Cloud Impacts on the Surface Energy Budget

Matthew Shupe, Ola Persson, Chris Cox, Michael Gallagher, Amy Solomon, Anne Sledd, Don Perovich

ASR Atmospheric System Research

ARM

NSF

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Lianna Nixon

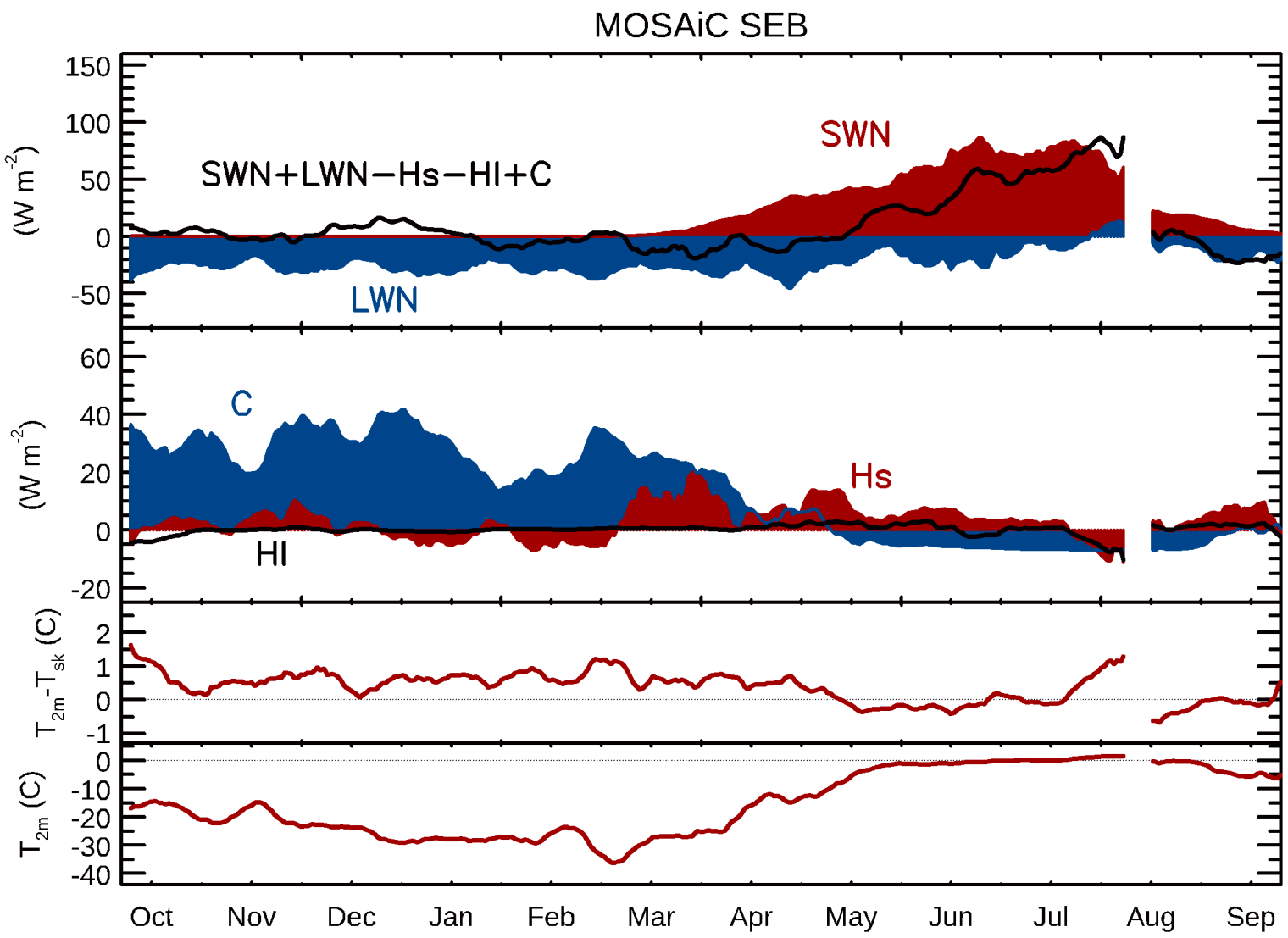
Goal: Determine the full energetic impact of clouds on the surface

Lianna Nixon

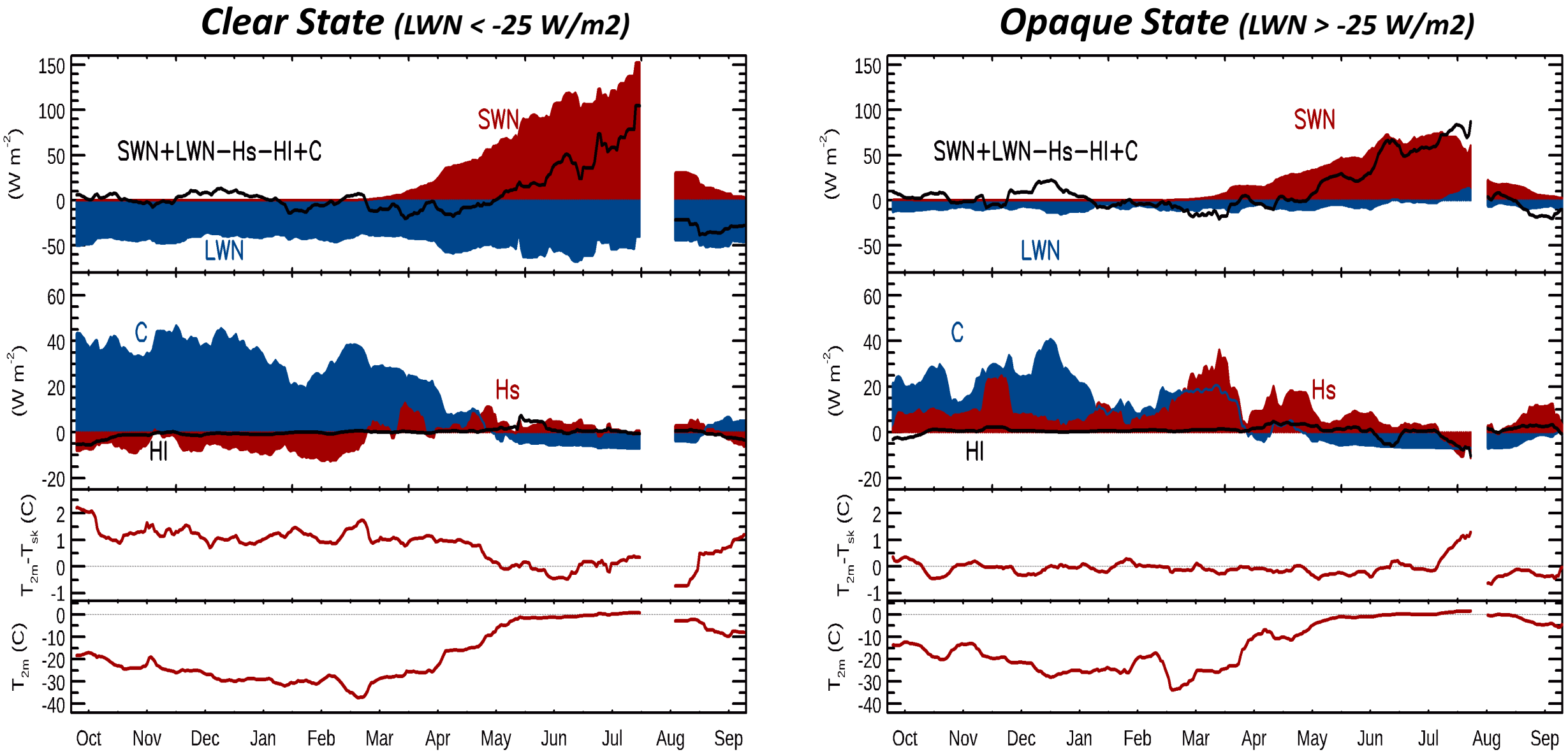
Radiation stations
Met tower
Flux stations
Radar/Lidar/MWR

SEB Annual Cycle

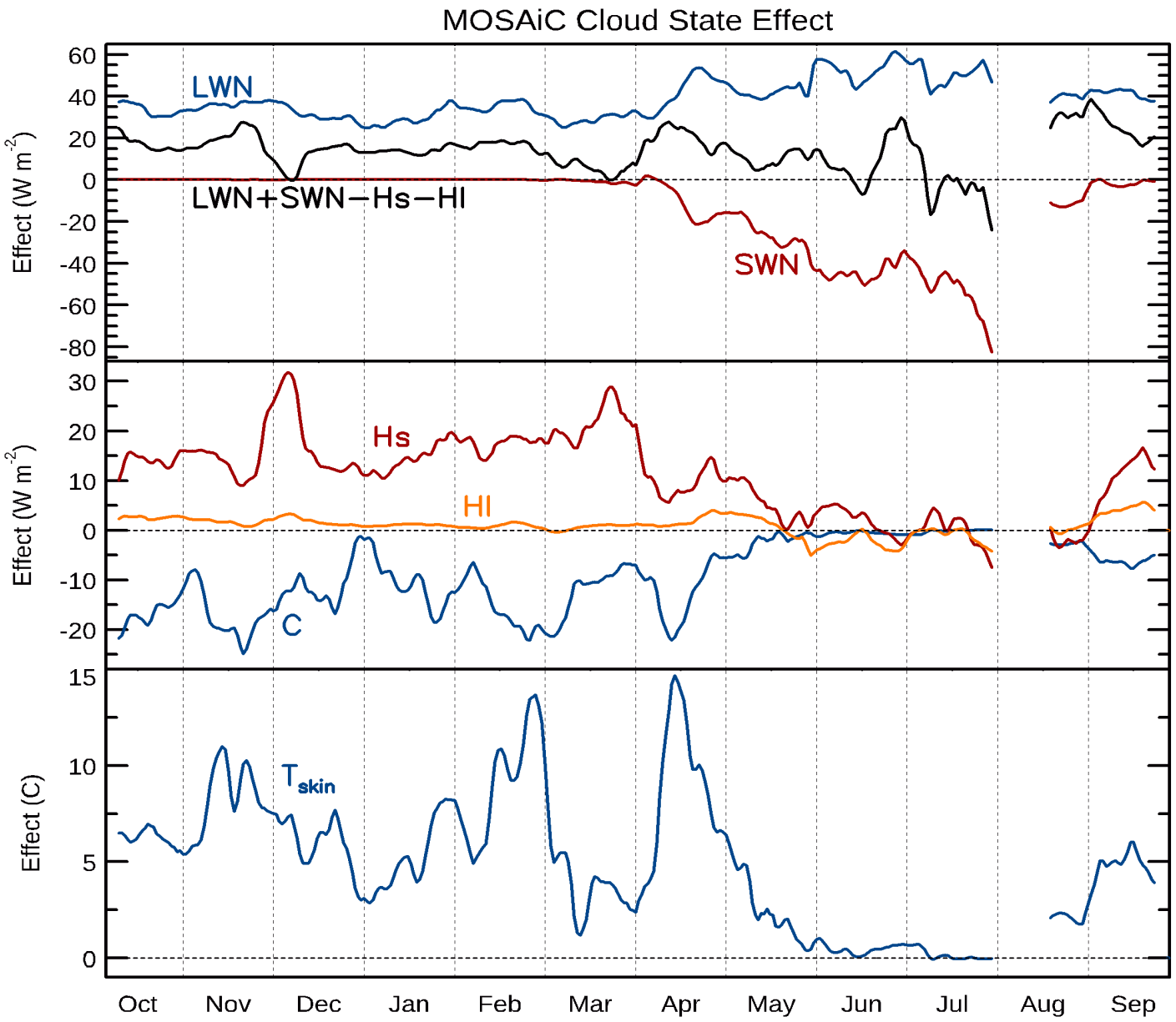
Optimal combined data set



Partitioned SEB Annual Cycle



Cloud Forcing of SEB Annual Cycle



$$F_{opaque} - F_{clear}$$

Clouds lead to:

- More surface LW warming
- More surface SW cooling
- More upward turbulent heat fluxes (cooling)
- Less upward conductive heat flux (cooling)
- Warmer skin temperature
- Net atmospheric warming for nearly the whole year

Cloud impacts are maximum in summer for radiation, but minimum in summer for turbulence and conduction (~0˚C)