conditions that are described when studying snow metamorphism. We have made what we consider to be, useful visual aids to support teaching these concepts. As we continue to build a portfolio, we intend to make these visual aids available to educators and to follow these efforts with some analysis that will indicate if the visual aids are beneficial. With good feedback from users, we can direct our image capture efforts toward building a more instructive portfolio.

References

Brusseau, P., Latosuo, E. et.al. ISSW 2010 Suitability of Infrared Thermography To Examining
Temperature Profiles In Snow Pack

Shea, C., Jamieson, B., ISSW 2010 Use of Thermal Photography to measure Snowpack Properties