Upstream flow and temperature conditions controlling downslope-windstorm-type flows in Arizona's Meteor Crater

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ABSTRACT

Nocturnal downslope-windstorm-type flows (DWFs) occur regularly in Arizona's Meteor Crater during undisturbed, clear-sky conditions because of the interaction of a mesoscale drainage flow with the crater topography. The almost circular and approximately 1.2-km wide Meteor Crater is located on a slightly sloping plain, where a southwesterly drainage flow forms during the night. DWFs can occur as the drainage flow impinges on the 30–50-m high crater rim and flows over the crater. During these events, a lee wave forms over the crater basin with the flow descending along the sidewall in the lee of the southwest crater rim. Temperatures over the southwest part of the crater can be much higher than over the crater center as the isentropes descend and increased wind speeds and turbulence are observed on the southwest crater sidewall.

The second Meteor Crater Experiment (METCRAX II) field campaign was conducted at the Meteor Crater in October 2013. The field experiment was designed to study the conditions leading to the formation of DWFs in the crater by simultaneously measuring the upstream conditions and the flow inside the crater basin. In this presentation, we will look at the evening and nighttime development of the approach flow upstream of the crater and at the crater rim and its impact on the occurrence of DWFs. In addition, we will also look at the influence on DWFs of cold air that pools upstream of the crater and partially drains into the crater basin. This cold-air mass causes the air at low levels to diverge around the crater, while air at higher elevations is carried over the crater rim and into the crater.