

# Using GOES-9 Multispectral Imagery to Detect Clouds on October 28, 1996

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## 1. Introduction

This TA-lite will look GOES-9 multispectral imagery from October 28, 1996. The situation present is complicated. A storm system has recently left snow cover on the ground across much of Utah and Wyoming. We will look at various GOES-9 image data to determine what type of cloud cover is present in various locations.

## 2. Discussion of multispectral data

We will be looking at the fog/reflectivity product, visible imagery, and IR imagery from 1300Z to 1530Z on October 28, 1996. We will concentrate mostly on southwest Wyoming. The location of Rock Springs (RKS) will be shown in all the images. At 1300Z RKS was reporting a ceiling of 100 feet and a visibility of 0.3 miles. Try to use the 11 $\mu$ m, seen in [Figure 1](#), to determine the areal extent of the low cloud/fog that is present at RKS. Even when enhancing the IR image (see [Figure 2](#)) it is very difficult to determine the edge of the low cloud/fog. One might guess that the low cloud/fog extends over much of southwest Wyoming and northwest Colorado. NOTE: The IR enhancement seen in Figure 2 can be displayed on RAMSDIS by entering: EU REST IRTEMPS LOOP=YES

[Figure 3](#) shows the fog/reflectivity product at 1300Z. Recall that during the night-time hours the fog/reflectivity product is made from the fog product alone. The light gray areas are generally areas of water clouds (this is due to emissivity differences of water droplets at 3.9 $\mu$ m and 11 $\mu$ m). See TA 95-25 for more details on the fog product. The 1300Z fog product image shows that the areal extent of the low cloud/fog is considerably less than was suggested by looking at the 11 $\mu$ m IR image. [Figure 3](#) also shows a rather large area of cold cloud tops (consisting of ice) across eastern Utah. In southeast Utah these clouds have a mottled appearance due to the lack of sensitivity of the 3.9 $\mu$ m image channel to very cold temperatures.

[Figure 4](#) is the 1300Z fog product image with the ceiling heights plotted. This does show the lower ceiling heights associated with the fog/water cloud signature and higher ceiling heights associated with the black and mottled (ice cloud) signature. Of course, it must be remembered that the satellite is sensing from above the clouds and only sees the cloud top, while the surface

observation looks from below the cloud and detects the cloud bottom. Therefore, ceiling heights cannot be directly related to what is seen in satellite imagery.

At 1500Z RKS was reporting a ceiling of 100 feet and a visibility of 0.3 miles. Again try to use the 11um, seen in [Figure 5](#), to determine the areal extent of the low cloud/fog that is present at RKS. Even when enhancing the IR image (see [Figure 6](#)) it is very difficult to determine the edge of the low cloud/fog. One might guess that the low cloud/fog extends over much of southwest Wyoming and northwest Colorado. [Figure 7](#) shows that even using the visible (since it is now daylight) is of little use in detecting the edge of the low cloud/fog in southwest Wyoming.

[Figure 8](#) shows the fog/reflectivity product at 1500Z. Recall that during the day-time hours the fog/reflectivity product is made from the reflectivity product alone. The light gray areas are generally areas of water clouds (this is due to reflectivity and emissivity differences of water droplets at 3.9um and 11um). See [TALITE 96-08](#) for more details on the reflectivity product. The 1500Z reflectivity product image shows that the areal extent of the low cloud/fog is considerably less than was suggested by looking at the 11um IR image.

### 3. Loops of the multispectral imagery (not yet available)

It is often useful to look at animation of imagery to help identify cloud features. In this case the animation of the 11um IR and visible data gives little help in determining the edge of the low cloud/fog in southwest Wyoming. It does however, especially in the fog/reflectivity product loop, show the movement of the high (ice) clouds in northeast Utah over the low clouds in southwest Wyoming.

### 4. Other interesting features in the imagery

The IR data ([IR at 1300Z](#)) shows that the temperature of the water cloud at RKS is between -10C and -15C. This indicates that the cloud is likely made up of supercooled water drops.

The [RKS meteorogram](#) shows that the surface temperature during the 1300Z to 1500Z time frame was near -12C. This is another indicator that the cloud top is near the surface (of course dependent on the vertical profile of temperature in the area).

### 5. Summary

This case points out that the fog/reflectivity product is of great use during night-time and day-time to detect water clouds. It can be supplemented with the IR and visible data to make additional determinations of cloud characteristics.

Figure 1

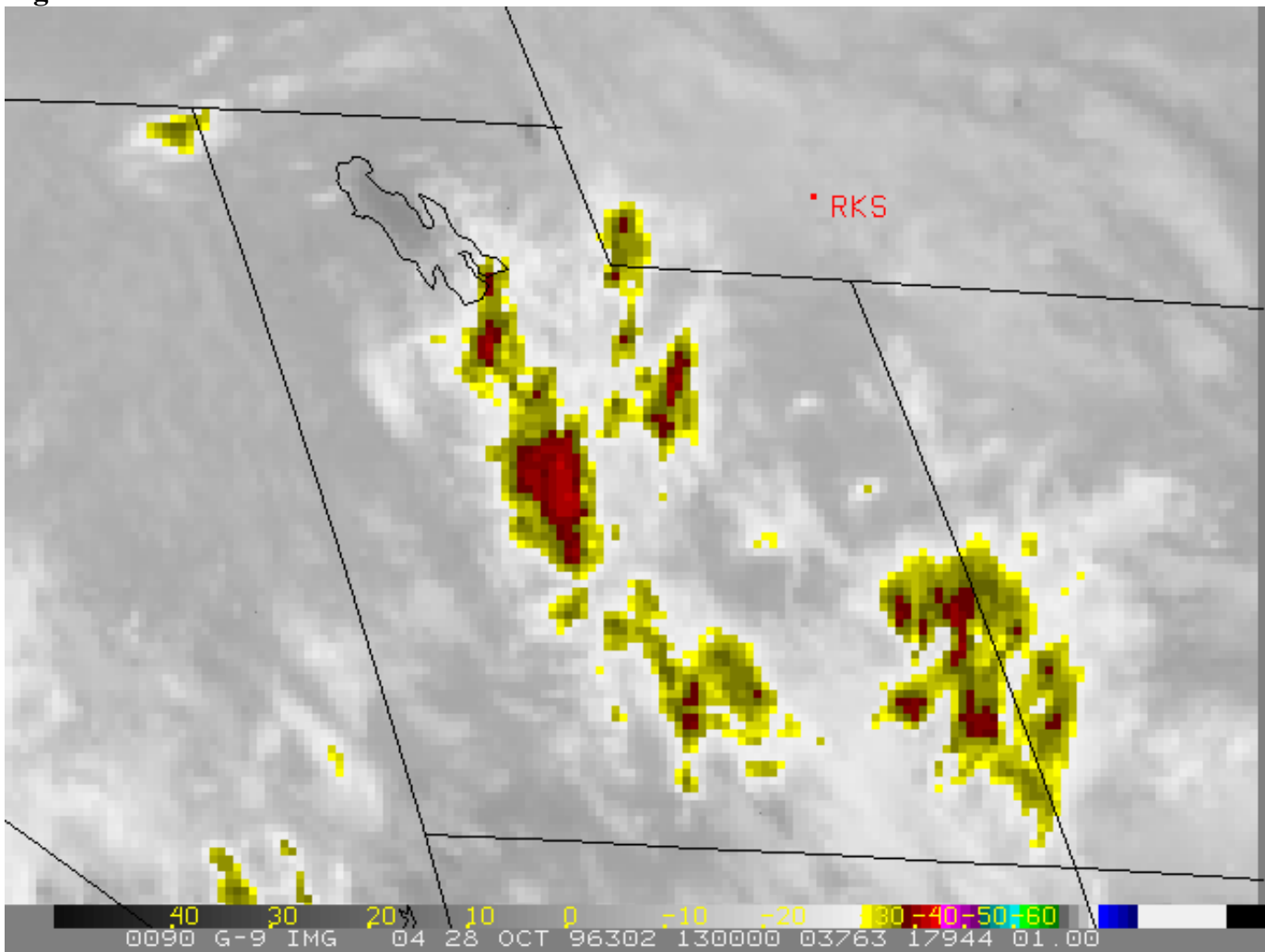


Figure 2

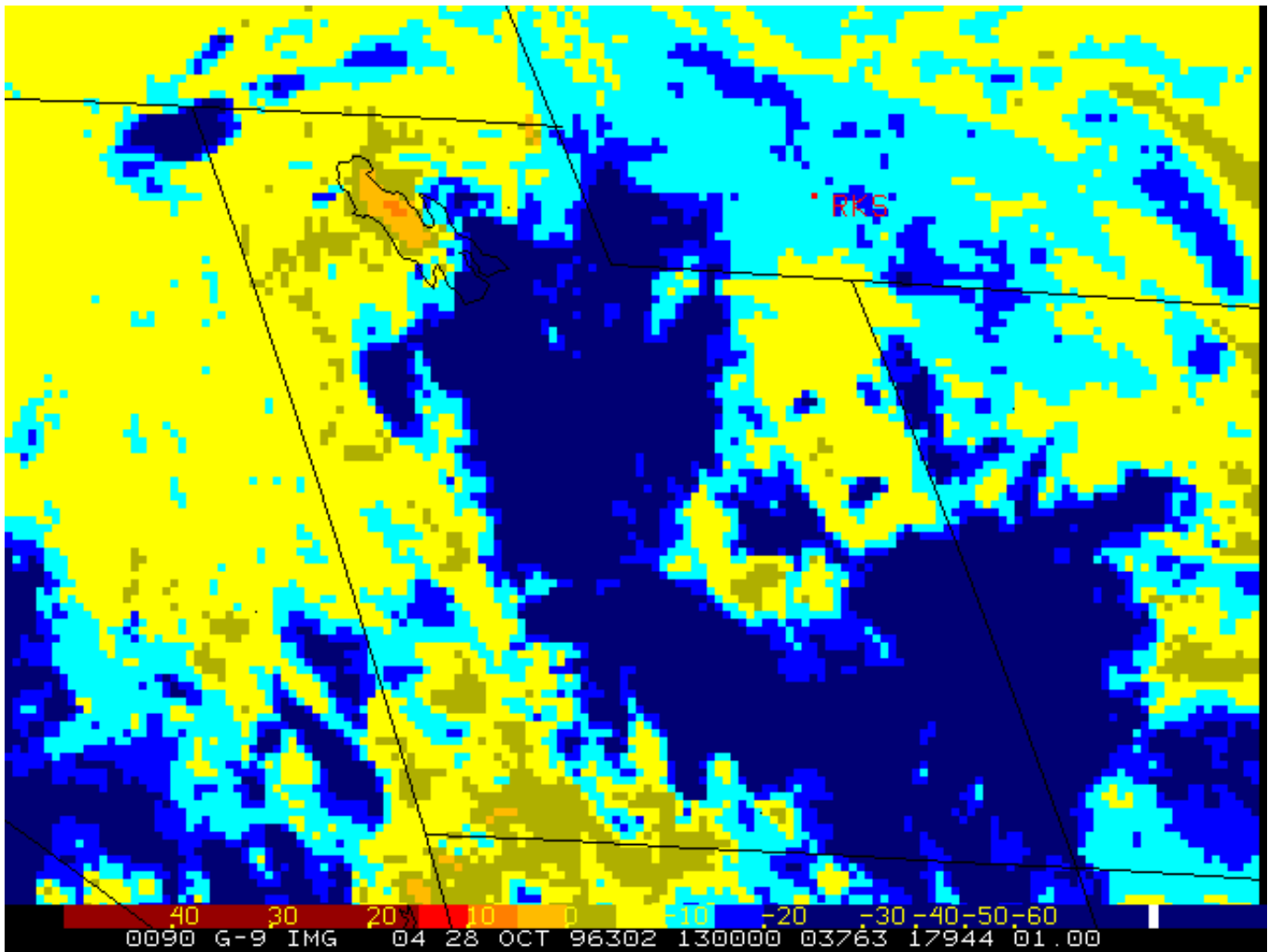
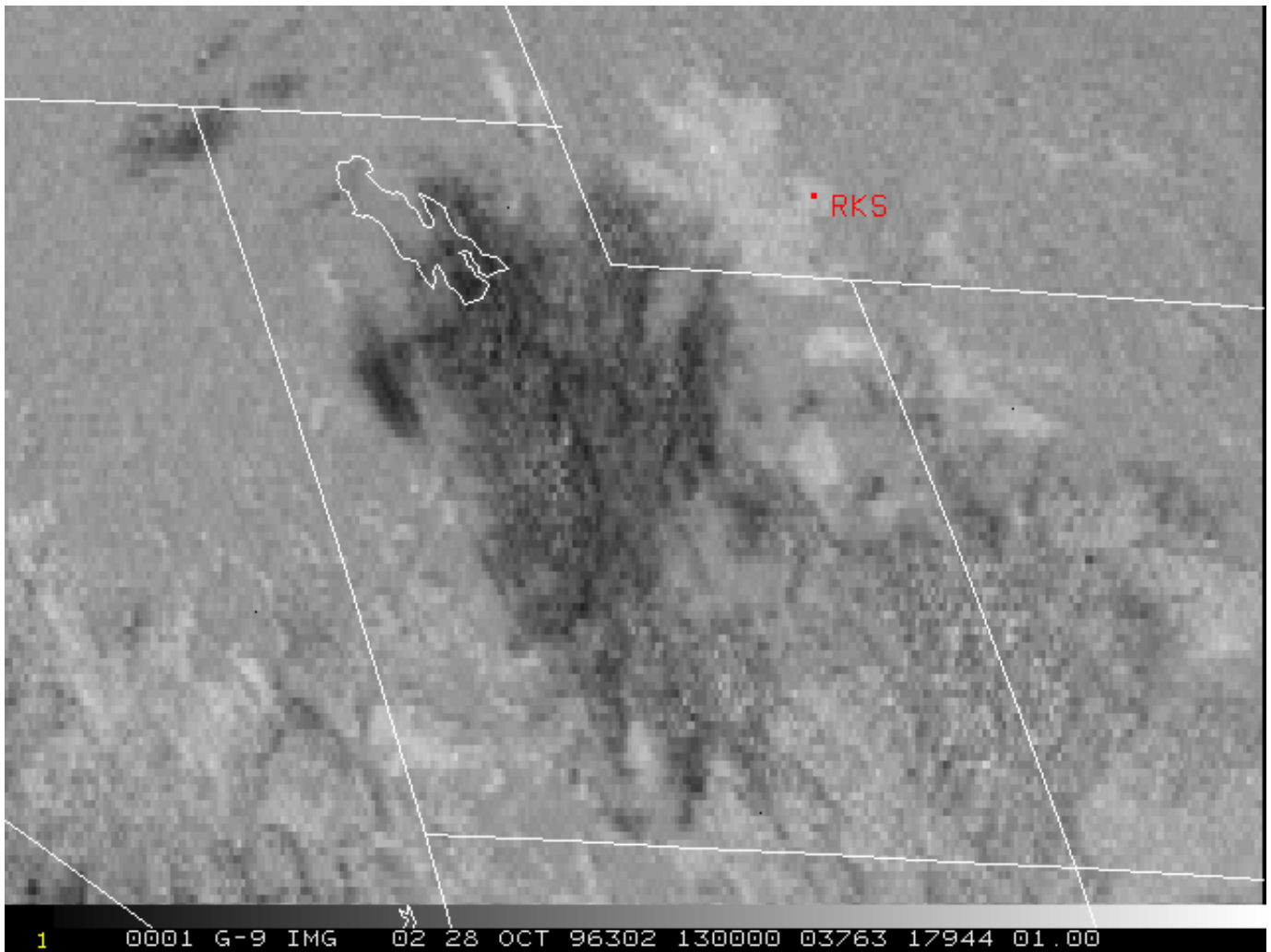
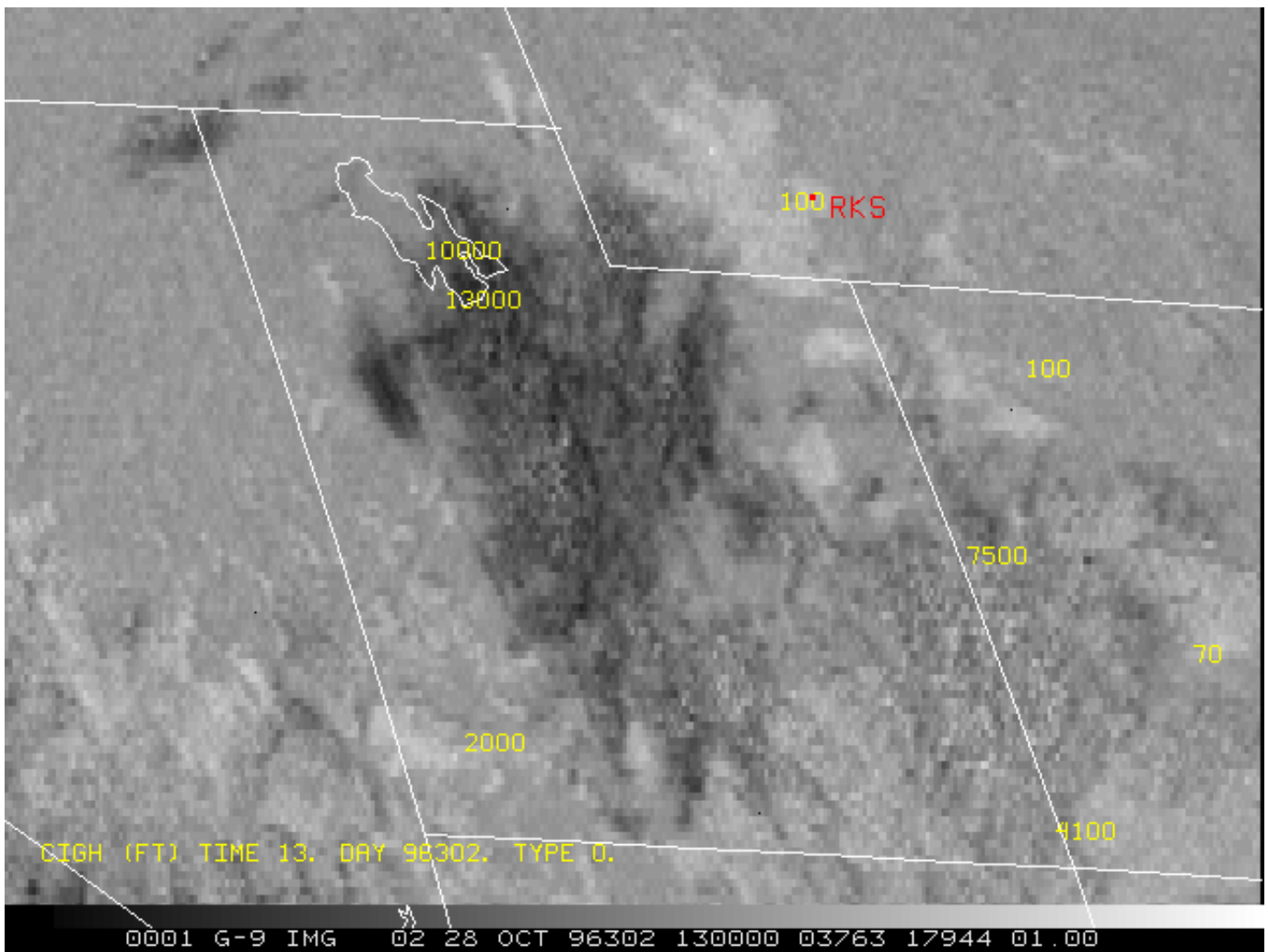


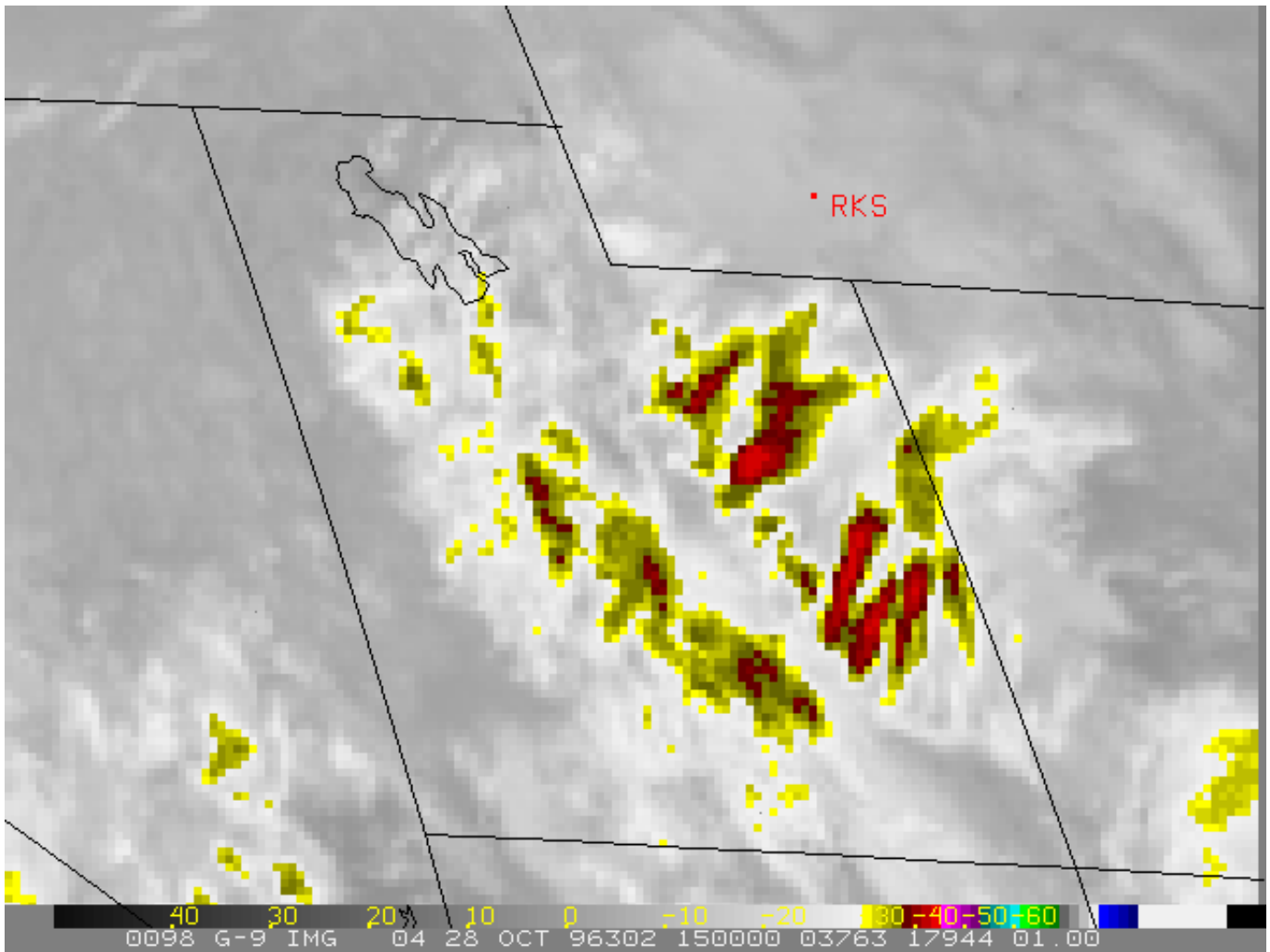
Figure 3



**Figure 4**



**Figure 5**



**Figure 6**

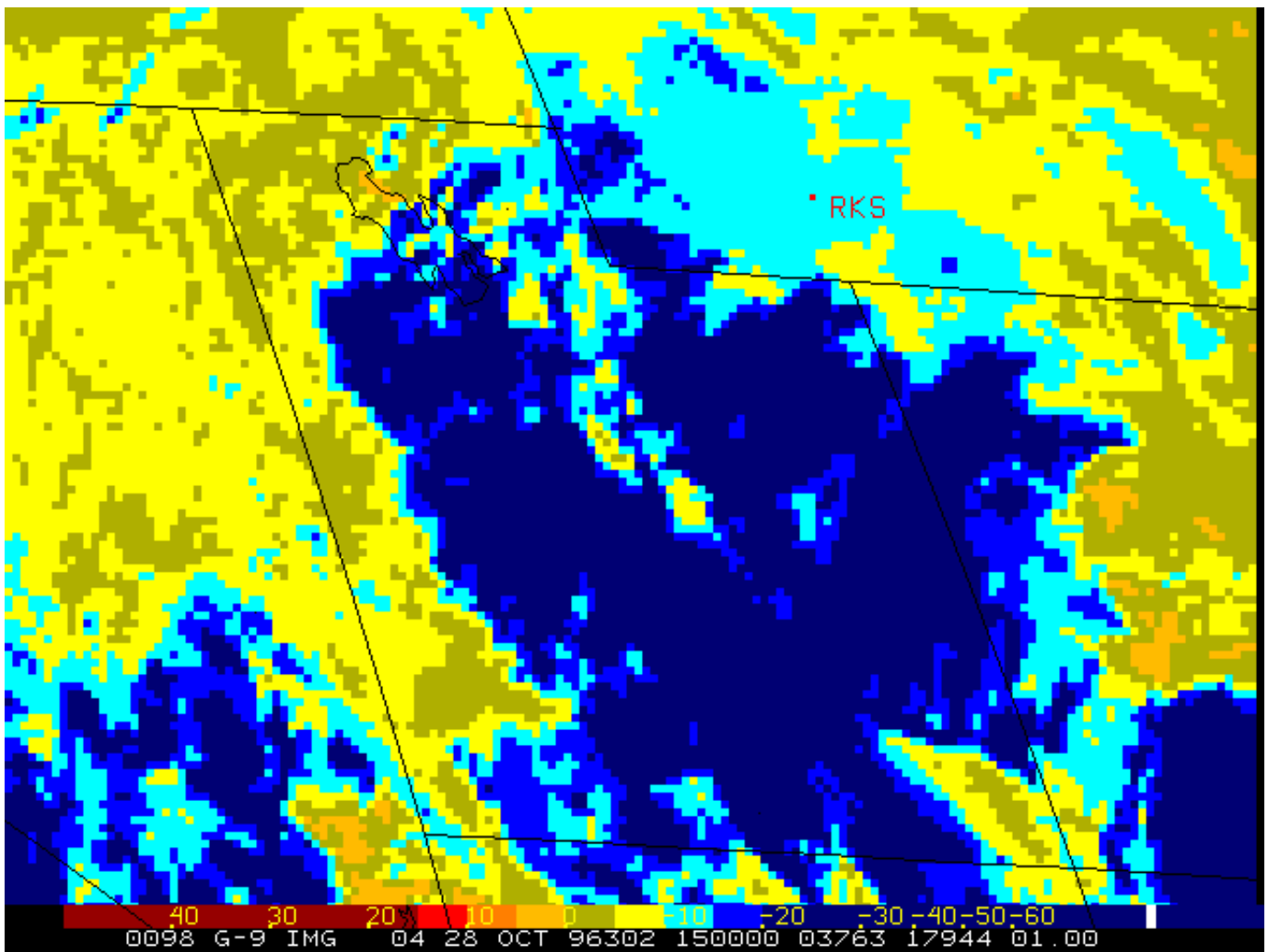
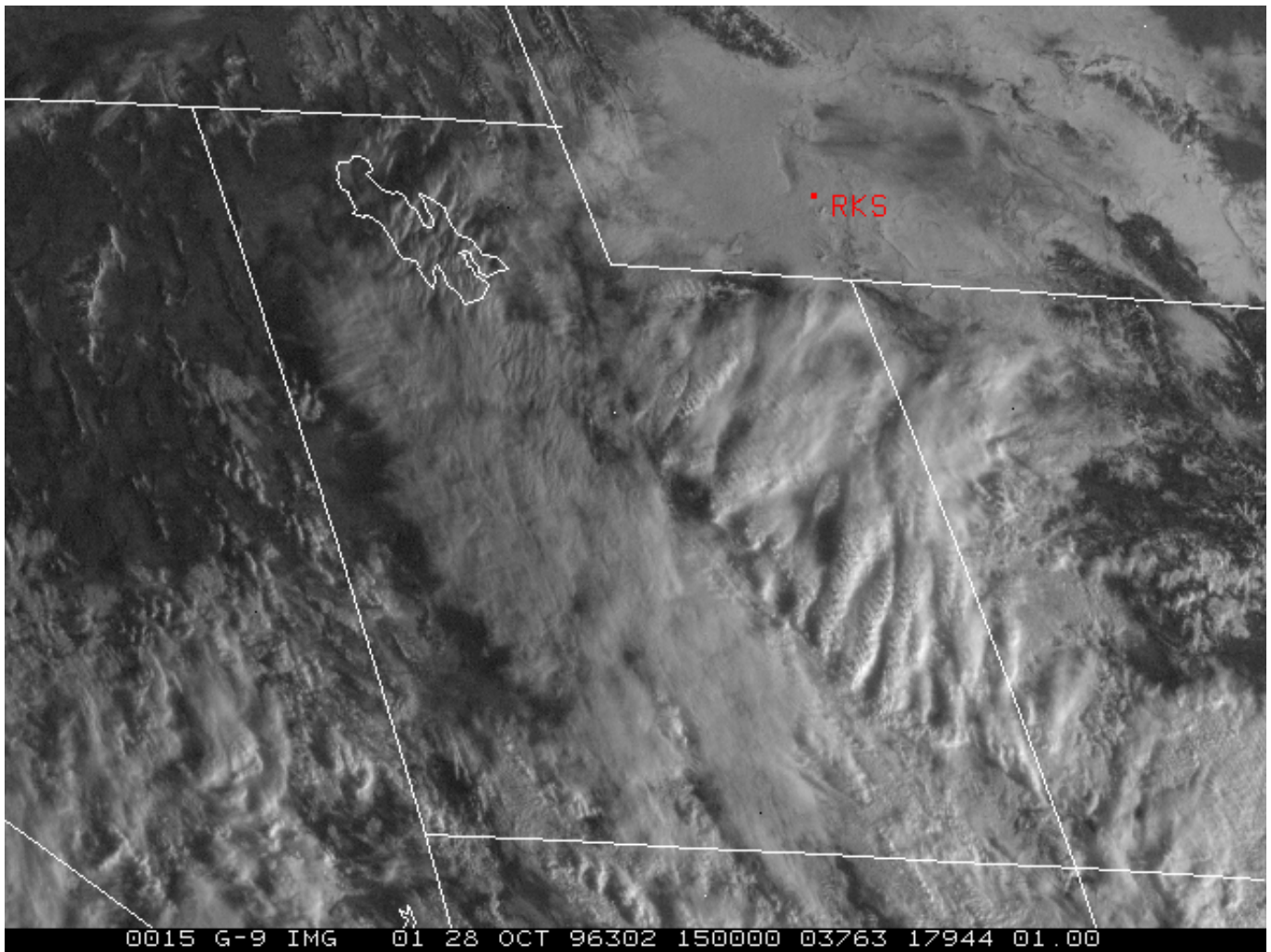
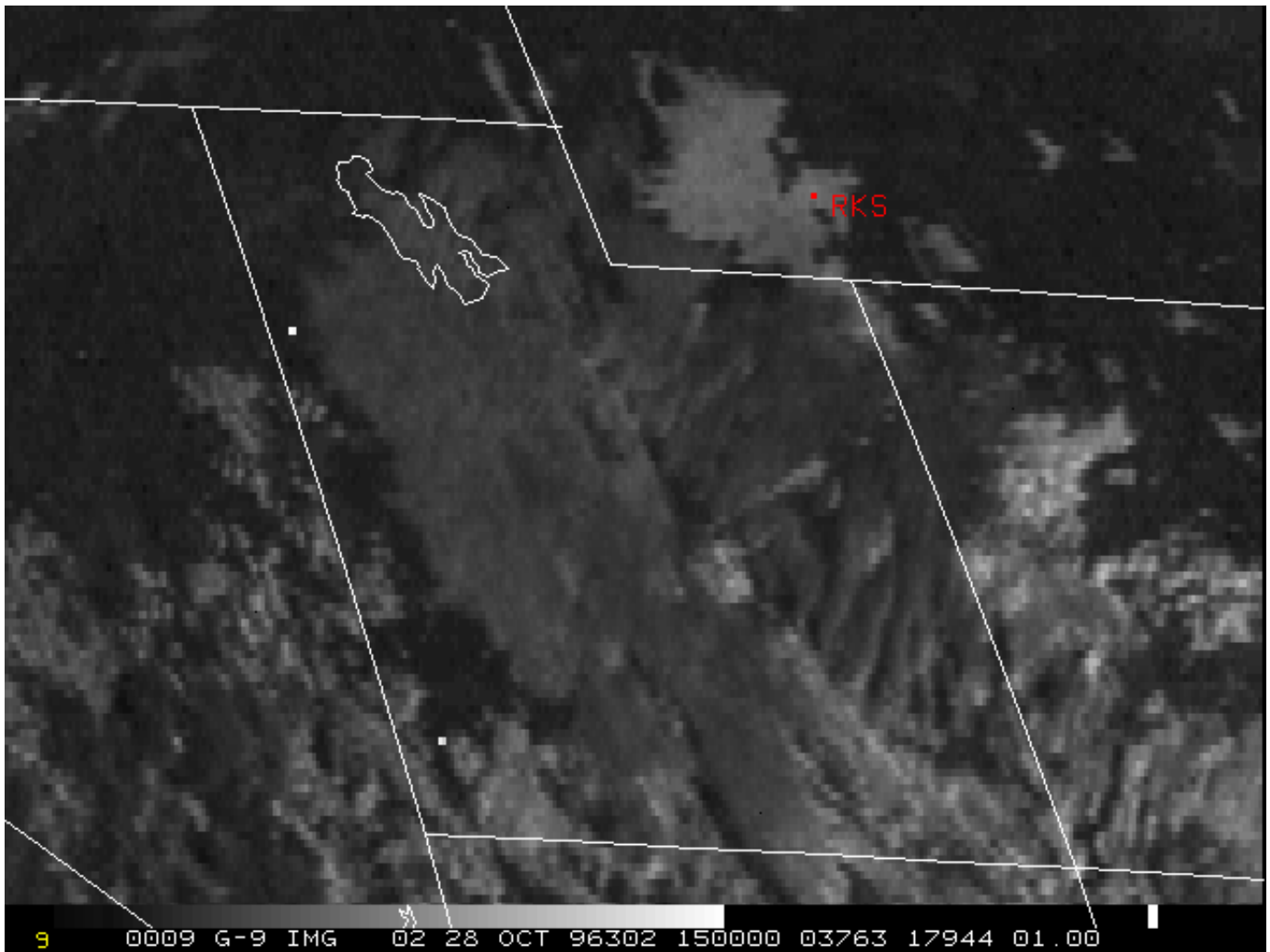


Figure 7

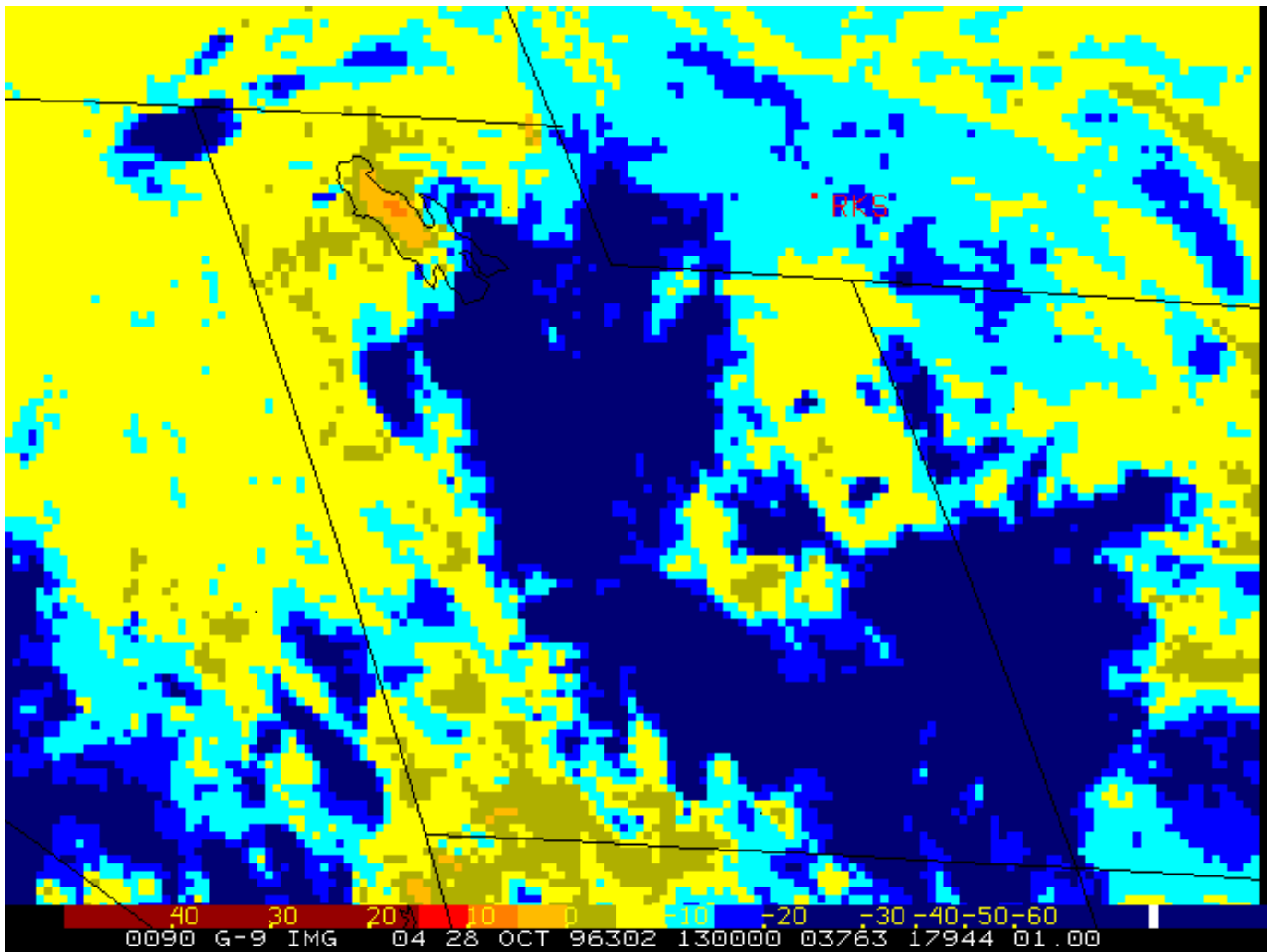




**Figure 8**



The IR data at 1300Z



The RKS meteorogram

KRKS96302 (10/28/96) CLOUDS - (M & FT) WIND - (KTS) TEMP - (C & F) PRES - (MB & IN)

