# Using in-situ measurements of ice water content to characterize the cloud radiative effect of Arctic cirrus

Andreas Marsing, Ralf Meerkötter, Romy Heller, Tina Jurkat-Witschas, Stefan Kaufmann, Christiane Voigt

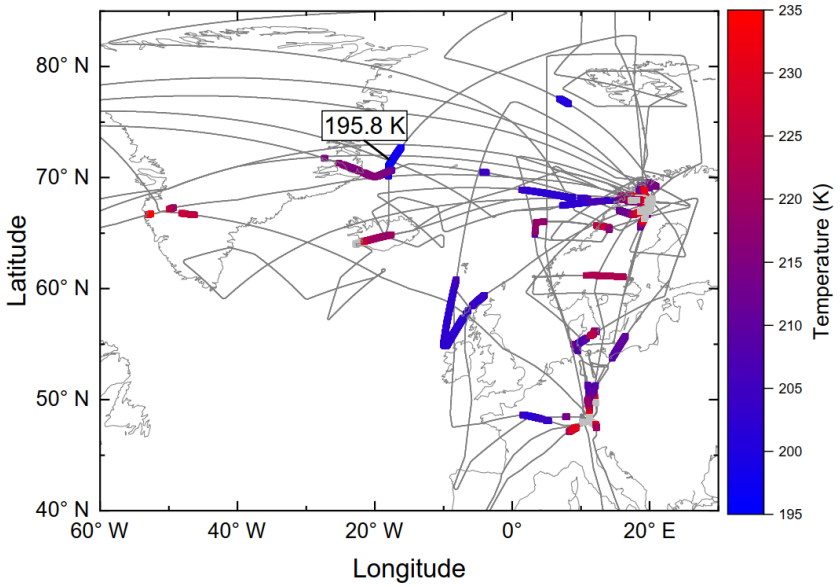
Institute of Atmospheric Physics, German Aerospace Center (DLR), Oberpfaffenhofen, Germany



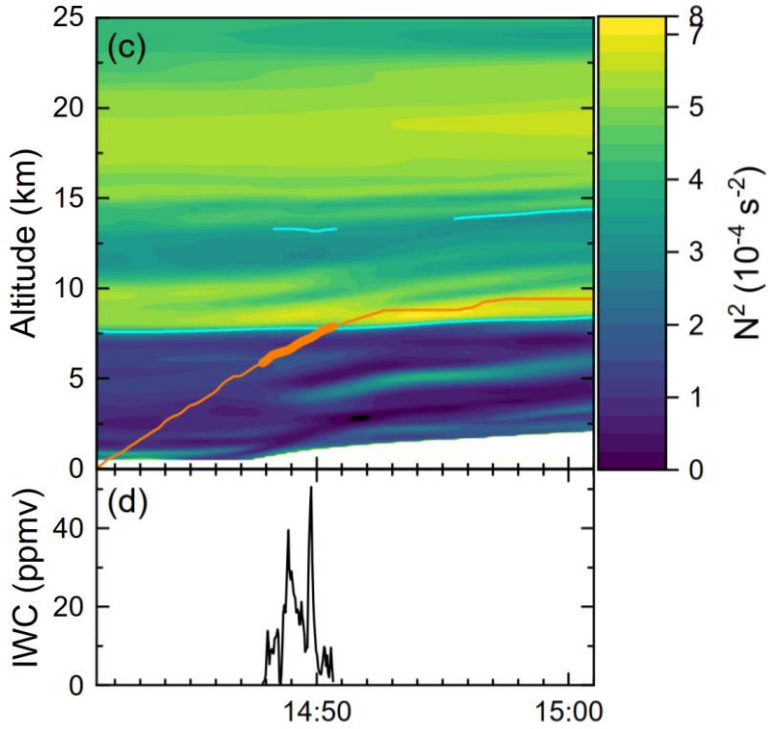
## Data

POLSTRACC
12/2015 – 03/2016

IWC derived from WARAN and BAHAMAS measurements


- 44 • Cirrus encounters
- 8 • Complete profiles
- 2 • Studied cases



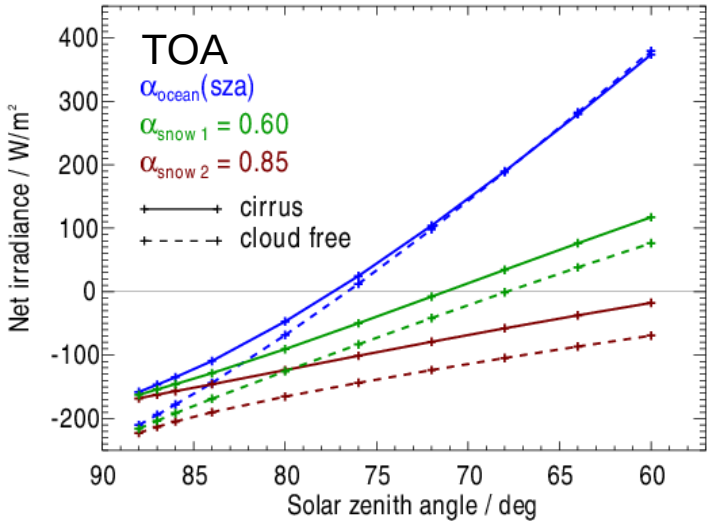

ERA-Interim CAMS

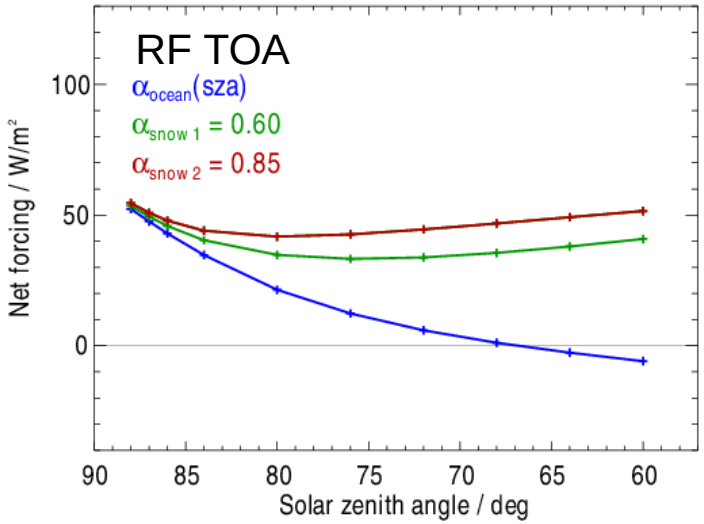
$r_{eff}$ (Liou et al., 2008)

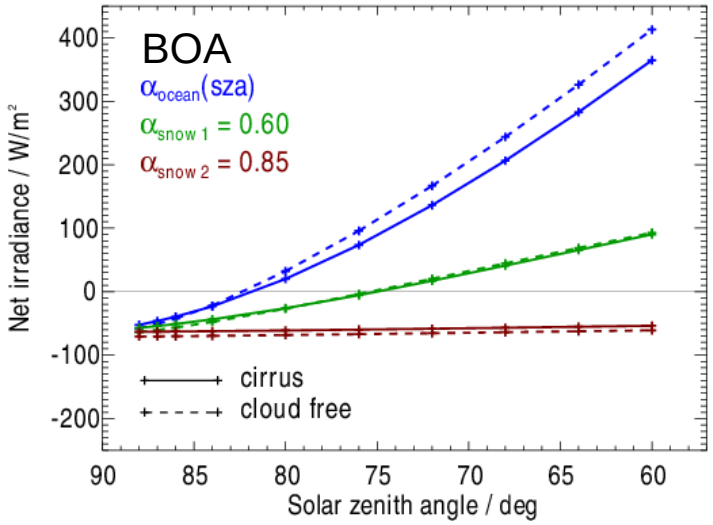
libRadtran

libRadtran

## Effect of solar zenith angle and albedo on radiation

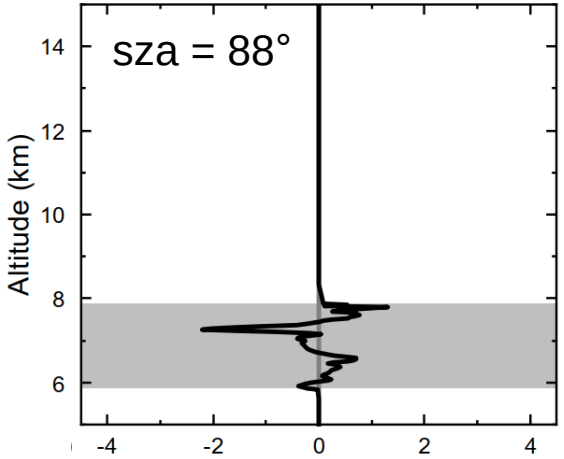


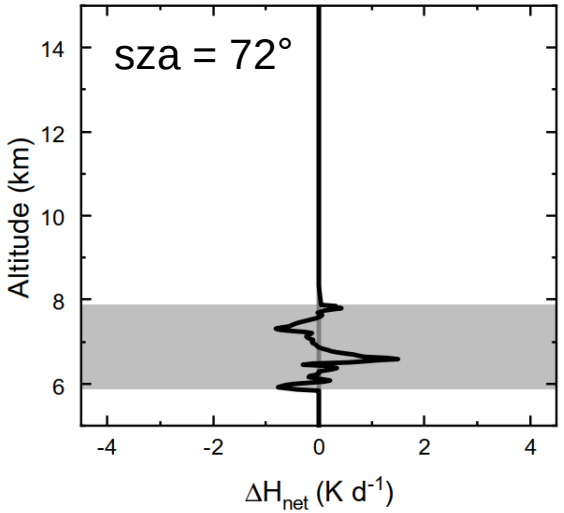




- Strong dependency of irradiance on typical Arctic surface types
- Cirrus shift the transition from cooling to warming to higher sza
- IWC profiles result in up to 4.62 W m$^{-2}$ difference in $F_{net,TOA}$ (0.26 for $F_{net,BOA}$) compared to simple box distribution
- IWC profiles lead to heating rate variations inside the cloud ($\Delta H_{net} \sim H_{net}$)
- More precise analyses to come with new data

## Heating rates

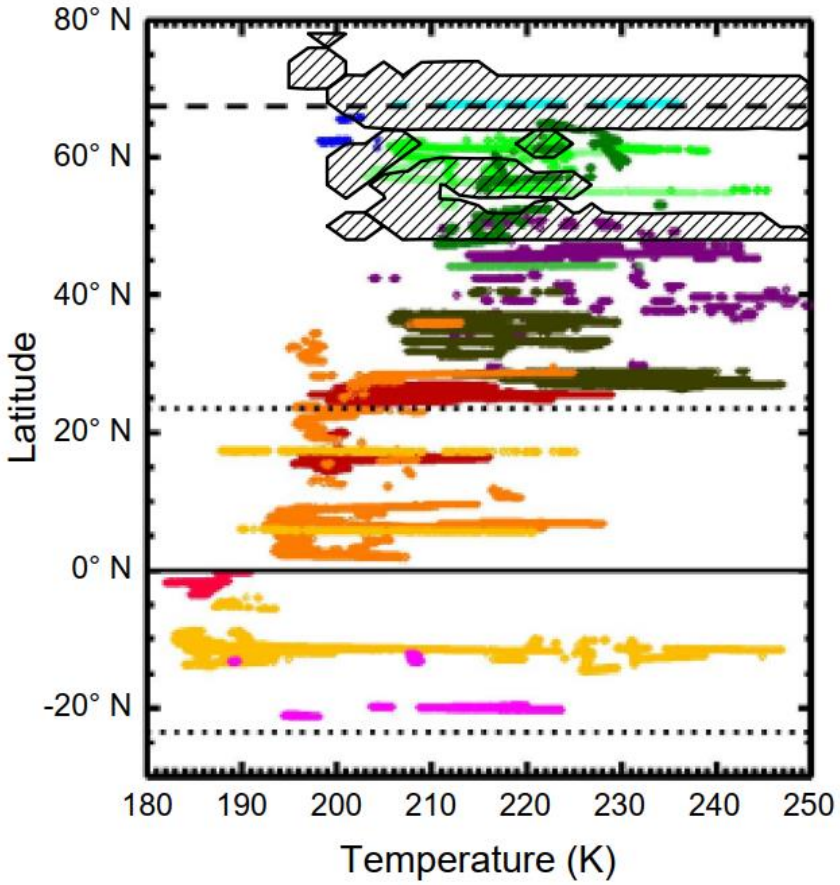


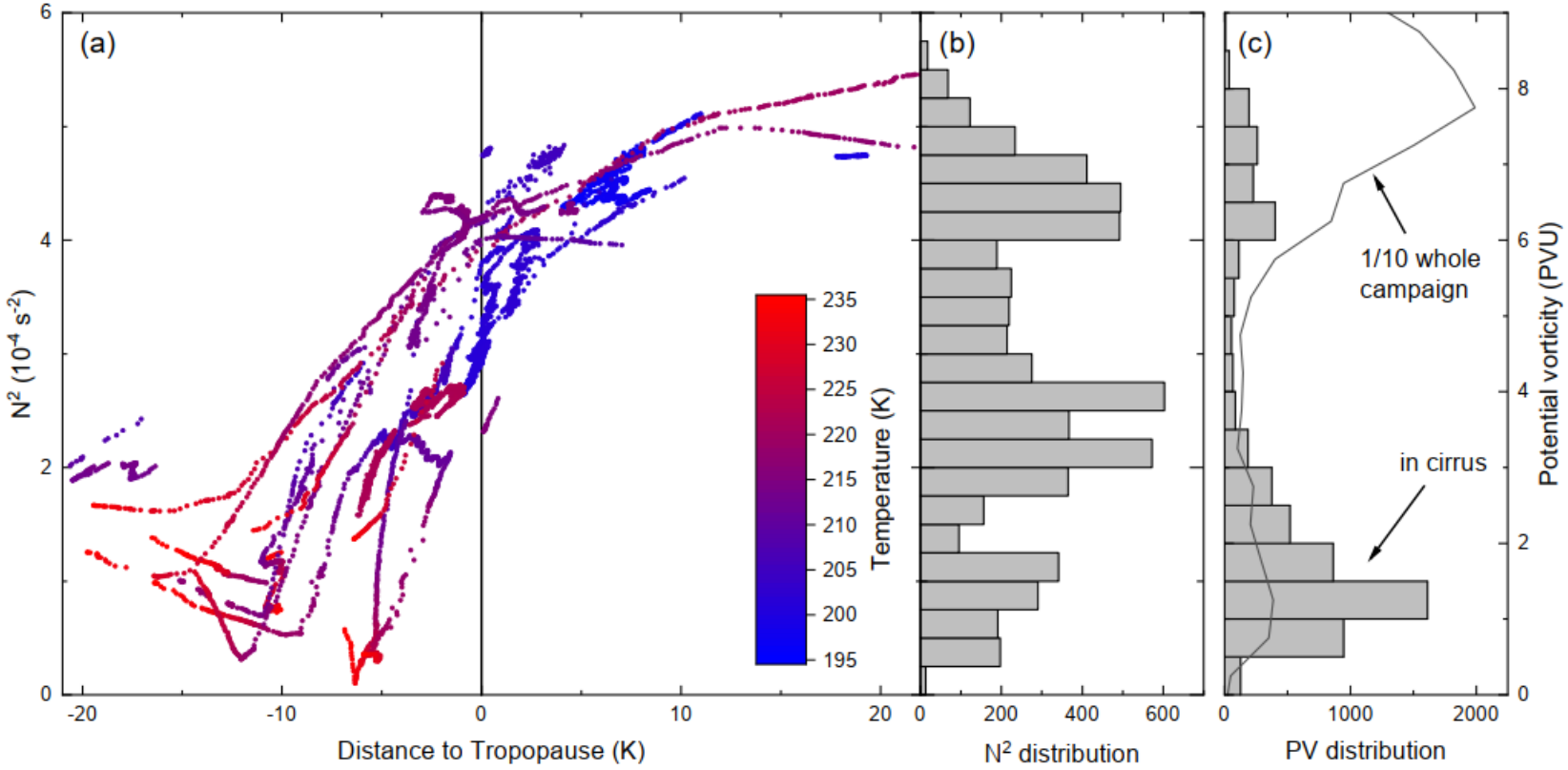




Marsing, Meerkötter et al., in submission to ACP

# Supplementary slides

# Distribution of in-situ cirrus observations during POLSTRACC

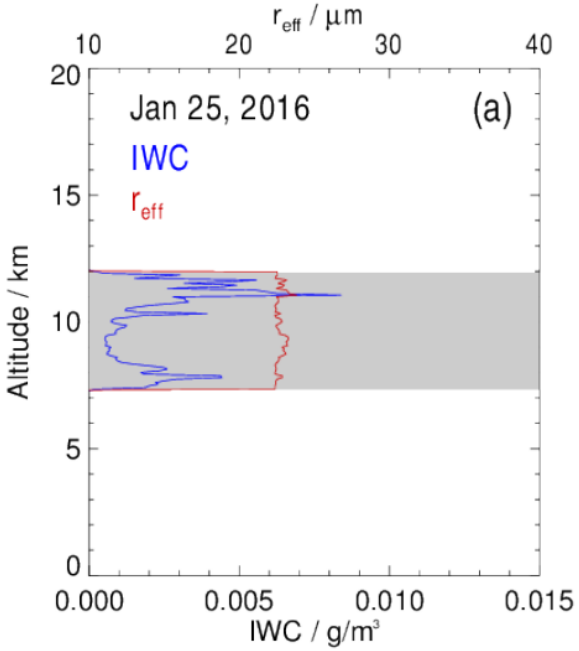


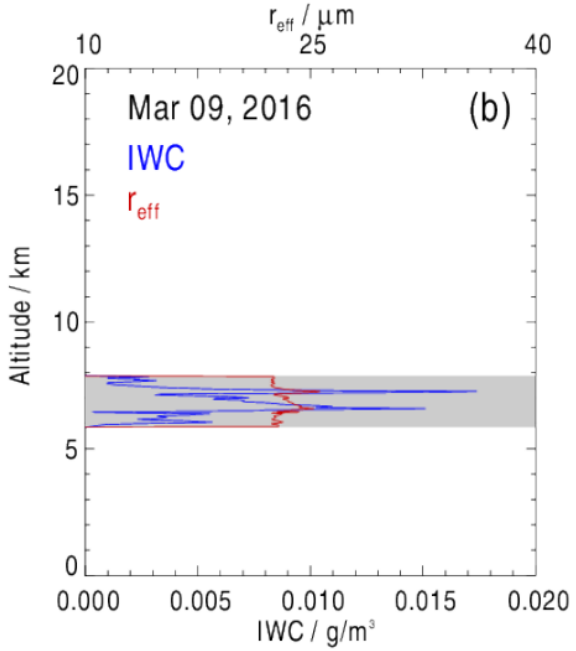




Marsing, Meerkötter et al., in submission to ACP

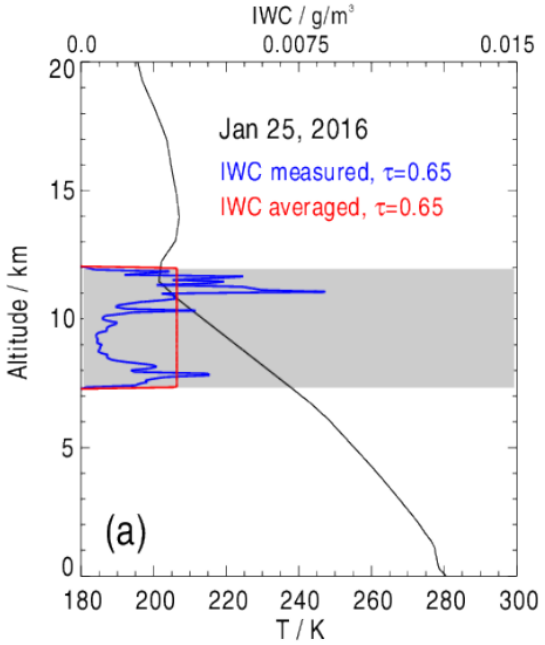
# Input clouds for radiative transfer simulations using in-situ IWC measurements

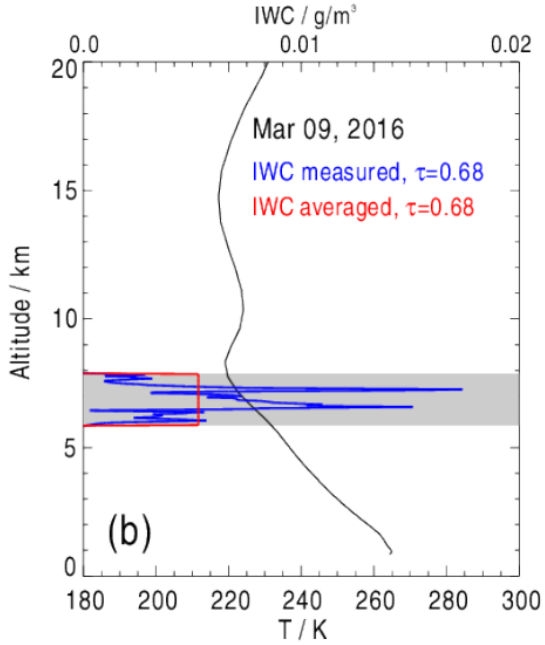
## IWC and $r_{eff}$



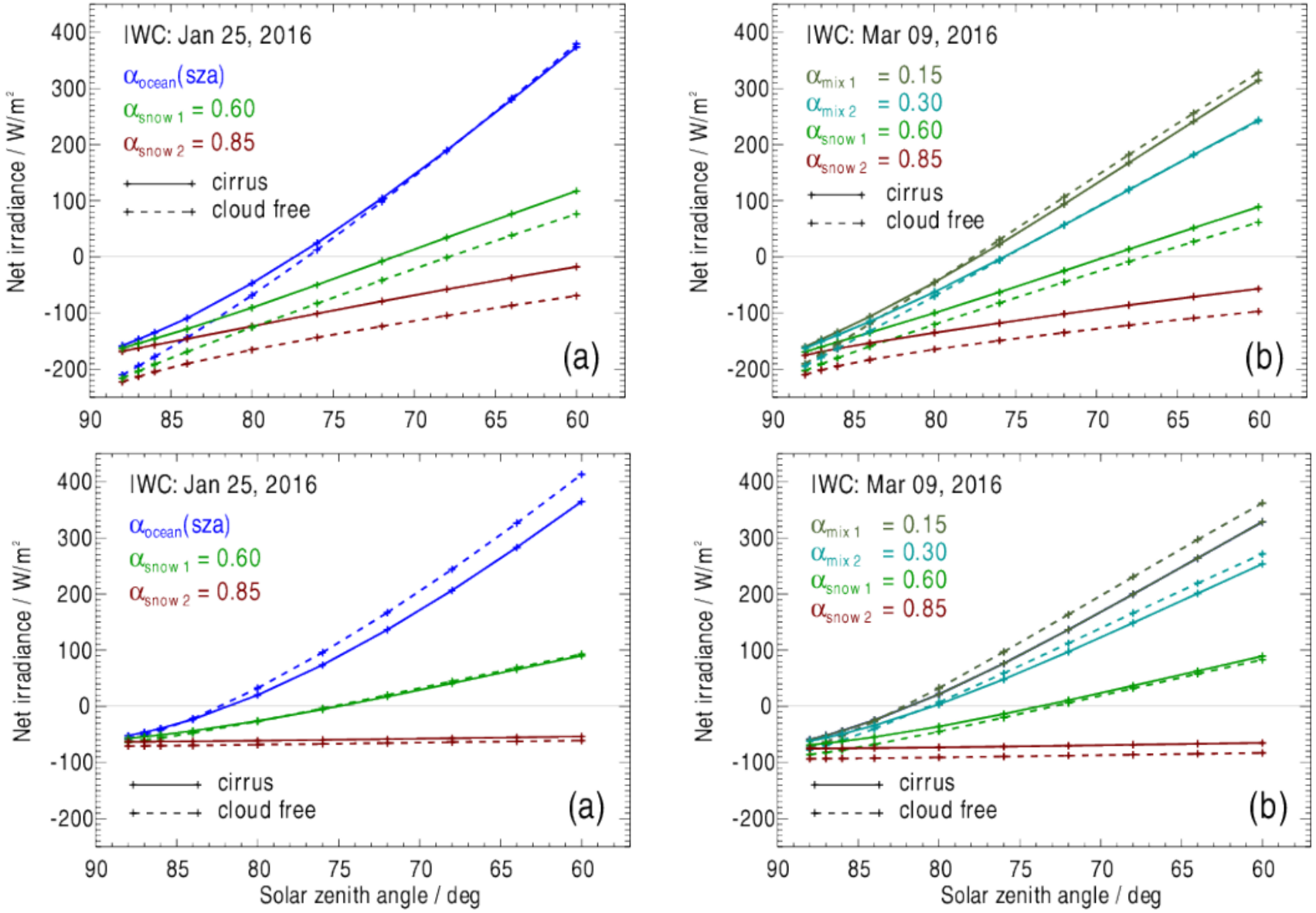

## IWC, box cloud and T profile



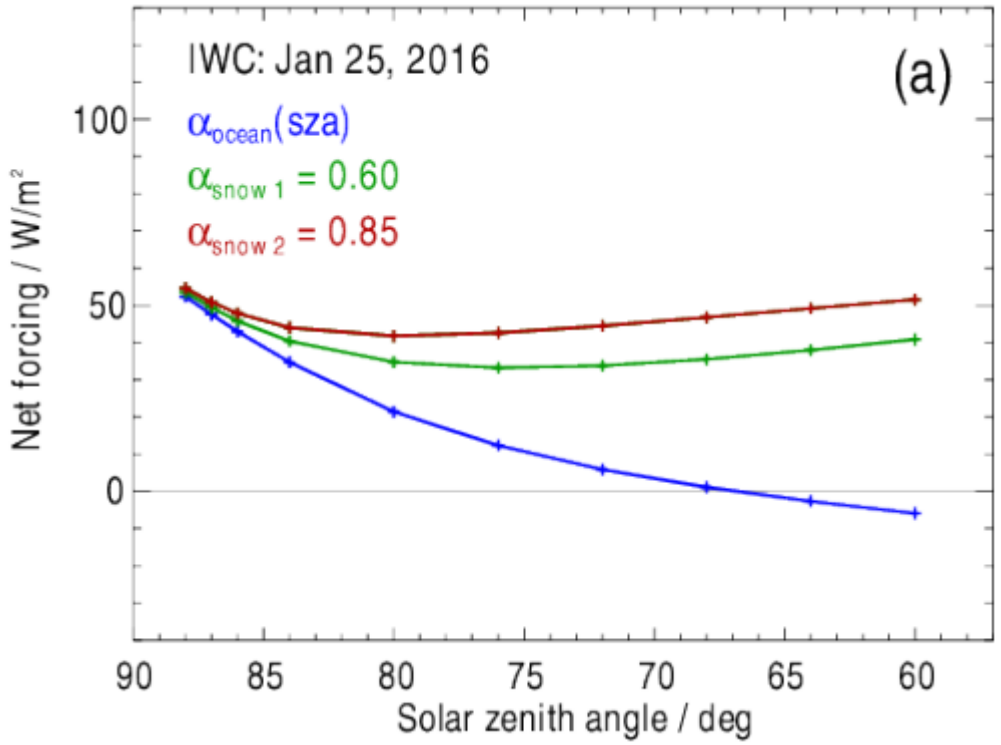

Marsing, Meerkötter et al., in submission to ACP

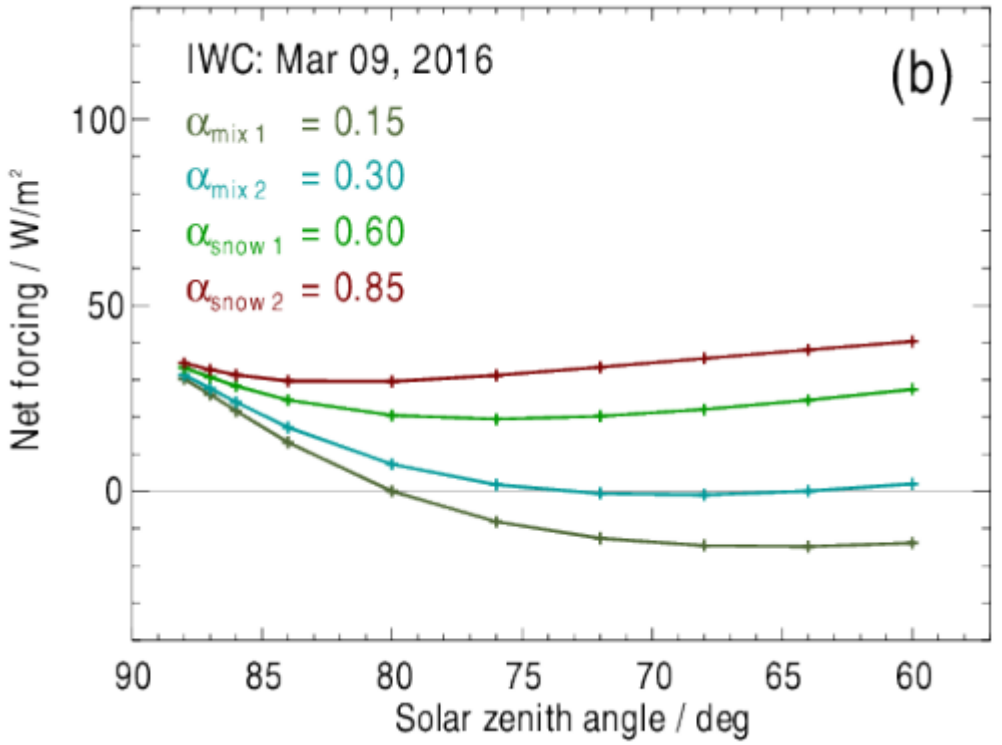
# TOA and BOA irradiances




Marsing, Meerkötter et al., in submission to ACP

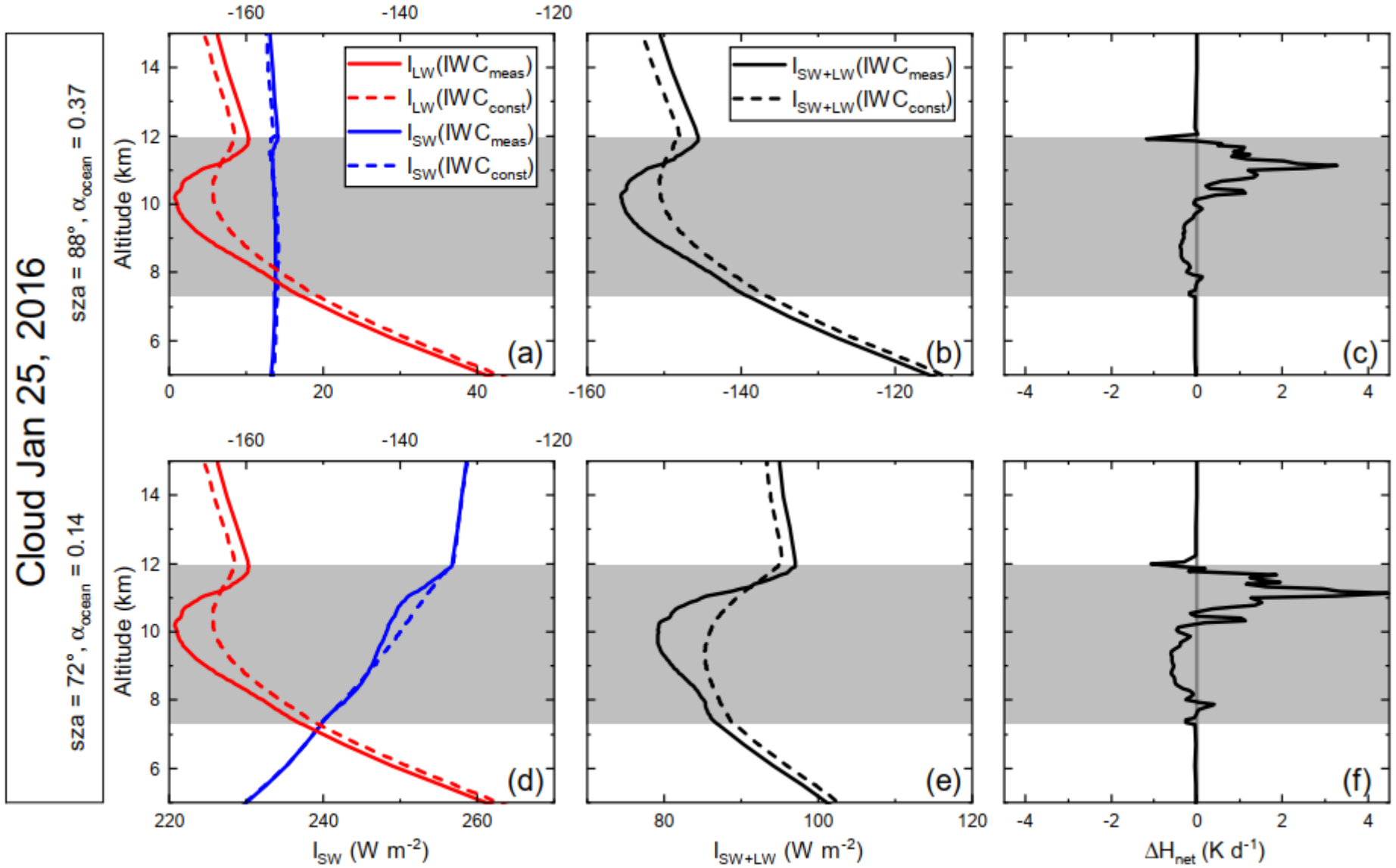
# TOA radiative forcing



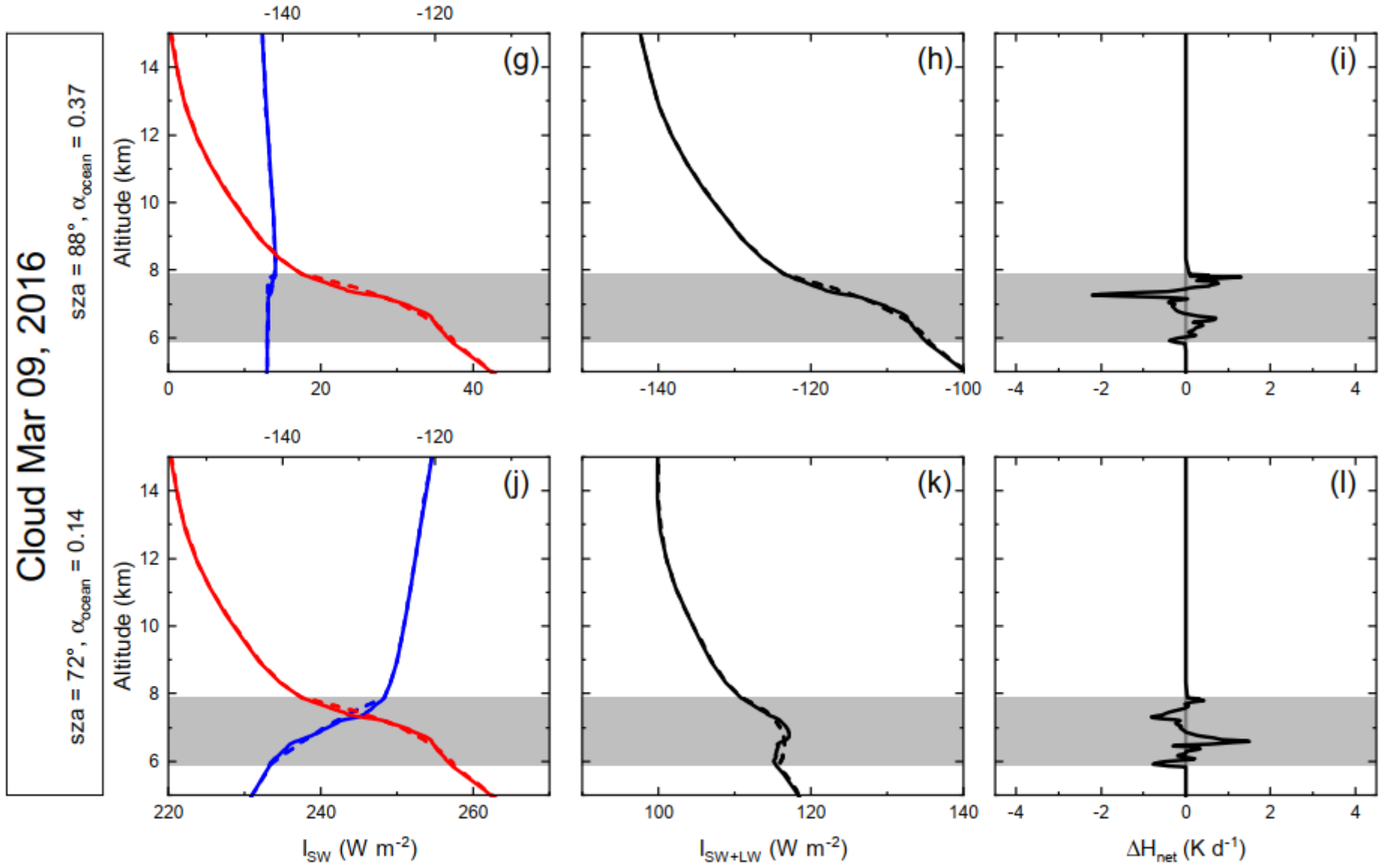

Marsing, Meerkötter et al., in submission to ACP

# Irradiance and heating rate profiles




Marsing, Meerkötter et al., in submission to ACP

# Irradiance and heating rate profiles




Marsing, Meerkötter et al., in submission to ACP