(1) INTRODUCTION
The role of radiative cooling and heating in valleys and basins is largely unknown. Observations are difficult and traditional radiative transfer models can not properly account for topography.

(2) A NEW MODEL
Monte Carlo code for the physically correct tracing of photons in cloudy atmospheres (MYSTIC) handles topography and variations in surface albedo and surface temperature (Kylling and Mayer 2001; Emde and Mayer 2007; Mayer 2009). MYSRIC has been validated against observations in complex terrain (Mayer et al. 2010).

(3) THE IDEA
Basin and valley topographies based on sinusoidal and Witch-of-Agnesi functions of 500-m depth are varied in width, and are combined with typical atmospheric temperature structures from observations in the Rocky Mountains for 1500, 1900 and 0600 LT (Whiteman 1980).

(4) BASIN CENTER AND BASIN LAYER-AVG. HEATING
Radiative heating rate (HR) profiles in the basin center differ from profiles averaged across the basin.

At the basin center, the influence of topography quickly decays with growing basin size.

However, basin-wide cooling is still greatly affected by topography even in 5 km wide basins.

(5) EFFECTS OF THE NEAR-SURFACE TEMPERATURE STRUCTURE
Flatt Terrain

1500 LT 1900 LT 0600 LT

Basin

(6) EFFECTS OF BASIN AND VALLEY SIZE

Impact of basin / valley size
- The HR profile at the basin center approaches the flat terrain case when the sidewall distance exceeds 1 km.
- The basin-wide HR is reduced from the flat plain case even when the basin width is ~ 5 km.

Near surface temperature structure
- Is a key factor for radiative heating or cooling.
- Air-surface temperature contrasts lead to strong heating and cooling along the sidewalls.
- Temperature contrasts modulate the dependence of radiative heating on basin size.

Meteor Crater, 22-23 October 2006
- The radiative cooling contribution to overall cooling varies with time, accounting for 10-40 % of the instantaneous cooling.
- The cumulative nighttime contribution of radiative cooling to basin heat loss is 20-30%.

(7) COOLING IN ARIZONA'S METEOR CRATER – IMPORTANT OF RADIATIVE TO OVERALL COOLING
Observed temperature profiles from 22-23 October 2006 during METCRAX (Whiteman et al. 2008) are used as input for MYSRIC.

(8) RESULTS

REFERENCES
Emde, C. and Mayer, B. 2007: ACP, 7, 2259–2270
Mayer, B., S. W. Hoch, and C. D. Whiteman, 2010: ACPD, 10, 13373-13405

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