Québec fires – air quality & monitoring via satellites

31 May, 2010 event
At least 54 fires in southern Québec – NASA MODIS image – 30 May 2010
MODIS close-up of the smoke from the Quebec fires – 31 May, 2010
MODIS Data, 6 July 2002. (Upper) Level 1b RGB composite image; (Lower) Level 2 AOD.
Sunglint in Gulf of Mexico – 31 May
How do we know where the smoke originated?
Ground observations
Webcam view of downtown Burlington on the morning of May 31, 2010 showing visibility reduced to below 2 miles in smoke.

National Weather Service Burlington
Mt. Washington – 31 May, 2010

Bitter cold, dense fog, heavy snow, and record wind... 6,288-foot Mount Washington is the Home of the World’s Worst Weather.

Since 1932, the non-profit Mount Washington Observatory has been monitoring the elements at one of the planet’s most extreme places—the rocky, windswept summit of Mount Washington, New Hampshire. We invite you to join in the adventure.

Observer Comments

It seems that there’s always something new to see on this mountain. Even here in late May, as we get into the summer months that tend to be much tamer than the winter months (that I have now gotten to see 5 sets of), something new can break up on you. Today, that happened in the form of a whole lot of mist coming from the ridges, some burning out of control, to our north in Quebec.

Images courtesy: Mt. Washington Observatory
“We actually started to see effects from these wildfires earlier in our shift last week. Ryan commented on the red moon he saw a few days ago, which in retrospect, was most certainly caused by smoke or ash aloft. Yesterday morning, we saw the first signs of significant amounts of smoke with what I have been calling a "smoke undercast", for lack of better term, below the summit. We often see cloud undercasts, which are simply clouds that we are looking down on the tops of below the mountain. In this case, there was a distinct layer of smoke filling the valleys below and blocking our view of anything below about 5,000 feet.”

22:17   31 May, 2010
Why was this episode relatively short-lived?
Jet stream (500-mb) map from Environment Canada – 1 June 2010
Jet stream (500-mb) map from Environment Canada – 2 June 2010
Why should we be interested in Quebec forest fires?
Why is this a chronic Forest Fire Area?
July 7, 2002 was one of the haziest days ever observed in VT. High PM concentrations, poor visibility, and unusual "Yellow" color.

Smoke from Canadian forest fires casts a haze over Vermont.

Photo by Peter Huoppi in the Burlington (VT) Free Press 7/8/02 (taken 7/7/02).
Quebec forest fires

- 6 July, 2002
- smoke shown in light blue
- heat signatures in red
- GOES imagery
- thermal and visible bands
View from Here through Clean Air:  http://www.hazecam.net/burlington.html
Quebec Forest Fire, 7/7/02
MODIS: The Fine-Scale Picture

MODIS Land Rapid Response System

The Fires and the Smoke Transport of Smoke from N. Quebec to SE Canada and NE US.

7/5/02 MODIS

7/6/02 MODIS

7/7/02 MODIS
Burlington, VT CAMNET

Continuous PM-2.5 from VT sites, 7/5-8/02

- Red line: Burlington CAMM
- Blue line: Rutland TEOM 30 deg

Unadjusted PM-2.5 (ug/m³)

- 5-Jul-02
- 6-Jul-02
- 7-Jul-02
- 8-Jul-02

7/5/02 15:00

7/6/02 15:00

7/7/02 15:00
Acadia impact occurred later (7/8-10) than other NE sites.

Burlington, VT camera faces West, so afternoon yellow color may be enhanced, but both the haze and the incident light had distinct yellow tint all day on 7/7/02.
Concerns over More Smoke on 7/11/02 Proved Incorrect

It appears the Fires had largely been extinguished by July 9th or 10th
Forest fire impacts
Forest fire impacts

- tropospheric ozone
- particulate matter
- aviation hazard
- human health
View of the Boston Skyline by automated CAMNET on 7/16/99

6/16/99 at 7 PM

7/16/99 at 6 PM

(a few hours before JFK Jr's plane went Down near Martha's Vineyard)
Ozone injury

Ozone injury to milkweed.

Ozone injury to yellow-poplar.
Smoke Produces Particulate Matter that Adversely Affects Human Health

- increased premature deaths
- aggravation of respiratory or cardiovascular illness
- lung function decrements
- increased work loss
- changes in lung function/structure/natural defense
National Air Quality Standards

Criteria Pollutants

- Carbon Monoxide
- Particulate Matter
- Ozone
- Nitrogen Oxide
- Lead
- Sulfur Dioxide

Key criteria pollutants generated by fire
Hourly AQI (Combined PM$_{2.5}$ and O$_3$)
Monday, May 31, 2010 12:00 AM EDT

Image (or graphic) obtained from the U.S. Air Quality Smog Blog (http://alg.umbc.edu/usag).
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