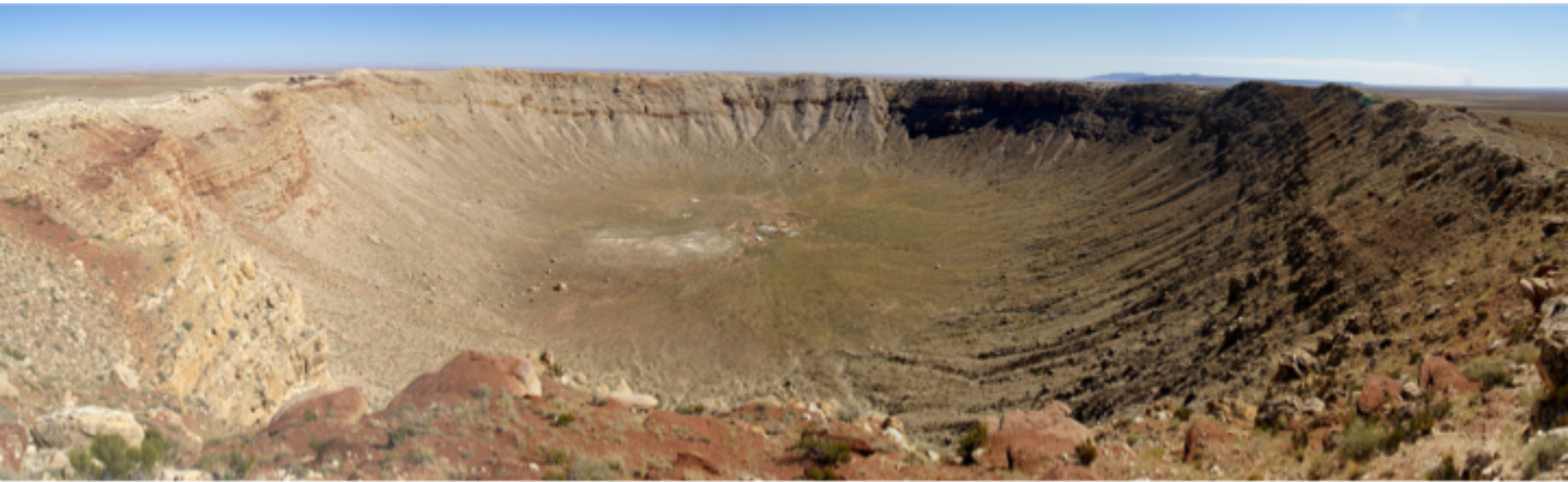


METCRAX II

An upcoming field investigation of downslope-windstorm-type flows on the inner sidewall of Arizona's Meteor Crater



C. David Whiteman, **Sebastian W. Hoch**, Rich Rotunno, Ron Calhoun, Manuela Lehner, Allison Charland, Matt Jeglum, Tom Horst, Steve Semmer, Bill Brown, Norbert Kalthoff, Bianca Adler, and Roland Vogt



Arizona's Barringer Meteor Crater

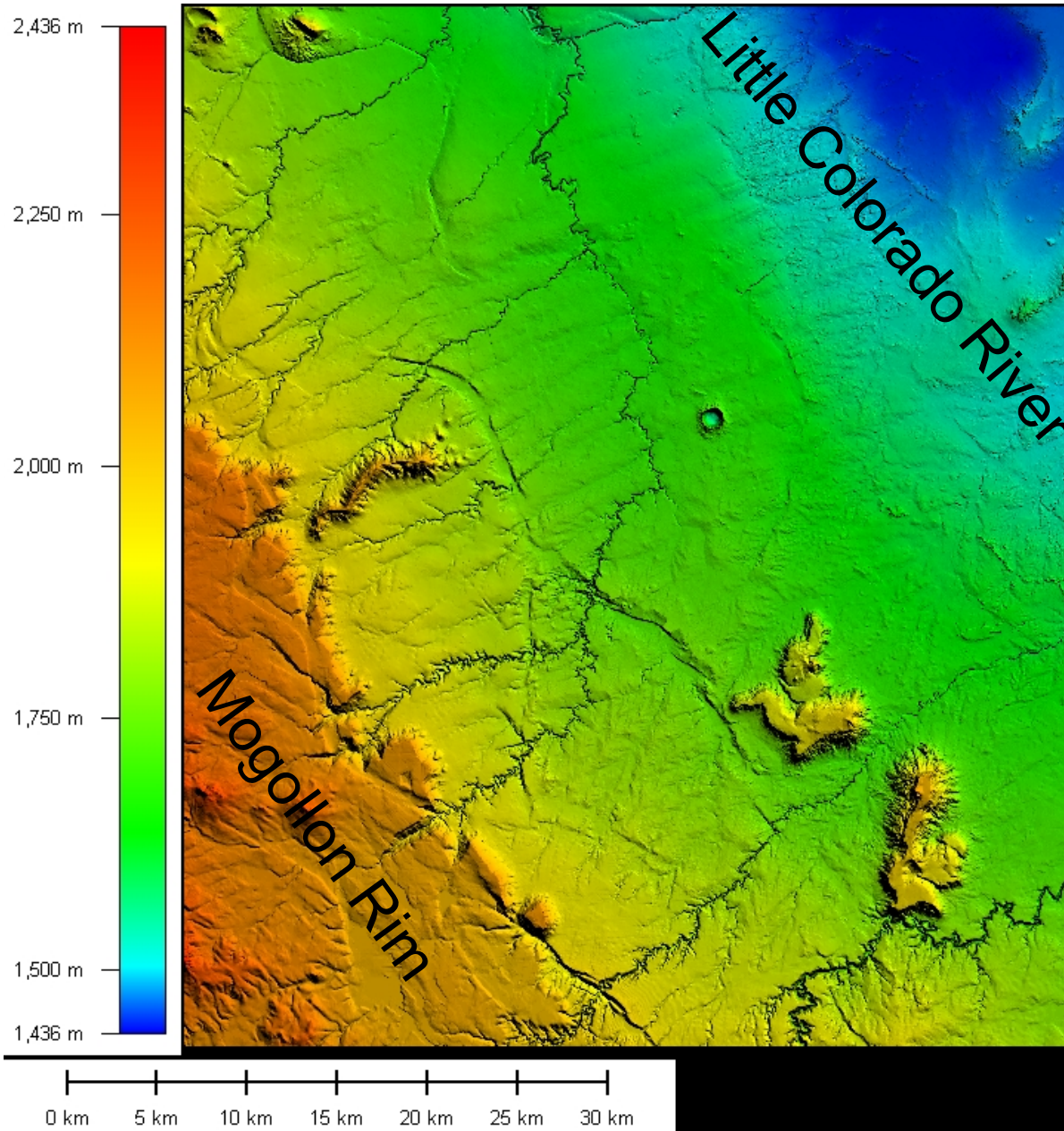
Diameter: 1.2 km

Depth: 170 m

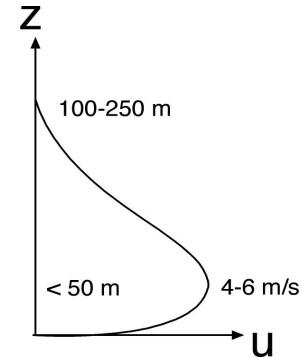
Plain-rim: 30-50 m



Meteor Crater Location



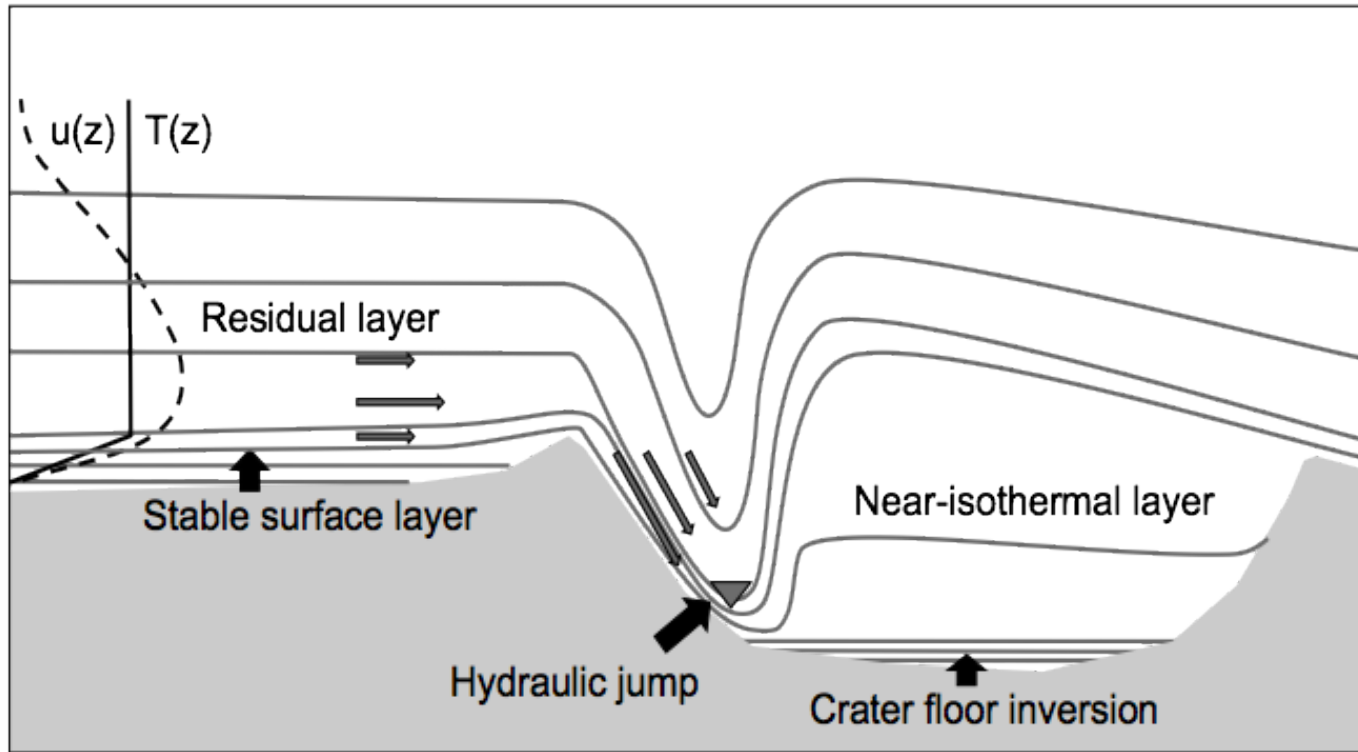
Nighttime drainage flows approach the crater from the Mogollon Rim



Model:
 $4-6\text{ m/s} < 50\text{ m}$

Observations:
 $5-8\text{ m/s}, 35\text{ m}$

Conceptual model



- During METCRAX-I in 2006 we found that intermittent downslope-windstorm-type flows developed over the crater's SW sidewall on clear, undisturbed nights. (See Adler et al. 2012)
- A new experiment, called METCRAX II, will be investigating these flows. Laboratory-like experiment – continuous observations of approach flow and response of crater atmosphere.

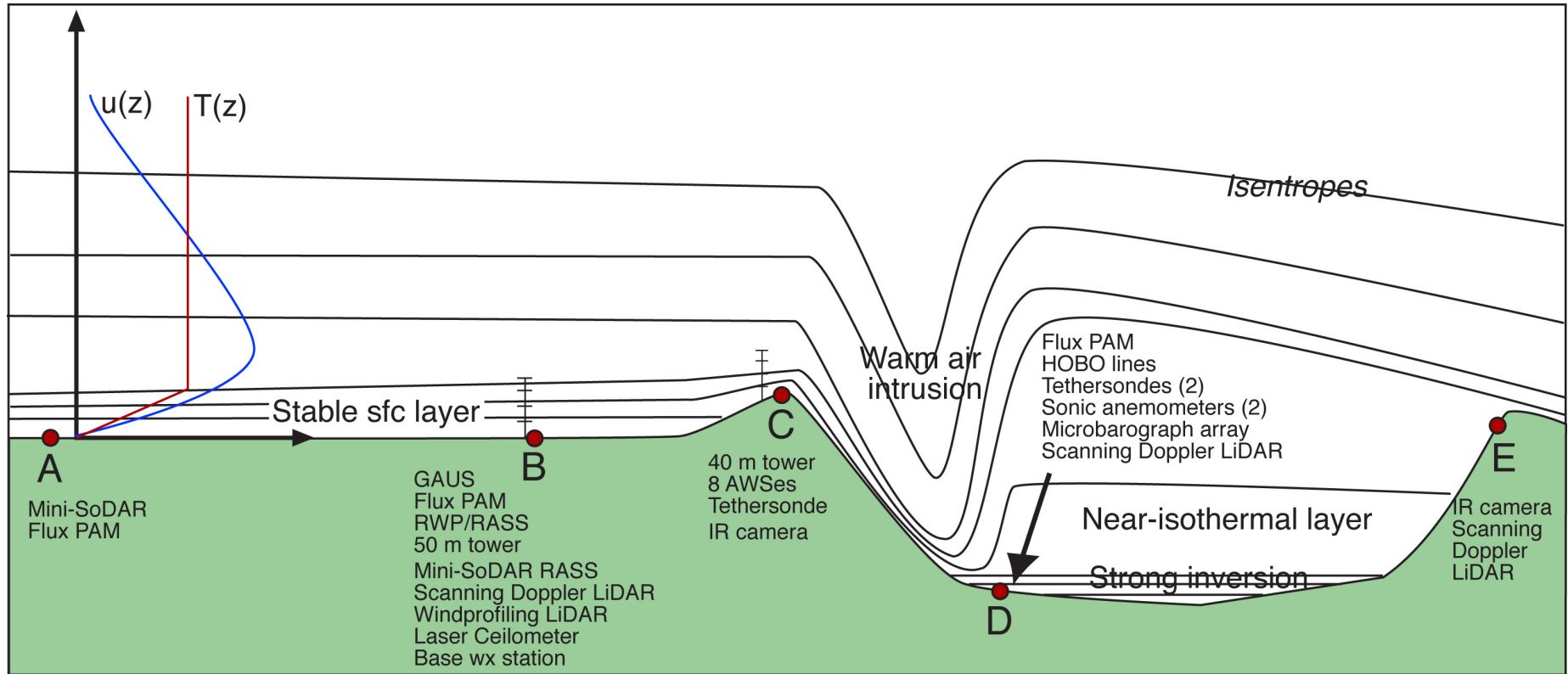
Experimental Goal

Improve understanding of hydraulic-analog atmospheric flows that produce downslope-windstorm-type events.

The overall research program will combine modeling with field research to improve understanding of these flows.

This presentation will focus on the *design of a field program* to investigate katabatically driven hydraulic-type flows at Arizona's Meteor Crater in a one-month experiment scheduled for October 2013.

Equipment placement - Sites A through E



Site A

Site B

Site C

Site D

Site E

Far upwind

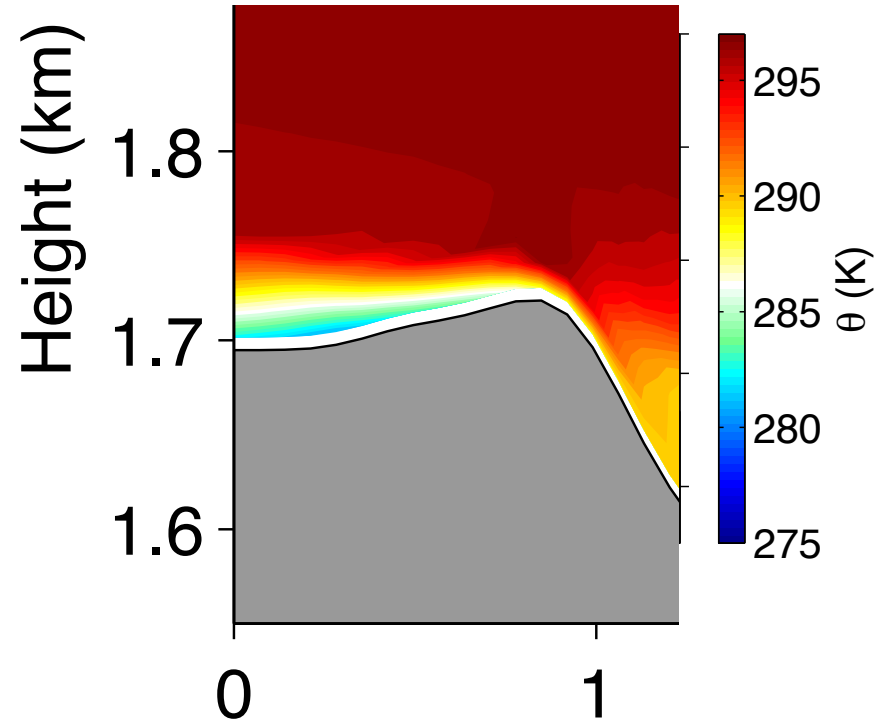
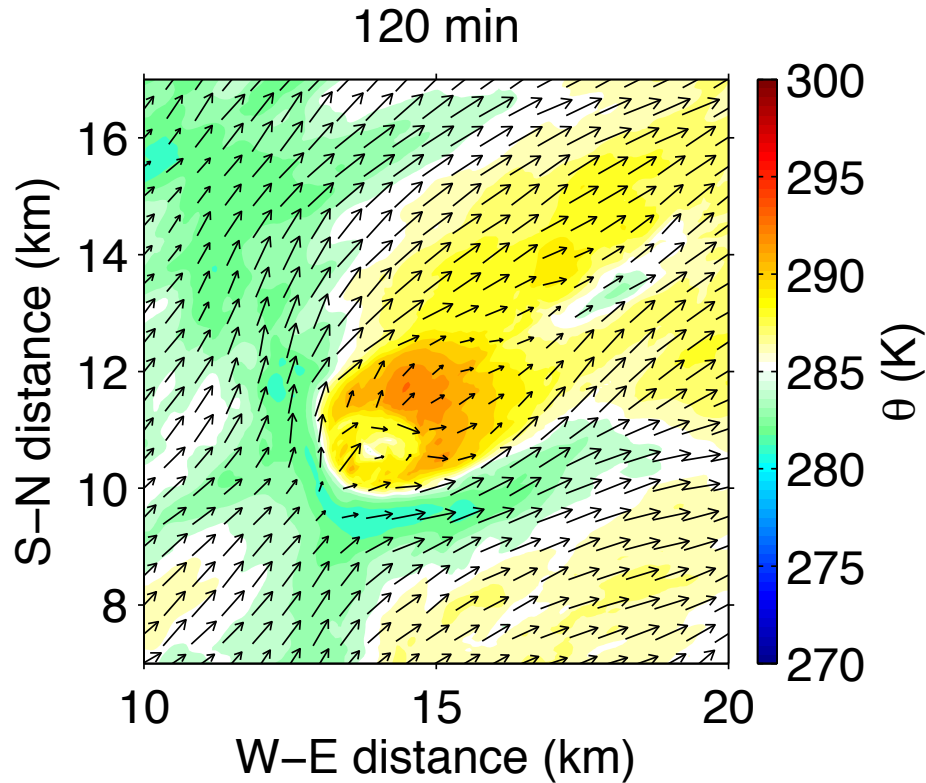
Flow field/
stratification
impinging on
crater
topography

Flow field/
stratification
at rim

In-Crater
response

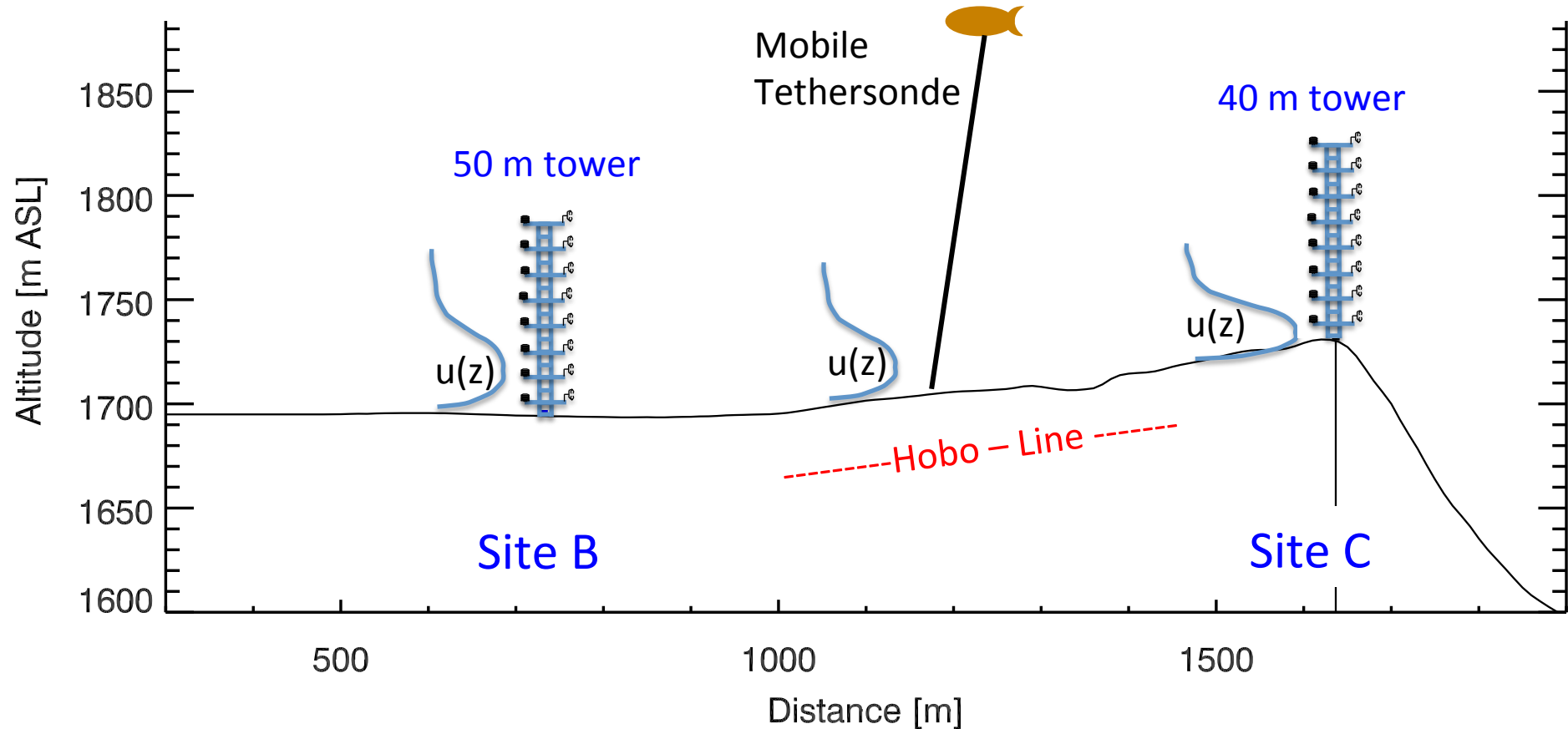
Vantage point
to remotely
sense crater
response

Flow upwind of Crater



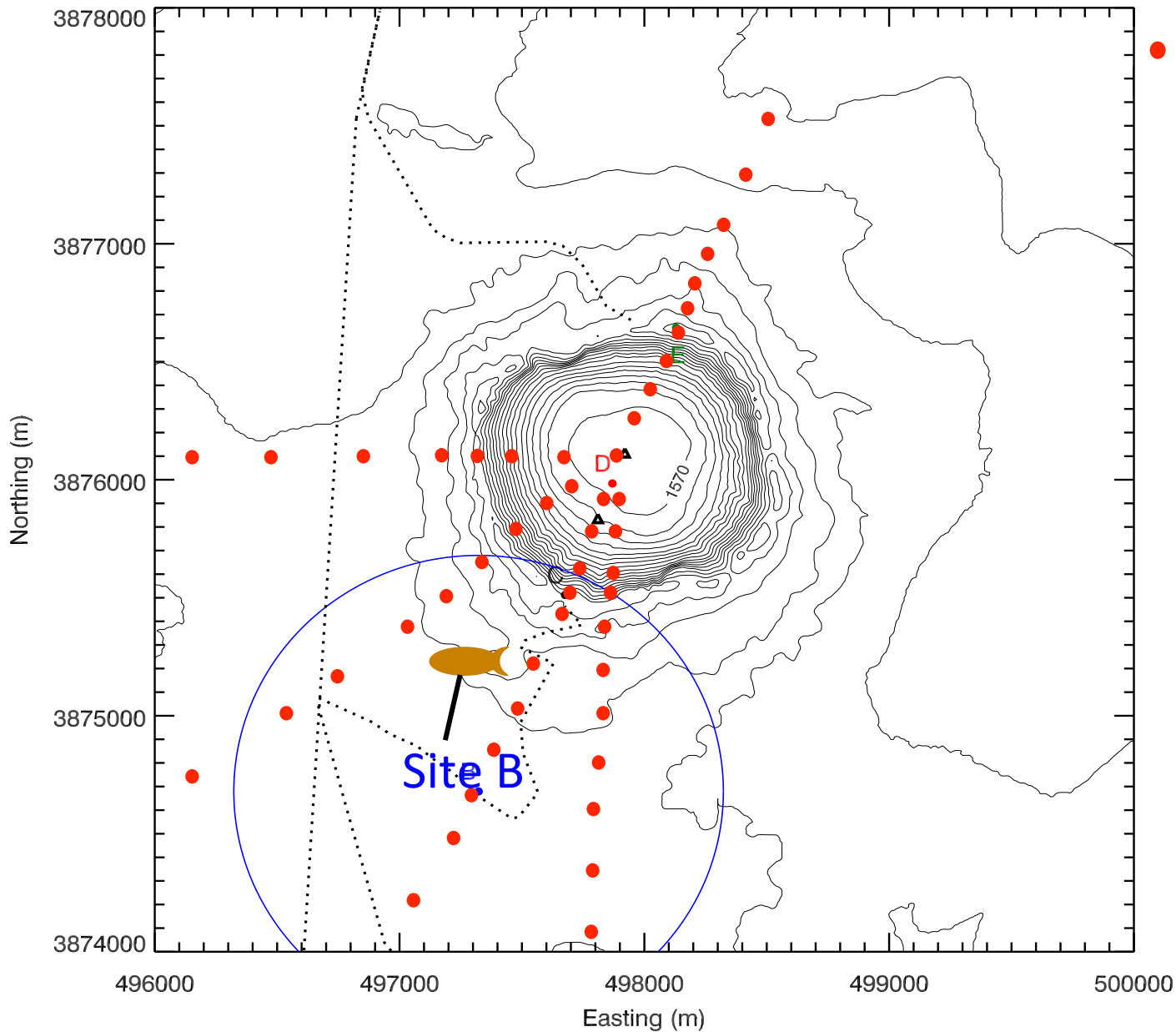
More Model results this afternoon in the talk by Manuela Lehner!

Flow and temperature structure upwind of Crater



- Radar Wind Profiler
- SoDAR / RASS
- Wind-Profiling LiDAR
- Scanning Doppler LiDAR

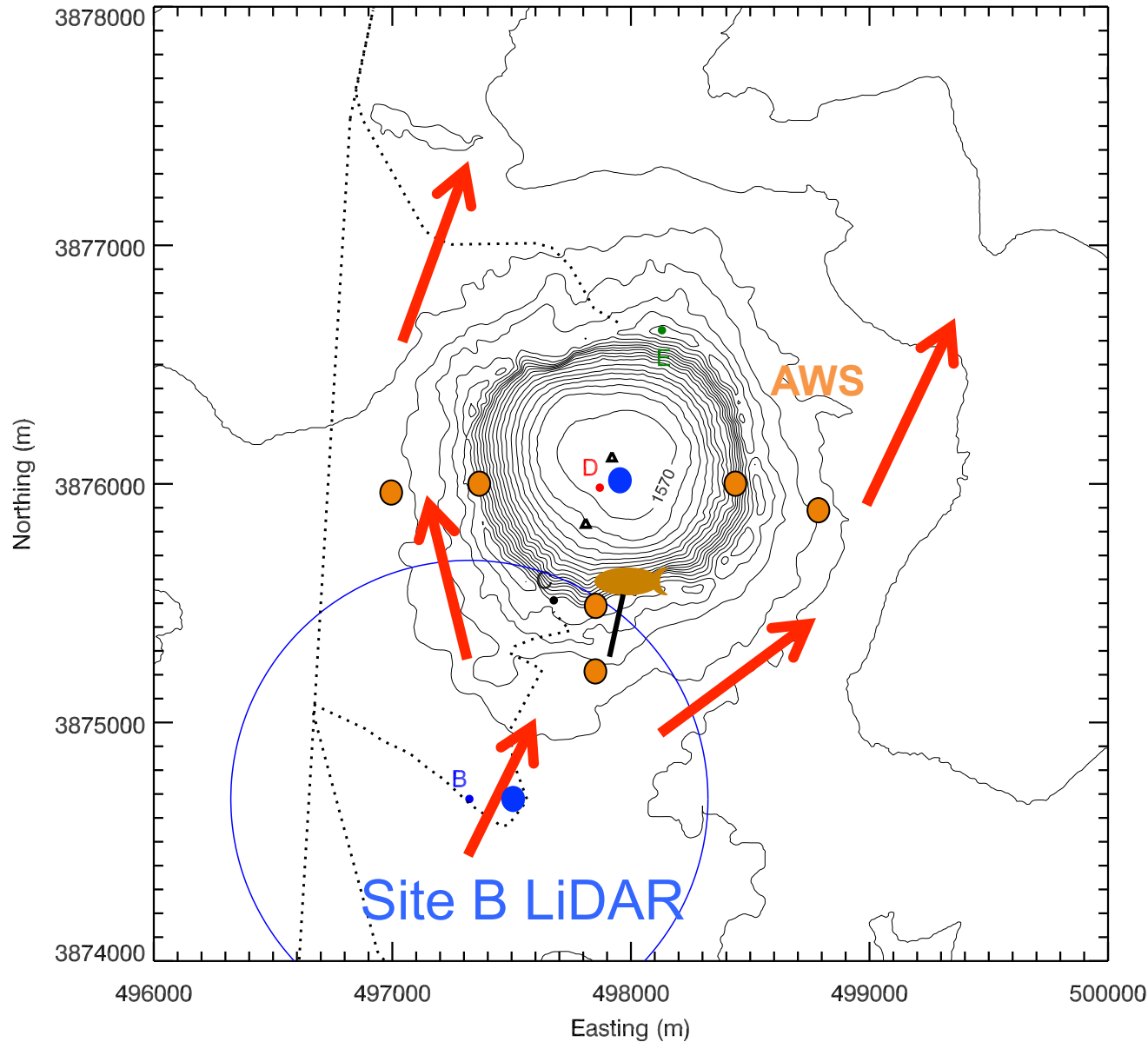
Cold air damming upwind of crater



● Hobo
temperature
data loggers

Mobile
tethersonde
Between
sites B and C

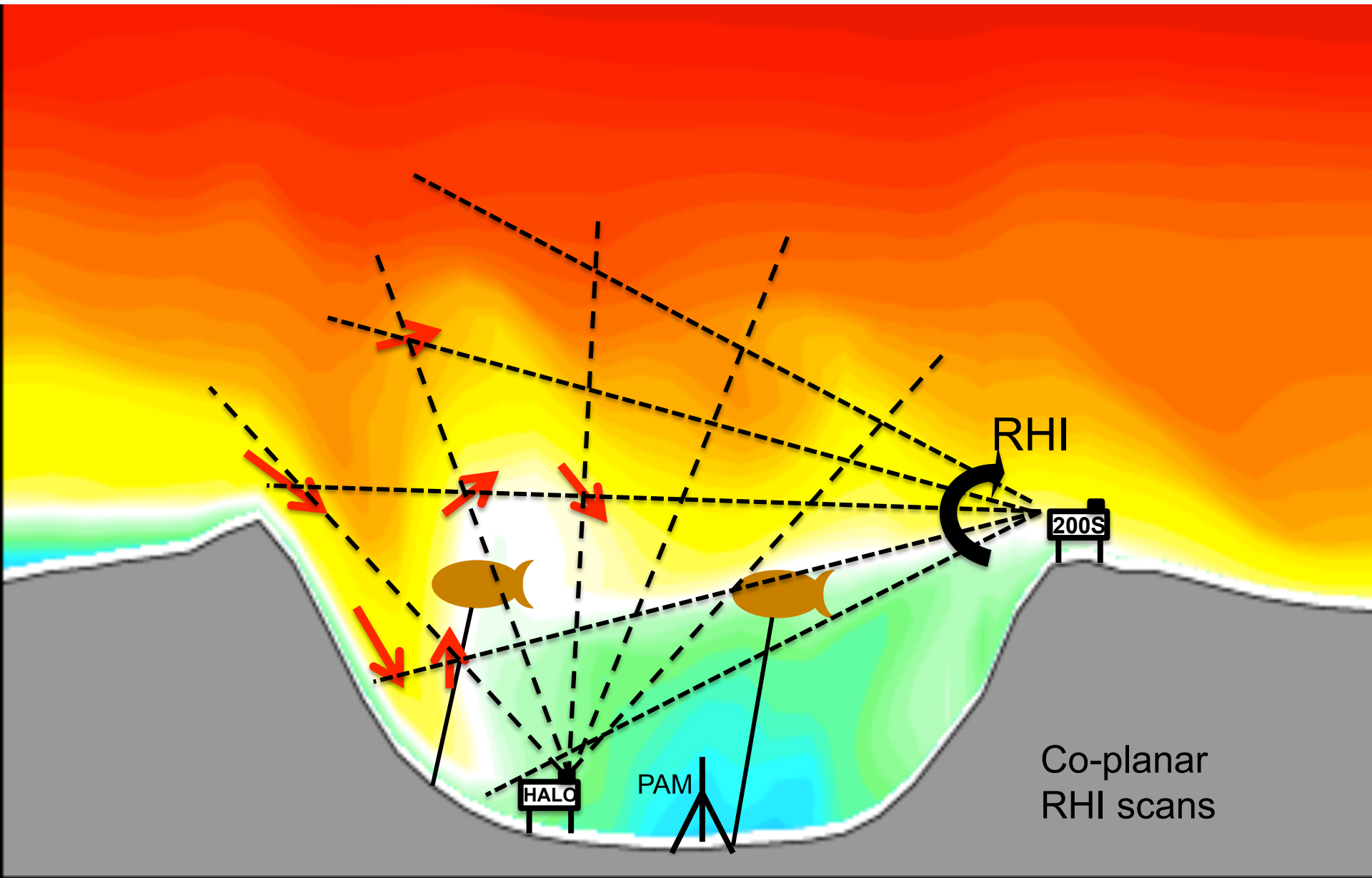
Flow splitting around the crater



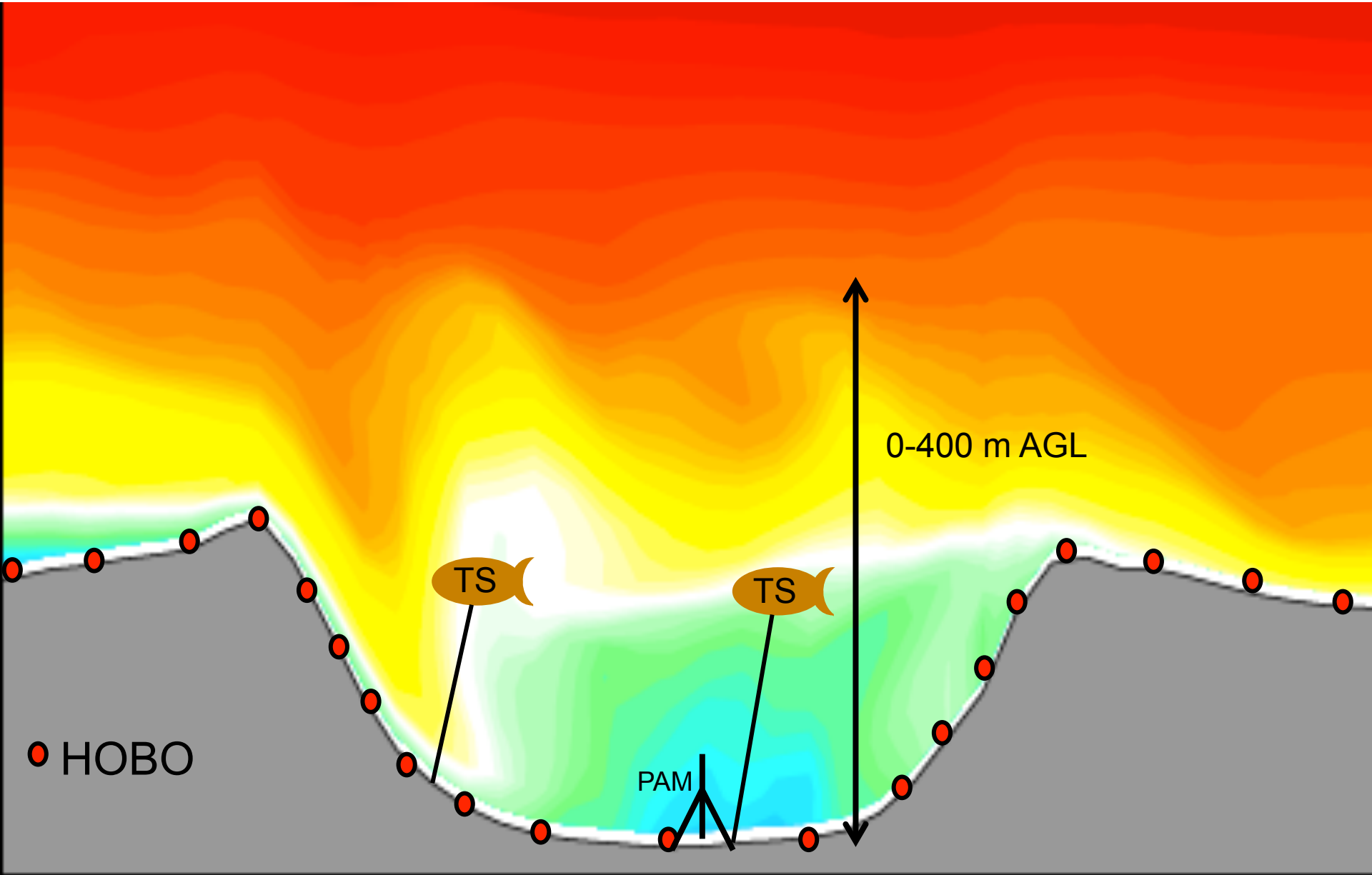
6 Automatic
Weather
Stations

Scanning
Doppler Wind
LiDAR

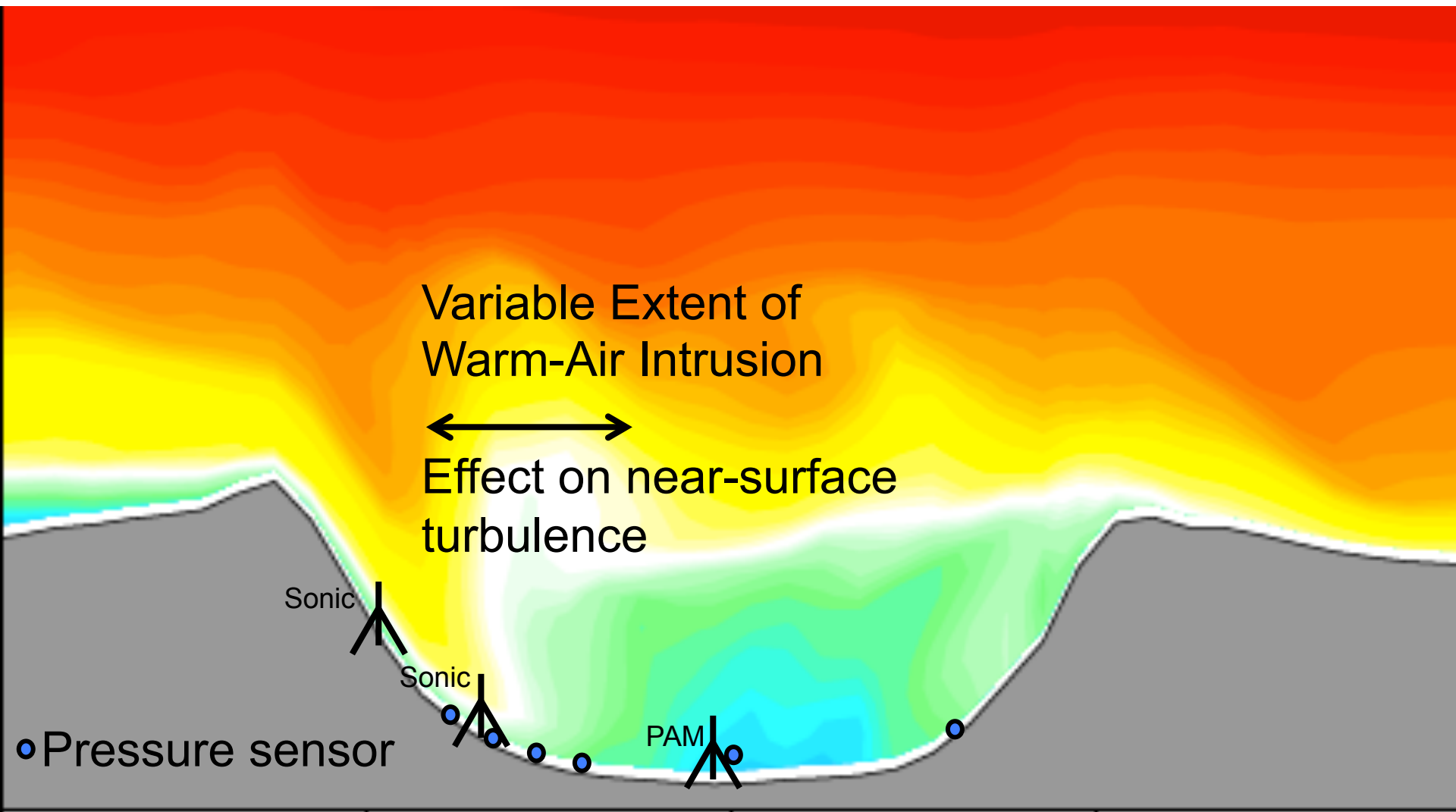
Warm-Air Intrusions & Wind Field in Crater



Temperature in Crater Basin

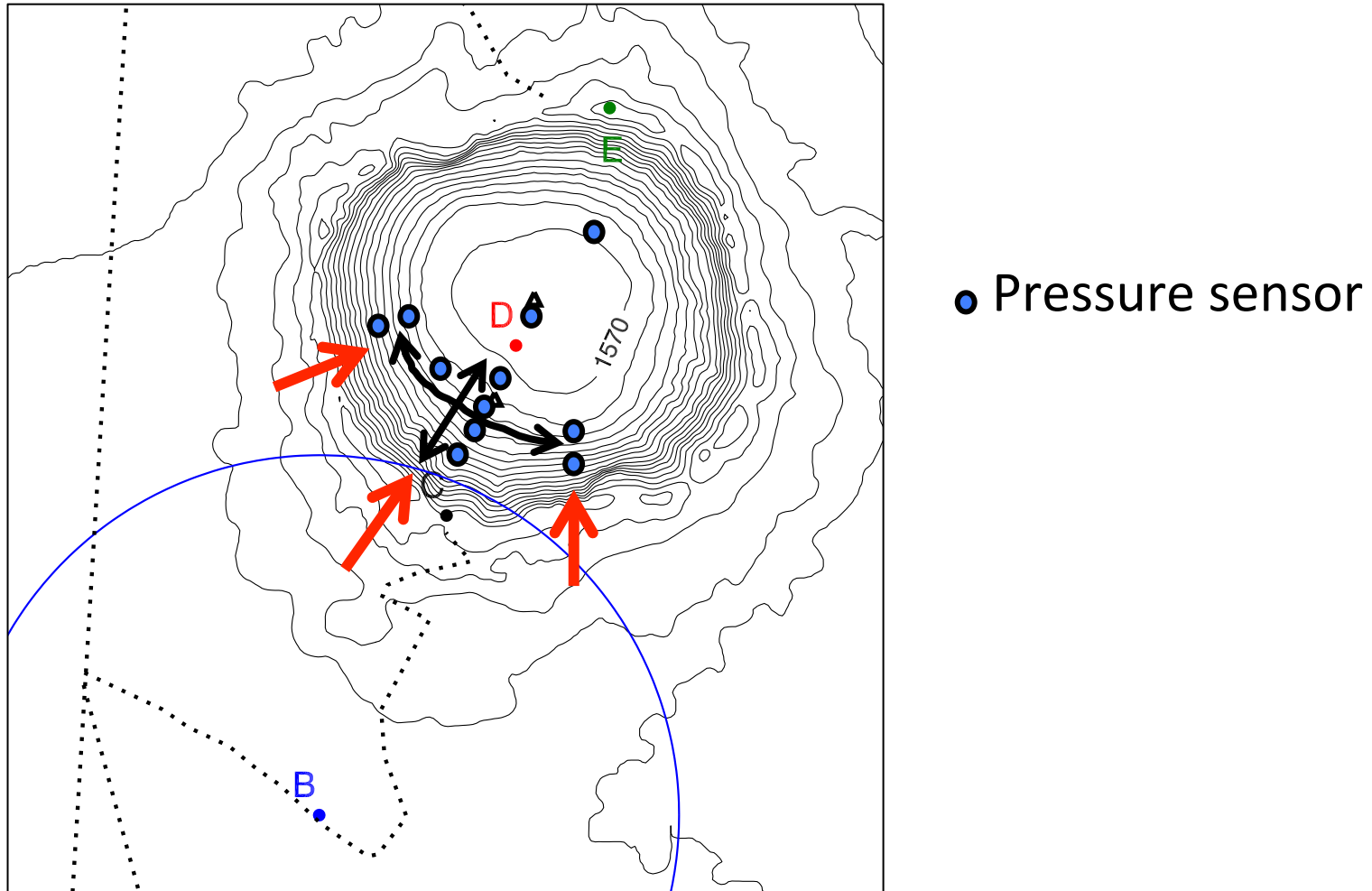


Warm-Air Intrusions & TKE



“Mini-PAM / AWS”: 1 level: Pressure, Sonic, T/RH

Warm-Air Intrusions & Pressure Field



Variable Extent of Warm-Air Intrusion

Summary

- METCRAX II, October 2013, will investigate katabatically driven hydraulic flows over the rim of Meteor Crater that produce warm air intrusions and hydraulic jumps.
- Unusual field equipment resources: 3 LiDARs and 2 tall towers
- Selected science issues:
 - evolution of 3-D structure
 - controlling upstream parameters
 - evaluation of existing theories
 - modeling

Project personnel - METCRAX II



Dave Whiteman
UU



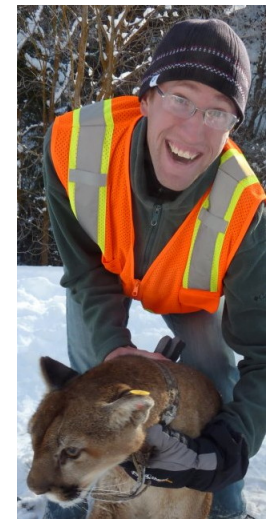
Sebastian Hoch
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Manuela Lehner
UU



Allison Charland
UU



Matt Jeglum
UU



Ron Calhoun
Arizona State University



Rich Rotunno
NCAR



Bill Brown
NCAR



Steve Semmer
NCAR



Tom Horst
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Norbert Kalthoff
Karlsruhe Inst. Tech.



Bianca Adler
KIT



Roland Vogt
Uni. Basel



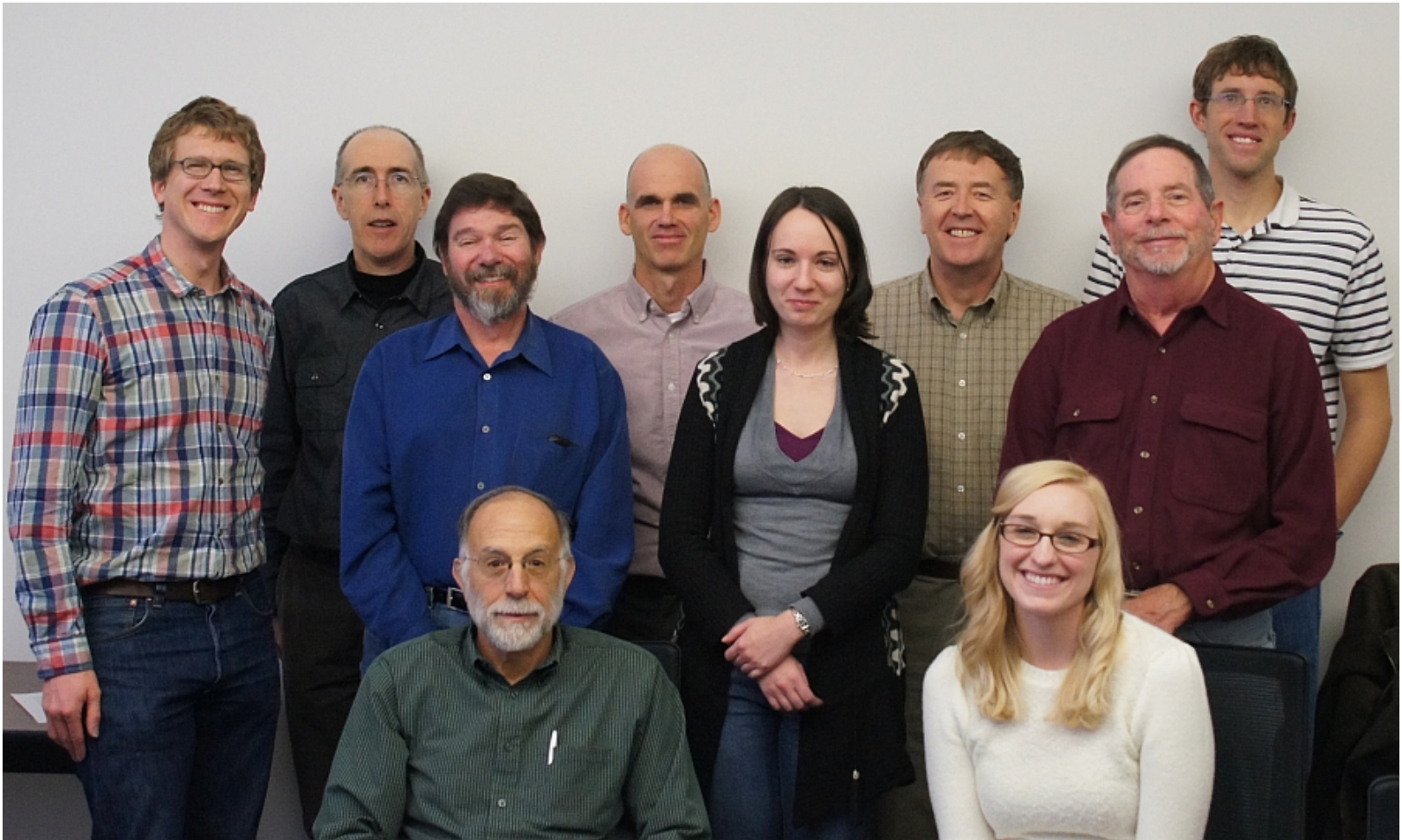
Christian Bernhofer
TU-Dresden



Jan Cermak
Ruhr Univ. Bochum



Funded by NSF



Questions?