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MMM SEMINAR *NCAR*

The Impact of Fire-Induced Vegetation and Soil Changes on the Diurnal Temperature Changes in the Hayman Fire Scar

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Observations, offline Noah-MP land-surface model runs, and high-resolution WRF simulations are analyzed to isolate the effects of vegetation and soil damage by the 2002 Hayman Fire on the diurnal changes in temperature eight years later. The observations, two 48-hour sequences of hourly- to 2-hourly radiosonde releases and high-frequency surface data taken during fair weather as part of the 2010 BEACHON experiment in middle to late August, were collected at two sites at similar elevations: Hayman, in a severely-burned area near the center of the fire scar, and Manitou, in similar terrain but outside the fire scar, roughly 15 km to the southeast of Hayman. While the Manitou site had Ponderosa Pine and some leaf litter on the ground, Hayman was left with charred tree trunks, bare soil, and grassy vegetation.

Daytime temperatures and temperature profiles at the two sites were similar during the day, but
Hayman remained warmer at night, up to about 500 m. Offline runs with the Noah-MP land surface model with the two types of vegetation and varying organic-matter profiles in the soil confirmed our suspicion that the warmer near-surface temperatures at Hayman could be traced to the lack of insulation (organic matter) in the soil, i.e., the heat absorbed by the soil during the day and over the summer kept the air warmer at night. Two WRF simulations – one with vegetation in the fire scar identical to that observed at Hayman, and one with the vegetation in its pre-fire state – were run to see whether terrain-induced airflow and cold-air pooling were additional factors in the difference. Almost perfect replication of observed night-time surface temperatures plus strong "fire"-"no fire" temperature differences at Hayman despite very similar night-time airflow suggest a strong role by surface vegetation. However, the strong Hayman-Manitou temperature differences were more focused on the lowest grid point than observed, as were the "fire"-"no fire" differences at Hayman. Also, the simulated cooling at Manitou was more modest than observed, suggesting either unsimulated cold-air pooling or locally cooler air in the bare spot where the balloons were released, compared to the nearby stand of trees.

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Thursday, 4 June 2015, 3:30 PM
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NCAR-Foothills Laboratory
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