The Broadband Radiative Heating Rate Profile (BBHRP) Project

The ARM BBHRP Focus Group

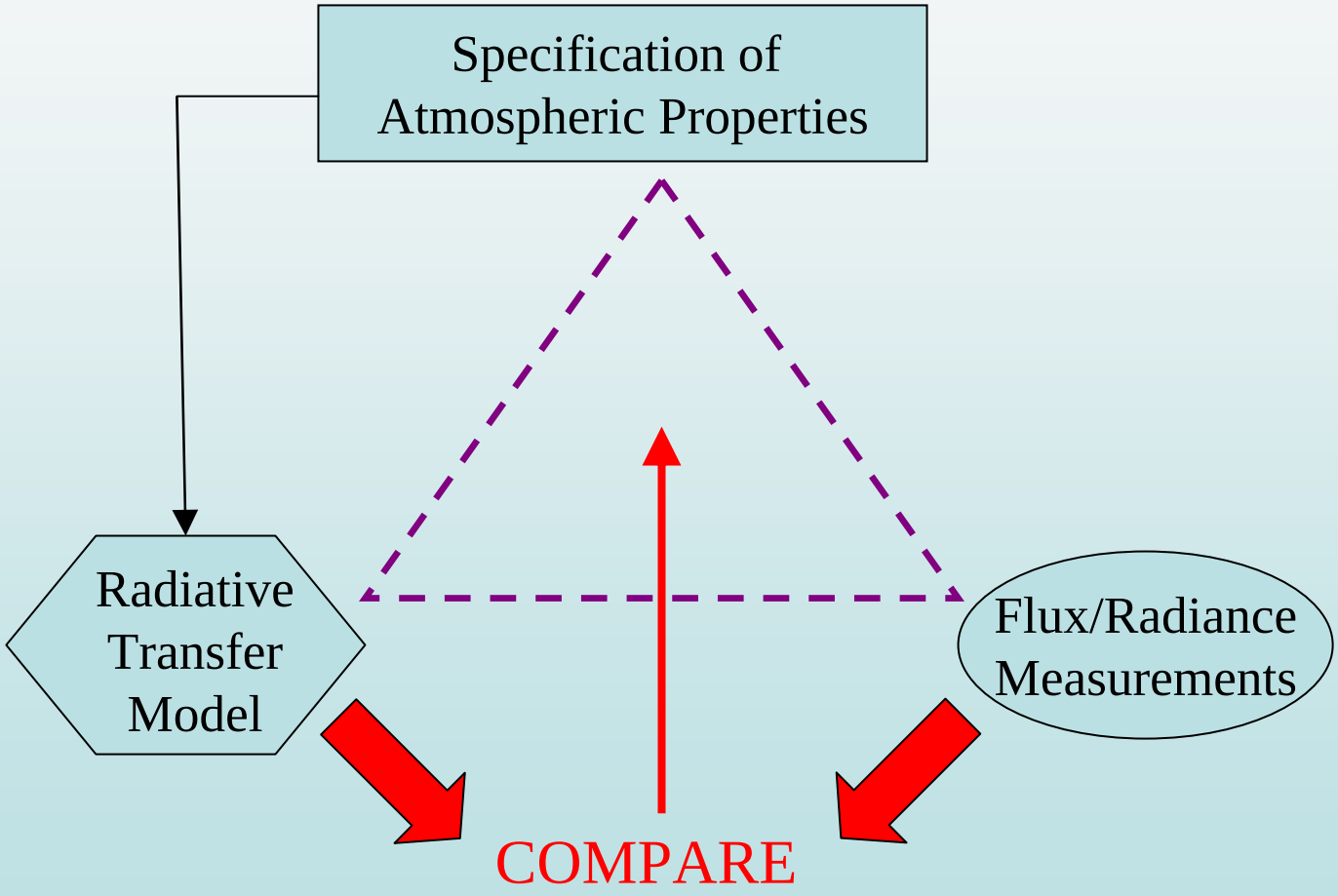
Goals of the BBHRP Project

Compute continuous vertical profiles of radiative heating for extended time periods at all ACRFs

Extend ARM radiative closure studies to:

- shortwave
- TOA
- cloudy conditions
- all ACRFs
- GCM grid cell

Radiative Closure Experiments



Goals of the BBHRP Project

Produce continuous vertical profiles of radiative heating for extended time periods at all ACRFs

Use as a 'test suite' to evaluate retrievals, parameterizations, …

Extend ARM radiative closure studies to:

- shortwave
- TOA
- cloudy conditions
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Goals of the BBHRP Project

Produce continuous 'validated' vertical profiles of radiative heating for extended time periods at all ACRFs

Use as a 'test suite' to evaluate retrievals, parameterizations, …

Extend ARM radiative closure studies to:

- shortwave
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General BBHRP Outline

Atmospheric State
Surface Albedo

Aerosol Best-Estimate Profiles

Cloud Property Profiles

Radiative Transfer Model (RRTM)

Vertical Profile Fluxes/Heating Rates

Two resolutions:
"soda straw"
grid-cell

TOA Validation
Satellite LW/SW Fluxes

Surface Validation
ARM LW/SW Fluxes

BBHRP

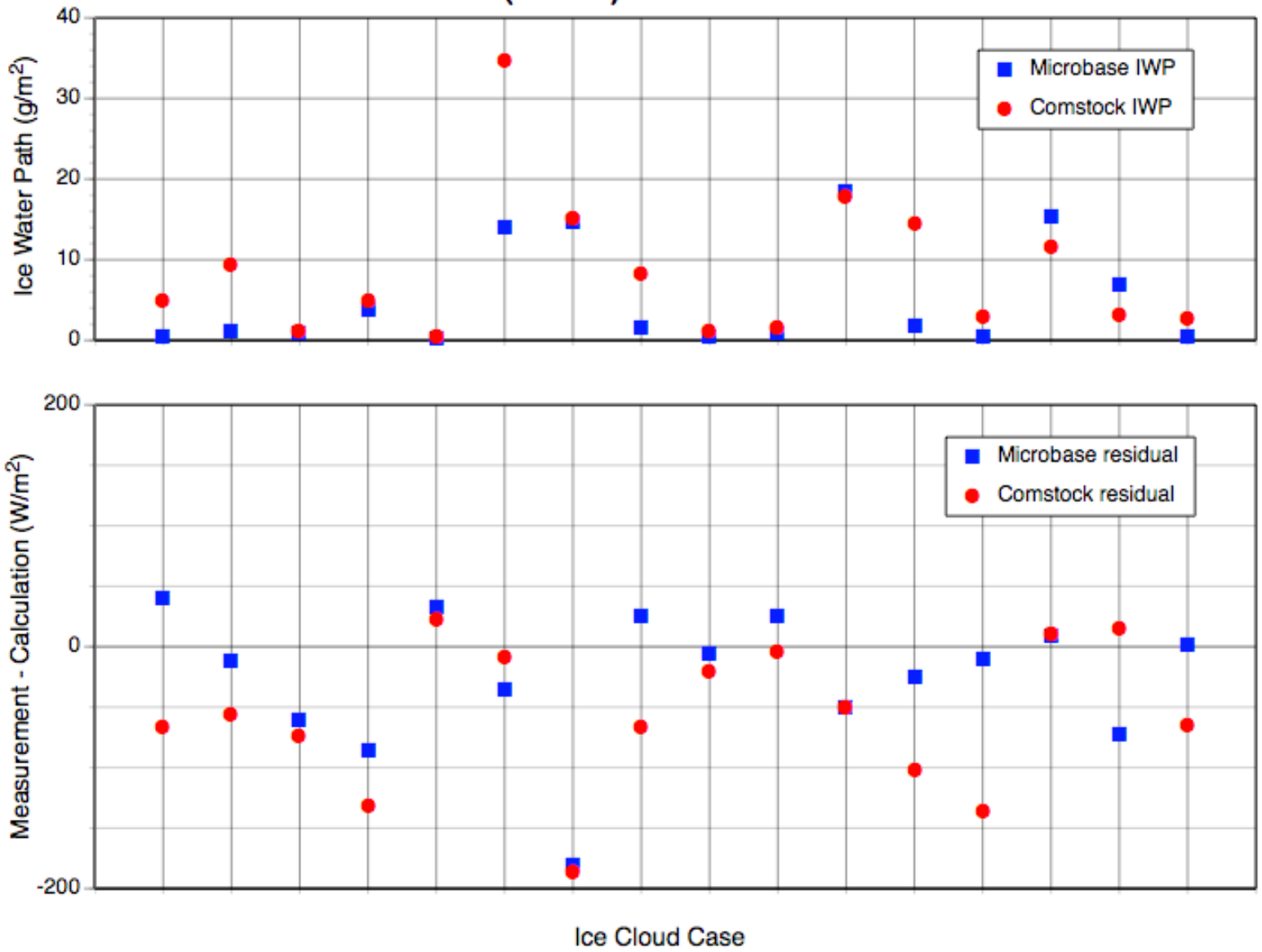
- Key input
  - cloud properties - Microbase (more in next talk)
  - aerosol properties - Aerosol Best Estimate from ARM Aerosol WG
  - thermodynamic profile

    Mergedsounding product - combines sonde and ECMWF profiles
- Status
  - SGP - mature (i.e. many ‘trials’ completed), but still improving
  - NSA - one-year complete, improvements needed
  - TWP - next
  - AMF

    o PRY - some work done

    o NIA - preliminary analysis ongoing

SW Diffuse - Comparing Microbase (Radar) and Comstock (Lidar) Ice Cloud Retrievals

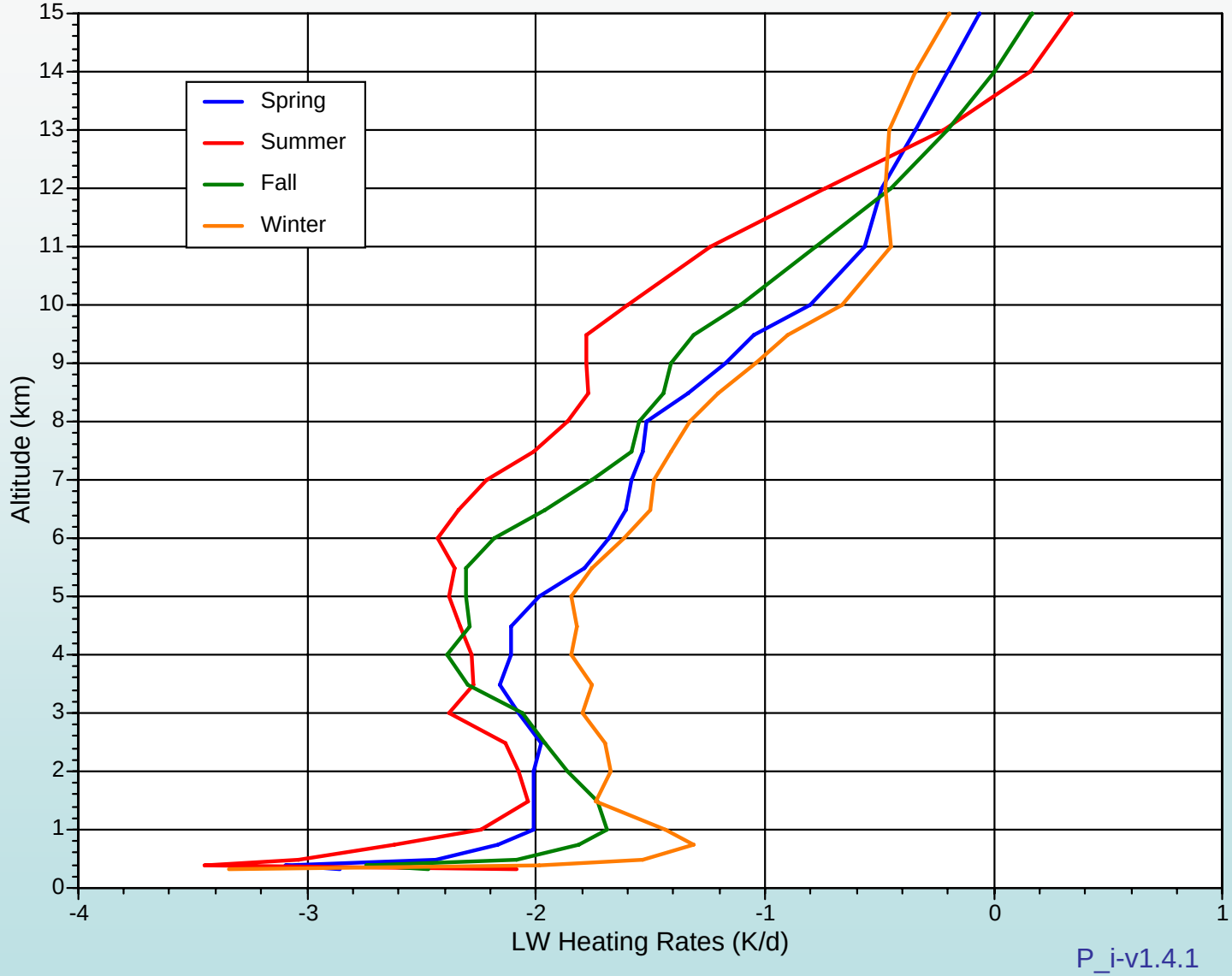


Evaluating MC-ICA

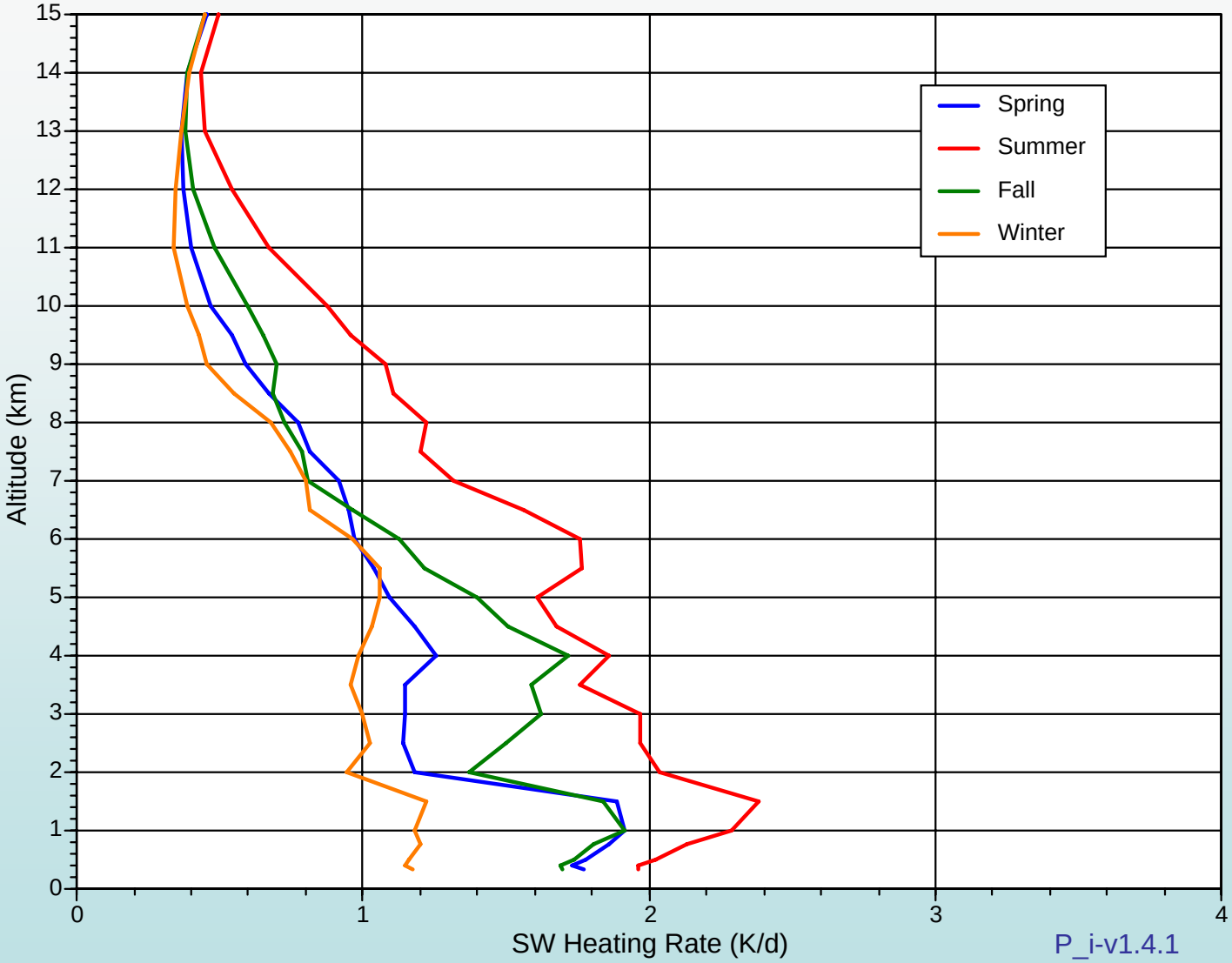
SW Diffuse Residuals, Overcast Cases, 3/00 - 2/01

Method	Cloud type	N	Mean residuals ($W\ m^{-2}$)	Stdev of residuals ($W\ m^{-2}$)
Reference (non-GCM)	Mixed	72	22.2	46.1
v1.4.1tL	Ice	53	-19.3	49.9
ECMWF (GCM)	Mixed	65	13.9	101.3
v1.4.1tR	Ice	55	72.3	84.9
MC-ICA (GCM)	Mixed	72	19.1	47.2
v1.4.1tS	Ice	53	-26.8	51.2

Clear-sky LW Heating Rates at SGP for 2000 by Season



Clear-sky SW Heating Rates at SGP for 2000 by Season



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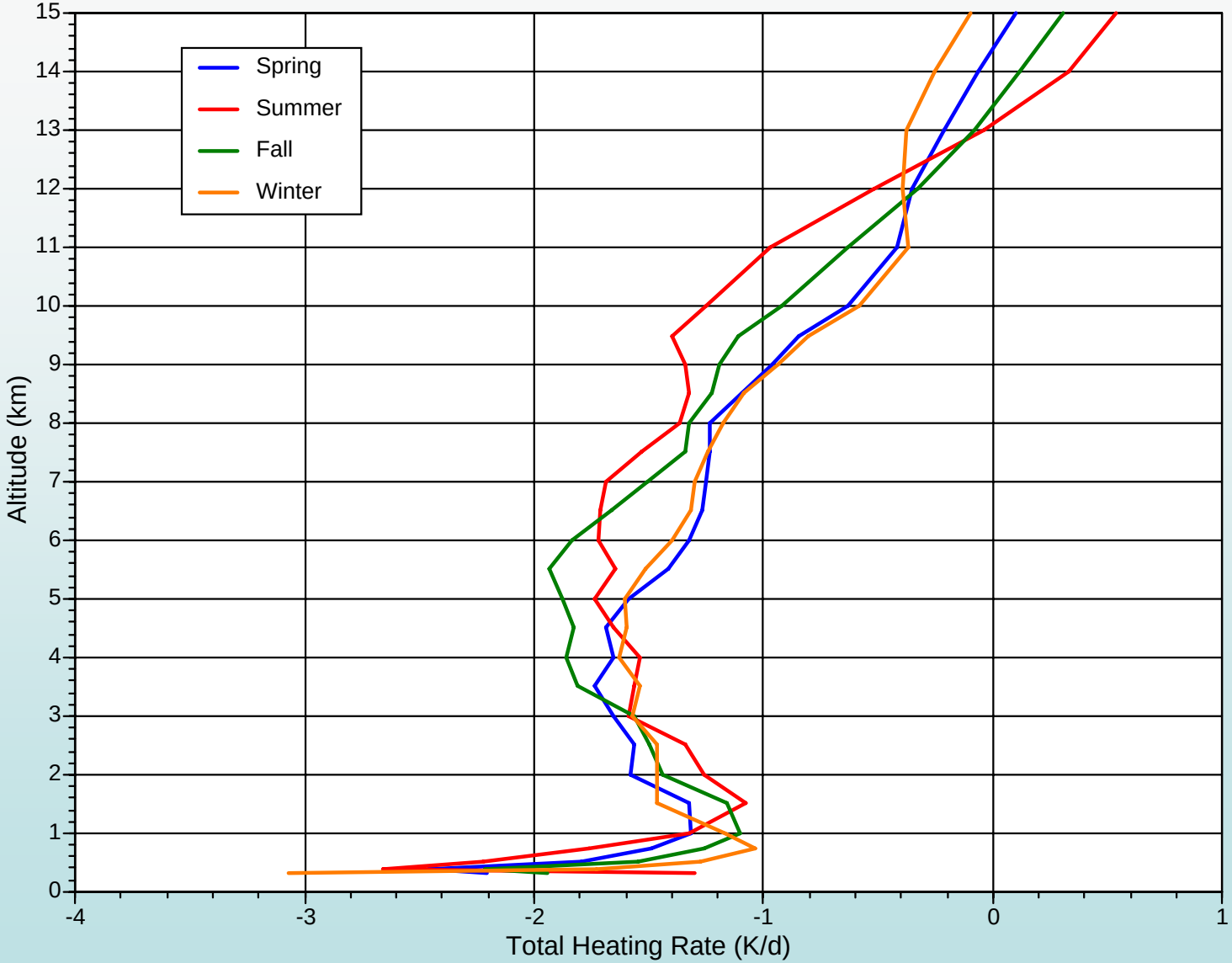
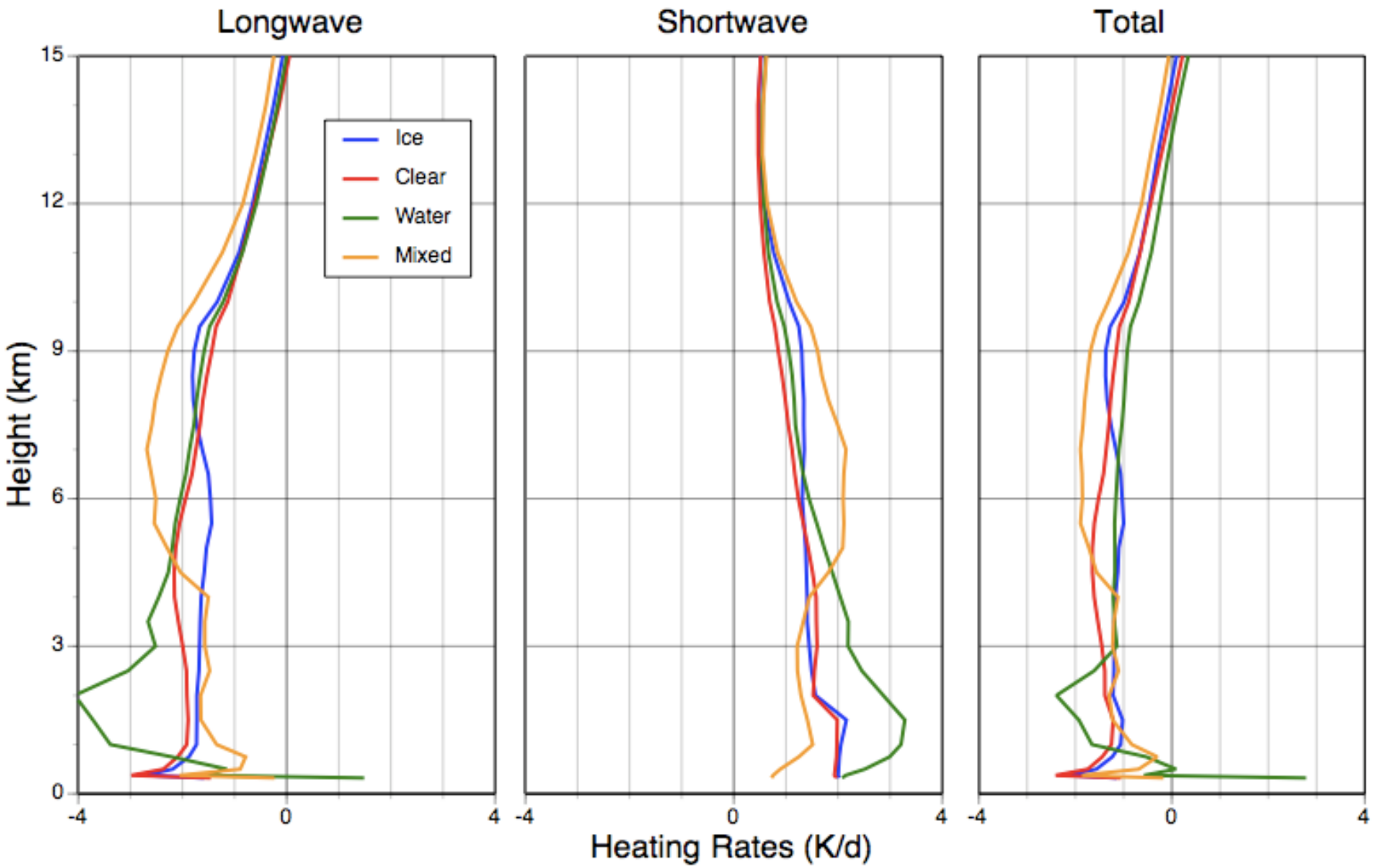
Clear-sky Total Heating Rates at SGP for 2000 by Season



Heating Rates by Cloud Type: SGP 2000



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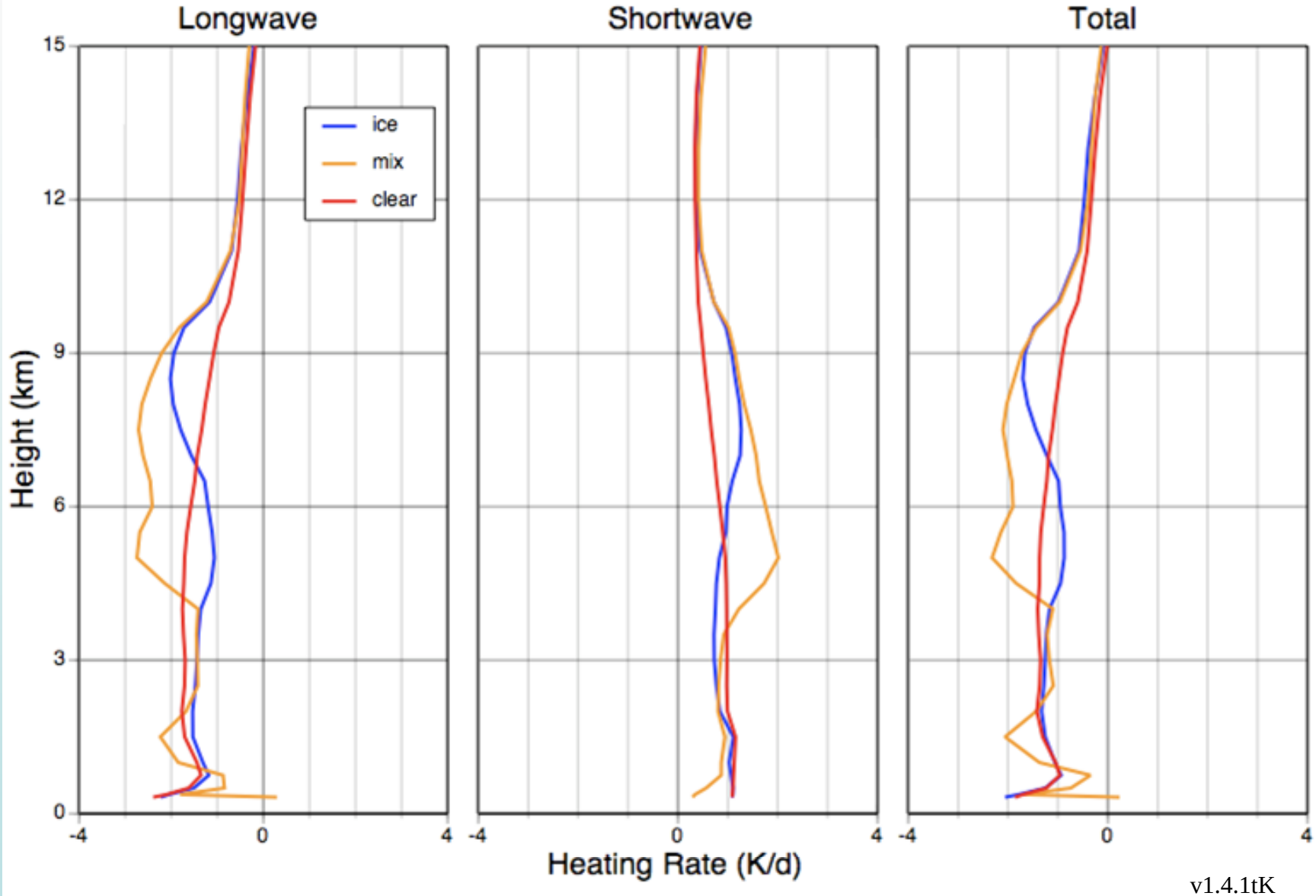
Heating Rates by Cloud Type: SGP, Winter 2000



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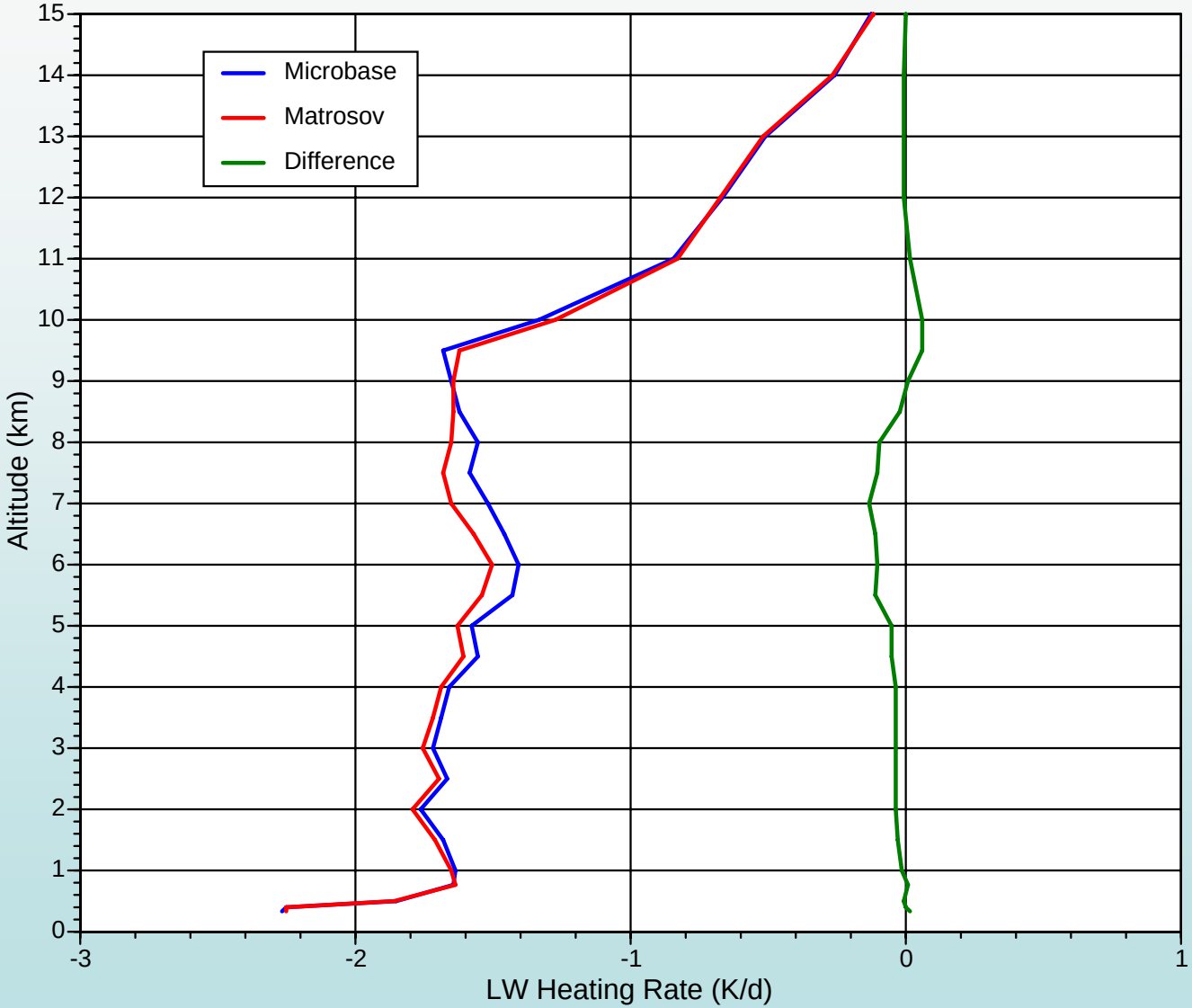
LW Heating Rates at SGP for 2000 for Ice Cloud Cases

Comparing Heating Rates: Two Ice Cloud Property Retrievals



Summary

- BBHRP a useful tool for evaluating
  - cloud retrievals
  - parameterizations
  - input sources
- ‘Validated’ heating rate profiles produced
  - Measurement-model agreement at surface and TOA necessary, but not sufficient, to guarantee accuracy of computed heating rates
  - Direct validation of heating rates - difficult

Response of some: “Let’s have a workshop (someplace warm).”

Web sites: //engineering.arm.gov/~shippert/BBHRP

//iop.archive.arm.gov/arm-iop/0pi-data/mlawer/