

# **New ARM Data Stream: Surface Images at NSA/AAO Sites in Barrow and Atqasuk**

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## **Abstract**

Web-enabled video cameras have been placed at both the Barrow and Atqasuk Atmospheric Radiation Measurement (ARM) Program sites to provide images of the surface surrounding the upwelling radiation instruments. These cameras give the researcher a visual indication of the surface cover. Hourly jpeg images from these cameras are now part of the ARM data stream and are being delivered to the ARM archive. In Barrow, the camera resides at the top of the 40-meter tower.

In Atqasuk, the camera is placed on a post attached to a piling near the 10-meter tip tower. An additional camera is placed on the instrument shelter and looks west over the SKYDECK instrument platform.

## **Introduction**

During the early stages of the ARM Barrow site development, various members of the ARM Science Team and ARM infrastructure voiced a desire to have an instrument that provides an indication of the snow cover at the site. This has been achieved at Barrow by placing a down-looking web camera on the 40-meter tower.

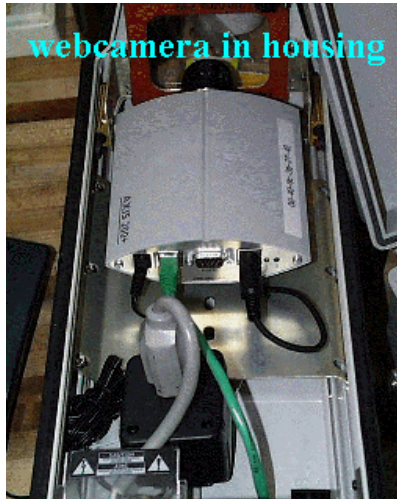
At Atqasuk, the camera is placed on a post mounted to a piling. Images are recorded once every hour and stored on the sited data system. These images are then transferred to the ARM archive. In addition to the down-looking camera, another web camera has been mounted that looks at the SKYDECK platform in Barrow.

## **Barrow Towercam Installation**

The cameras that we are using are Axis 200+ web cameras mounted in a heated Pelco environmental enclosure. These cameras have a 24-bit color, 768 x 582 charge-coupled device array with an f1 auto-iris lens.

The webcam has a built-in web server so that a separate computer is not required for operation but we use a laptop to buffer up the images for collection by the site data system. The webcam is connected to the local area network through the use of a Proxim RangeLAN wireless Ethernet bridge.

Figure 1 shows the camera mounted in the environmental housing. The camera has been operated 24/7 for the past two years without failure. Figures 2 and 3 show the camera and wireless radio frequency link mounted on the elevator of the 40-meter tower.



**Figure 1.** Webcam in environmental housing.



**Figure 2.** Barrow webcam on 40-meter tower.



**Figure 3.** Barrow 40-meter tower.

## Barrow Towercam Operation

The camera sends a 704 x 576 pixel jpeg image file once every hour to the buffer personal computer (PC) located in the instrument shelter. These files range in size from 25 to 90 Kb. These images are then collected by the site data system (SDS), packaged, and sent to the ARM archive. Images are also sent to the ARM web page at 10-minute intervals for public relations purposes but these images are not stored. Figure 4 shows an image from the Barrow towercam and identifies features that exist in the

image. Note that the towercam completely covers the surface that the downward-looking radiometers (Precision Spectral Pyranometer, Precision Infrared Radiometer, and Infrared Thermometer) that are mounted on the 10-m tip tower.



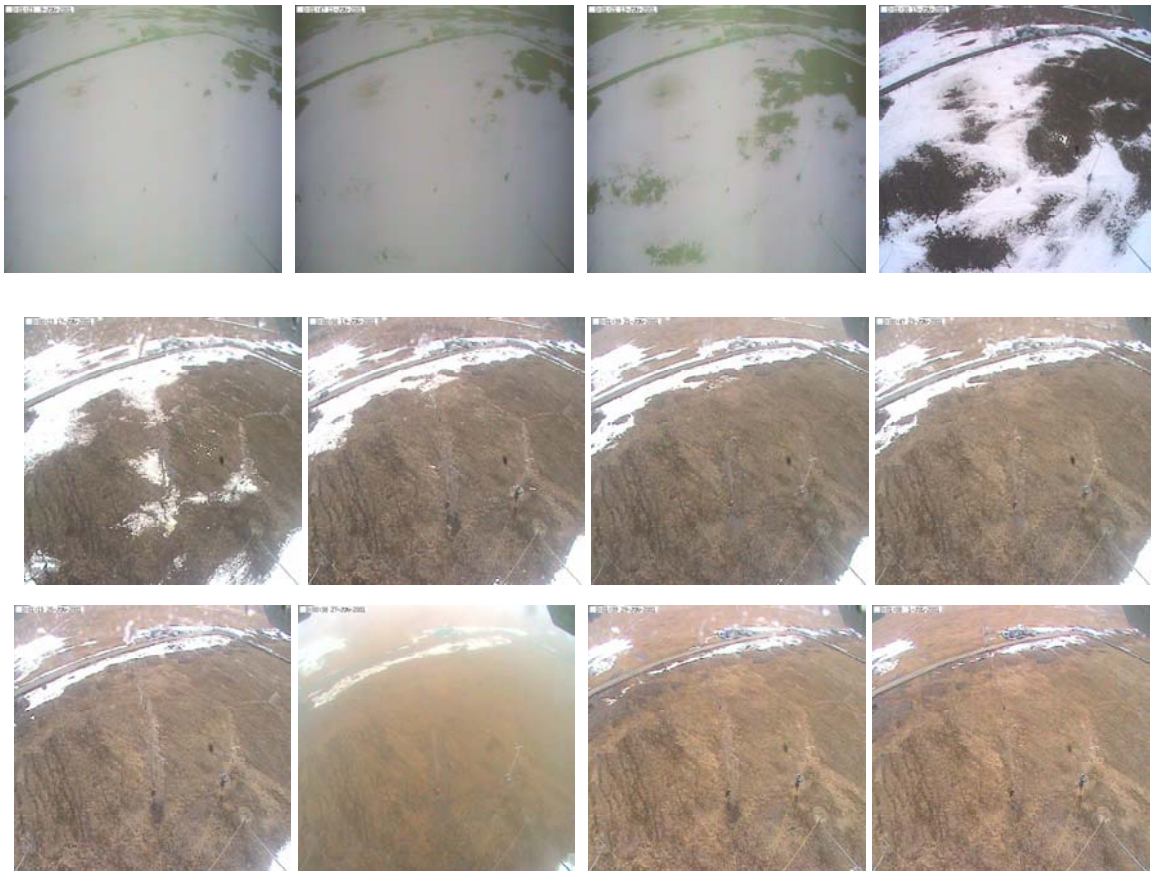
Figure 4. Annotated Barrow towercam image.

## Barrow 2001 Melt Season

Figure 5 shows a series of images taken by the Barrow towercam during the melt season in June 2001. Although images are stored every hour, for brevity, images are shown for every other day at noon local time. One can see that the melt is very fast!

## Atqasuk Towercam Installation

The tower camera at Atqasuk was installed in March 2002. Unfortunately, there is not a 40-meter tower at the Atqasuk site as in Barrow. We chose to place the camera at a height of approximately 3 meters looking toward the 10-meter tip tower that contains the up-welling radiometer suite.



**Figure 5.** 2001 Barrow melt.

The camera sends a 704 x 576 pixel jpeg image file once every hour to the buffer PC located in the instrument shelter. These files range in size from 25 to 90 Kb. These images are then collected by the SDS, packaged and sent to the ARM archive. Images are also sent to the ARM web page at 10-minute intervals for public relation purposes but these images are not stored. Figure 6 shows a recent annotated image from the Atqasuk towercam.

## Potential Uses of Towercam Images

The Whole Sky Imager and Total Sky Imager provide data for cloud cover. The images from these cameras can aid researchers in understanding what is happening with ground cover. Currently we are producing only the jpeg images. Using image analysis software, it will be possible to determine the percent of snow cover for a specific region within the camera field of view.

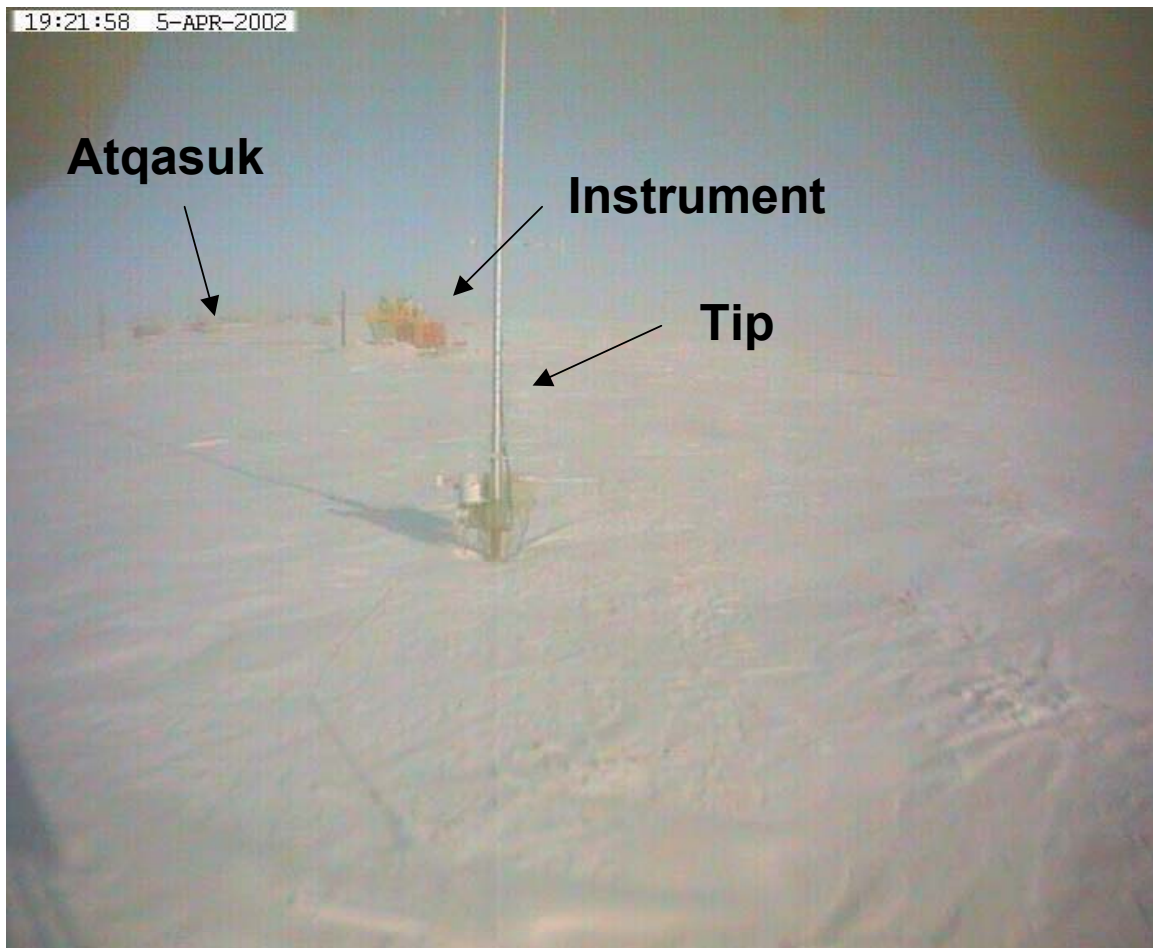


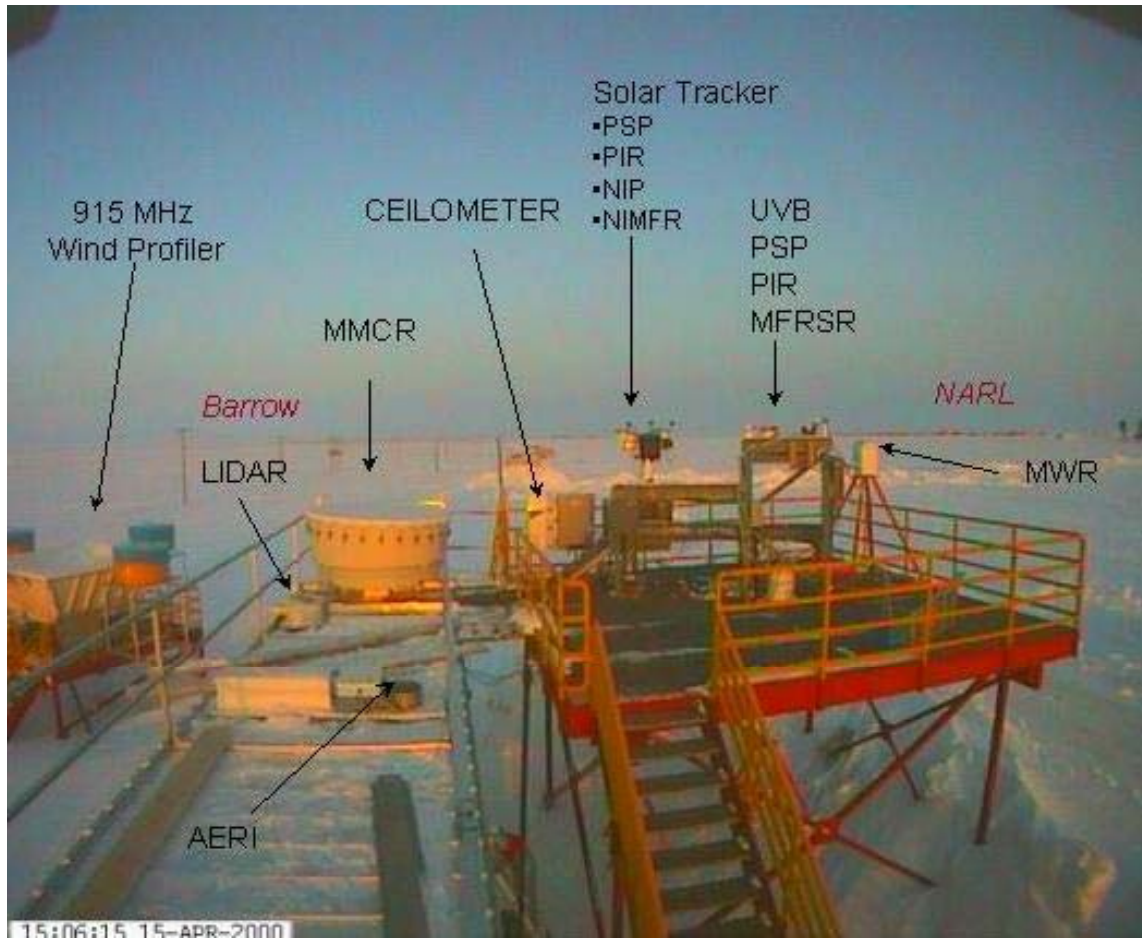
Figure 6. Annotated Atqasuk towercam image.

## Barrow SKYDECK Webcam

There is also a camera that points toward the SKYDECK instrument platform at the Barrow site. These data are not sent to the archive at this time. The scientific value is minimal but it has been very useful in determining the present operational conditions at the site. Figure 7 shows an annotated image from the SKYDECK webcam. These images are sent to the ARM web page at 10-minute intervals.

## Summary

Web cameras are installed at both Barrow and Atqasuk sites. Hourly images from the web cameras are being delivered to the ARM archive. These images may be used to visually monitor the ground cover under the up-welling radiometers, especially during the summer and fall transition periods.



**Figure 7.** Barrow SKYDECK annotated image.