Kimiwan Complex Lab #3 - Upslope Flow

In this lab, we will study the impact of a mid-latitude cyclone that crossed over the Rocky Mountains and produced heavy precipitation in the region.

We will be examining several new forecast products in this lab. For more information about these products, please refer to the Explanations of Weather Forecast Maps on the course website (https://www.eoas.ubc.ca/courses/atsc413/met_concepts/annotated-tools/contents.html).

Dates: 22-23 May 2023

For this lab, please:

1. Use the Forecast Tools to analyze the synoptic weather conditions. (https://www.eoas.ubc.ca/courses/atsc413/fct/forecast.html)
    a. Looking at the 50kPa Geopotential Heights and anomalies product. Please describe the position of the trough over BC Valid for 00Z 23 May 2023 using initializing times 00Z (18,19,20,21,22,23) May 2023 (3 Points).

    b. Looking at the Multi-Parameter [3-hr Precip (mm), MSLP (hPa), 100-50kPa Thickness (dam)] product. Please describe the position of the surface low pressure east of the Rocky Mountains in AB Valid for 00Z 23 May 2023 using initializing times 00Z (18,19,20,21,22,23) May 2023 (3 Points).

c. Explain how changes in the position of the trough influence the position of the surface low-pressure system (2 Points).

d. Again, use the Multi-Parameter product with initializing time (Int 00Z on 23 May 2023) and note the position of the surface low-pressure system valid for the same time (00Z on 23 May 2023) (1 Point).

2. Use NOAA's near surface weather analysis tool: (https://www.wpc.ncep.noaa.gov/html/sfc-zoom.php)
   a. Note the position of the surface low-pressure system at 00Z on 23 May 2023. Compare its location with the surface low-pressure modeled by the GFS from question 1d. Describe any differences in observed and model surface low-pressure values (2 points).

   b. Describe the wind flow pattern around the surface low-pressure system at 00Z on 23 May 2023 (1 point).

   c. What was the approximate wind direction over the Kimiwan Complex Fire (1 Point)?

d. Analyze whether the wind is moving up or down the local terrain and explain how this flow, considering sufficient water vapor, affects precipitation (3 points).

3. Using the Forecast Tools. (https://www.eoas.ubc.ca/courses/atsc413/fct/forecast.html)
    a. Examine the 85kPa Wind Speeds and direction. Describe the evolution of wind speeds and direction from 00Z on 22 May 2023 to 00Z on 24 May 2023 using the forecast with an initializing time at 00Z on 22 May 2023. Pay special attention to how the wind interacts with the local terrain (3 points).

    b. Study the 70kPa Relative Humidity. Describe the evolution of relative humidity from 00Z on 22 May 2023 to 00Z on 24 May 2023 using the forecast with an initializing time at 00Z on 22 May 2023. Consider the high or low values of relative humidity in relation to the local terrain (2 points).

    c. Analyze the total accumulated precipitation (mm) product valid for 00Z on 24 May 2023. Relate these totals to the 85kPa wind patterns and 70kPa relative humidity values from questions 3a and 3b (3 points).

d. Investigate the total accumulated precipitation (mm) product valid for 00Z on 24 May 2023. Describe why the amount and pattern of forecasted precipitation shifted from forecast run to forecast run for initializing times at 00Z on 19, 20, 21, and 22 May 2023. Hint: Refer to your answers from questions 1a and 1b (4 points).

4. Looking at NASA's worldview tool: (https://worldview.earthdata.nasa.gov/) Activate the *Aqua / MOIDS Corrected Reflectance (True Color)* layer and *Fires and Thermal Anomalies (Day and Night) Terra and Aqua / MODIS* and *Precipitation Rate IMERG*
    a. Determine if the precipitation was sufficient to extinguish the Kimiwan Complex fire. Explain how you arrived at this conclusion (2 points).