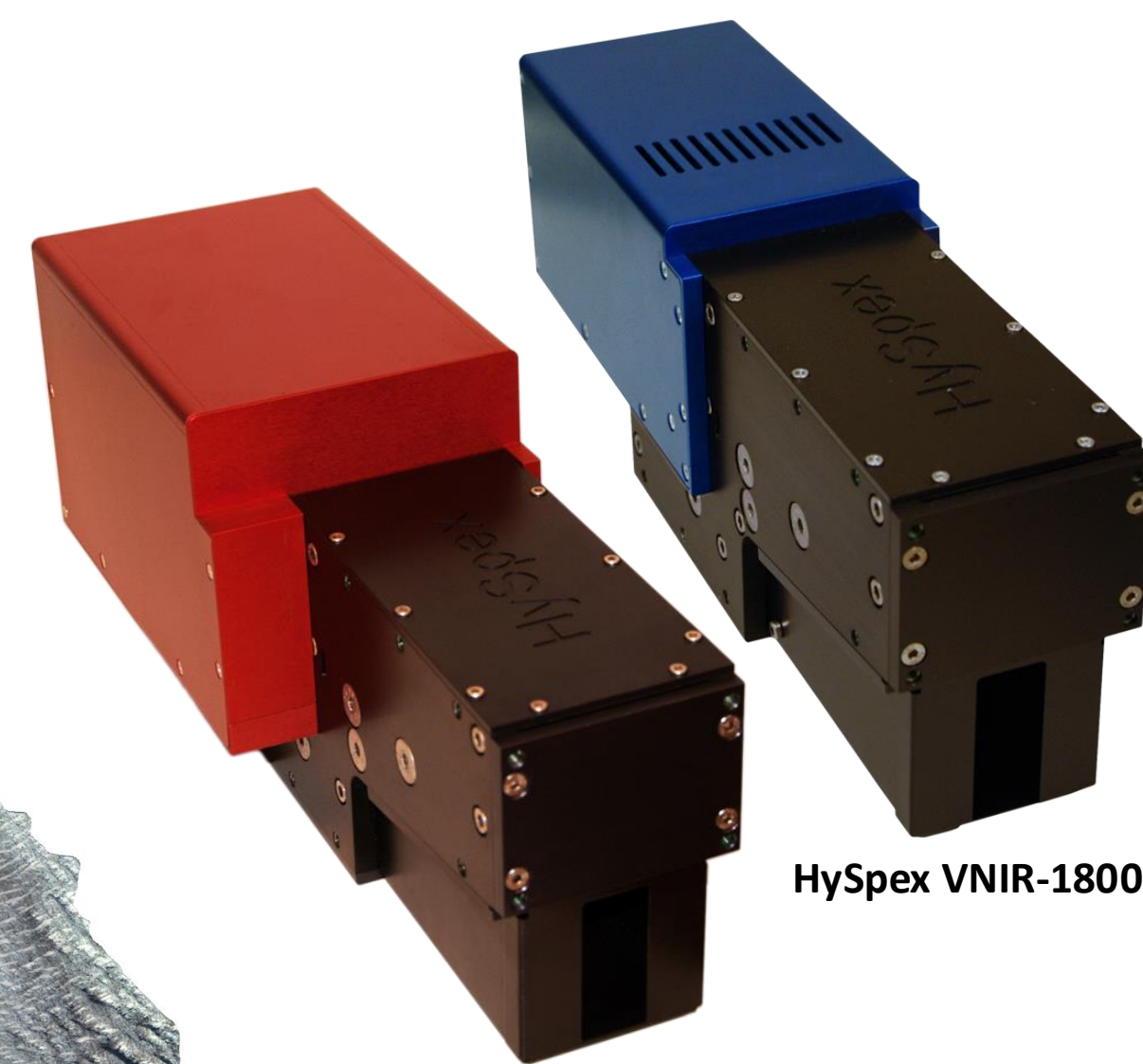


## Mendenhall Glacier

The Mendenhall glacier is a popular tourist destination near Juneau, Alaska. An outlet for the Juneau Ice field, the glacier covers a large range of altitude from around 1500 m (highest part imaged) down to near sea level. Mendenhall Glacier has been imaged by HyLab on four occasions when research objectives brought the research aircraft to the area. The glacier was covered in fresh snow at higher altitudes which switched to highly fractured ice lower down on the glacier.

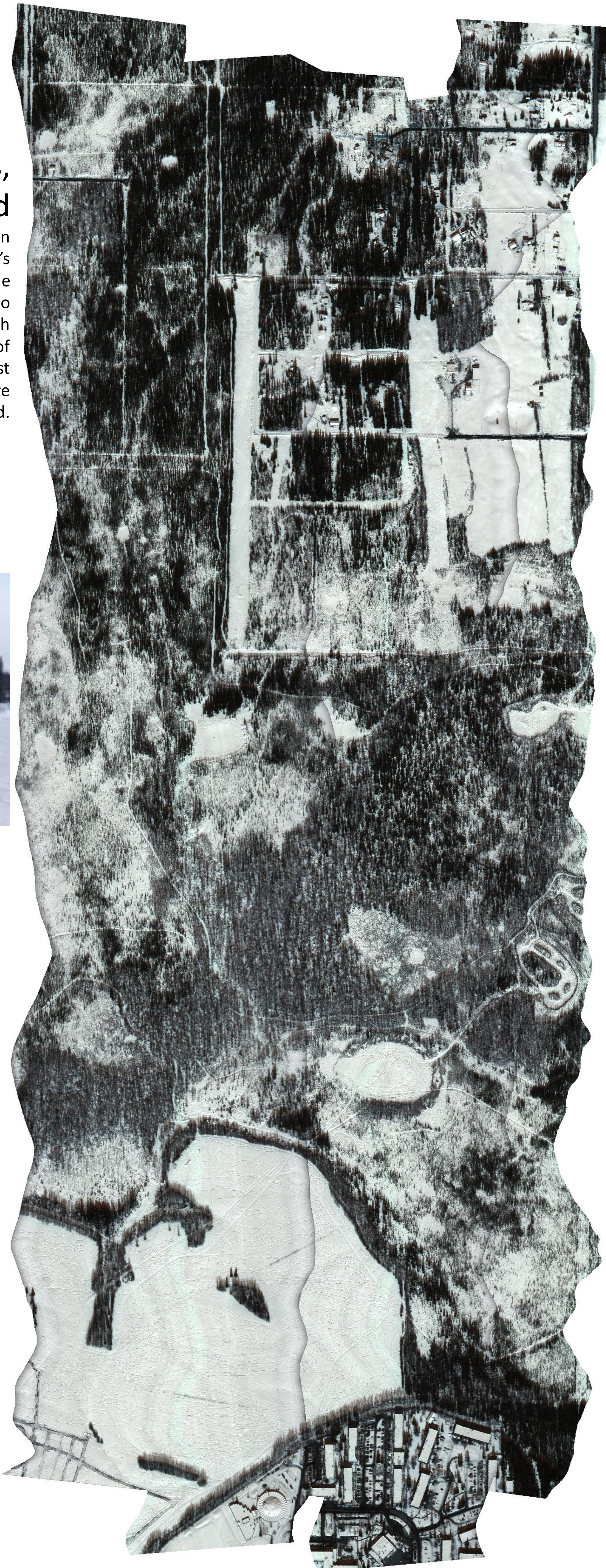
## Fairbanks, Creamer's Field

Creamer's Field is a mix of open terrain and boreal forest. Creamer's was imaged in April 2023 around the time of SNOWEX. The image to right is a mosaic of 6 flight lines which passed over the main open area of Creamer's field and to the north over forest and some cleared land. The flights were conducted just before the main melt period.



HySpex SWIR-384

HySpex VNIR-1800



## Grewingk Glacier

### Kenai Peninsula

The Grewingk Glacier in the Kenai Peninsula is one of the main drainages into Kachemak Bay. The region is drier than the Juneau region (Mendenhall glacier) and therefore the glacier often has less fresh snow at higher altitudes. The Grewingk Glacier has been imaged on several occasions by HyLab when the research aircraft was in the area for studies of Kachemak Bay. A publication is in review on the role of glacier fed creeks in enhancing turbidity in the Bay. Hyperspectral imagery of the Grewingk Creek outflow and its variability is shown below. Hyperspectral data has been used to better quantify the turbidity. The resulting relationships have been applied to the Landsat dataset providing a long term history of the impact of glacial till in the region.

### Introduction:

Hyperspectral imaging (the measurement of reflected light at high spectral resolution) of glaciers can provide a wealth of information on the current state of the glacier. The University of Alaska, Fairbanks Hyperspectral Laboratory (UAF-HyLab) has collected hyperspectral data on several Alaskan glaciers as well as seasonal snow. The UAF HyLab instruments collect spectral data from 450 to 2500 nm with approximately 1 square meter resolution.

The University of Alaska, Fairbanks Hyperspectral Research Lab: HyLab

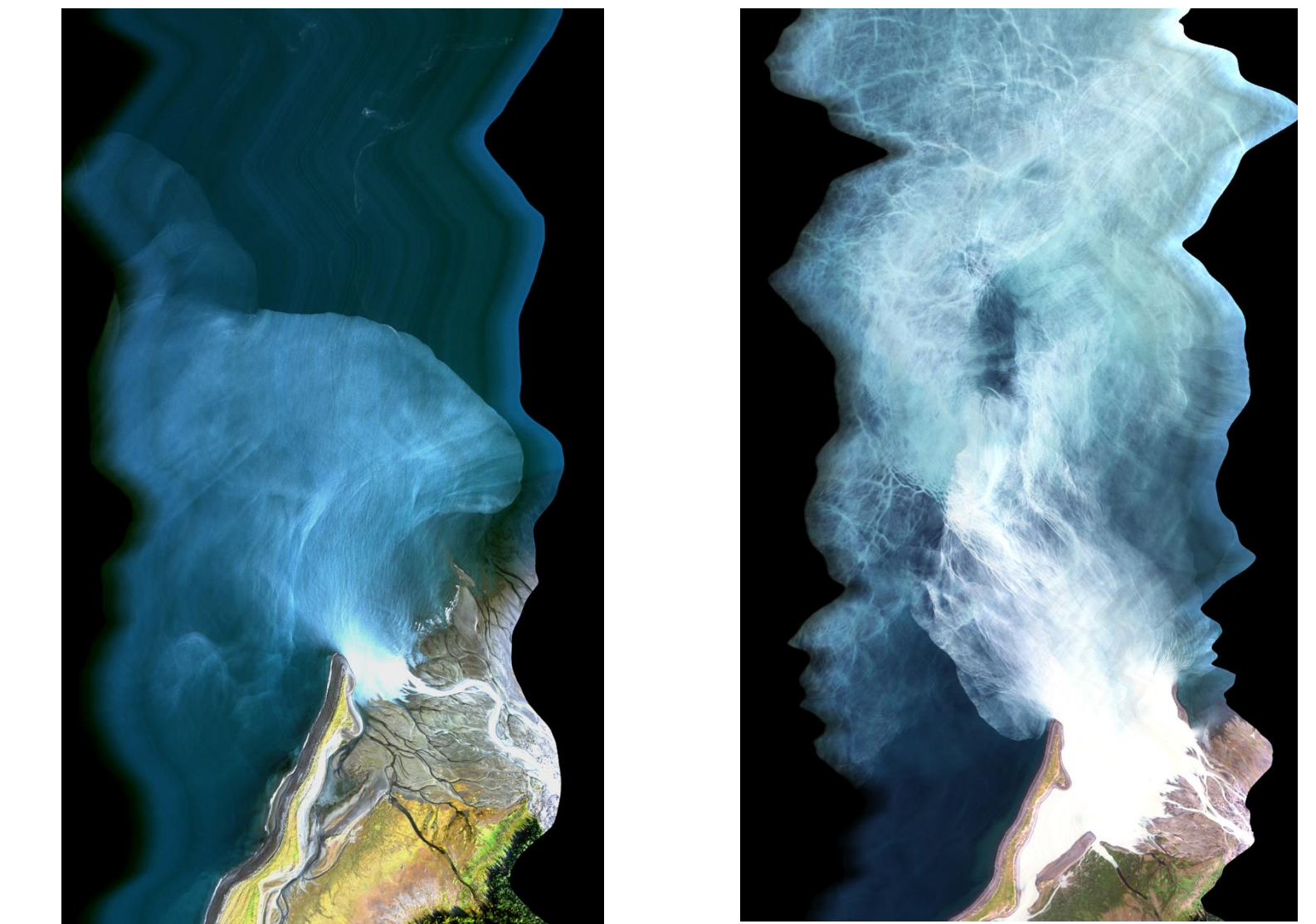
The National Science Foundation (NSF) Major Research Instrumentation (MRI) Program, funded the University of Alaska Fairbanks (UAF), to establish hyperspectral imaging capabilities in the State of Alaska. The MRI enables UAF to establish a new capability in airborne hyperspectral imaging that has not previously existed, and inherently opens doors to new basic and applied research, and research training. Lab hyperspectral cameras include HySpex VNIR-1800 (186 channels) and SWIR-384 (288 channels) cameras. Both cameras (474 channels total) are pushbroom Hyperspectral cameras that have low stray light levels, low sensitivity to polarization, and low smile and keystone effects (<10% of a pixel). The cameras have automatic electromechanical shutters for acquisition of dark offset. The VNIR-1800 unit is built on a Si CCD with 12 bit digitization and acquires data at a max frame rate of 160 fps. The SWIR-320m-e unit is built on an HgCdTe detector with 14 bit digitization. The SWIR FPA is equipped with 5 stage peltier cooling (monitored and PID regulated) to provide stable 195k temperatures and the camera can acquire data up to a maximum frame rate of 100 fps. The VNIR-1800 and SWIR-320m-e cameras have across track FOV of 17° and 13.5° respectively that can be increased to 34° and 27° respectively using a FOV expander that provides flexibility in terms of the ground swath width and pixel spatial resolution during airborne acquisitions.

Precise georeferencing is possible with the associated GPS and IMU data. The HySpex cameras are integrated with an IMAR iTrace RT-F400 IMU/GPS (Inertial Measurement Unit / Global Positioning System) unit in a mount with passive vibration dampening. The mount is compact and flexible to enable installation of the system in a range of aircrafts. The IMAR iTrace RT-F400 is a GLONASS-enabled GPS/IMU unit that records positional and angular information to an accuracy of 2 cm and 0.01° respectively with an update rate of 400 Hz. An IMU/GPS unit with high accuracy and update rate is essential for accurate direct georeferencing of raw hyperspectral datasets particularly those acquired from smaller planes.

### USGS PRISM (Processing Routines in IDL for Spectroscopic Measurements)

At HyLab, we are using PRISM extensively for critical minerals studies (see example to the right). PRISM comes with a database of spectra from different surfaces, mostly geologic, but some forestry and some snow and ice data. PRISM spectral libraries can be easily expanded with spectra from Malvern Panalytical ASD FieldSpec Spectroradiometers. With ground truth measurements of snow in the Fairbanks region and of glacier surfaces on nearby easy to access glaciers (Gulkana Glacier) we hope to develop methods to more accurately characterize glacier and snow surfaces.

### Grewingk Creek outflow during high and low runoff periods



### Example of PRISM processing for mineral detection

