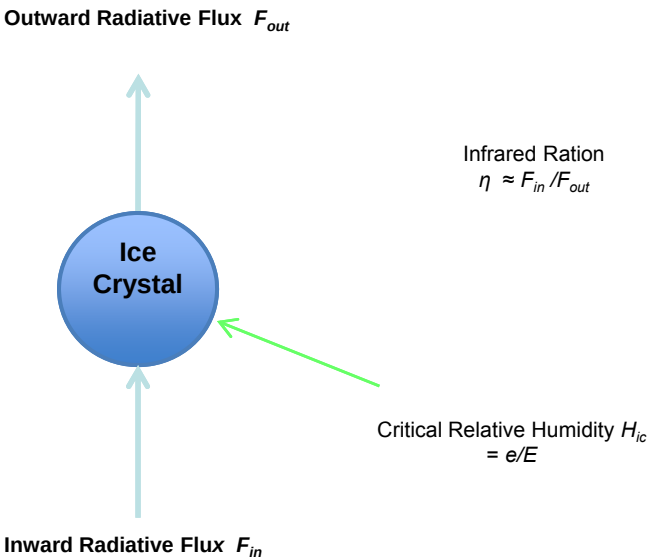
Modeling Diamond Dust and other Arctic Clouds

Xiping Zeng, NASA/GSFC

- Why does our CRM work well in the Tropics and middle latitudes, but not in the Arctic?
- Overlooking diamond dust (or clear-sky precipitation, cloudless ice crystal precipitation) a common phenomenon in the Arctic?
- Can CRMs duplicate the diamond dust?
- Can we learn something from sub-visual cirrus clouds in the Tropics?

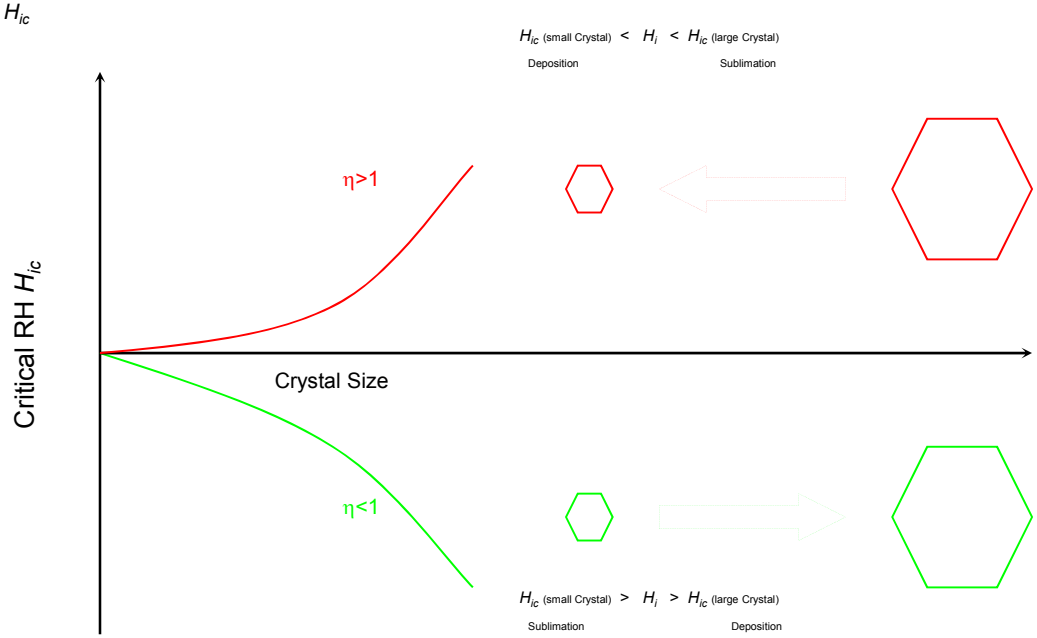
Direct Effect of Radiation on Ice Crystal Growth



- same η
- different crystal temperature
- different saturation vapor pressure near crystal

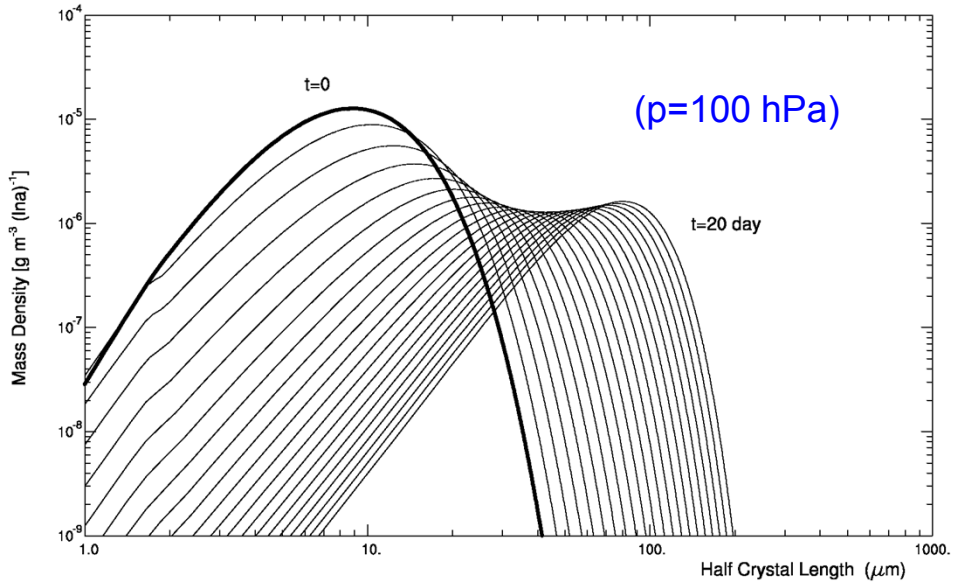
- When $H > H_{ic}$, crystal grows
- When $H < H_{ic}$, crystal shrinks

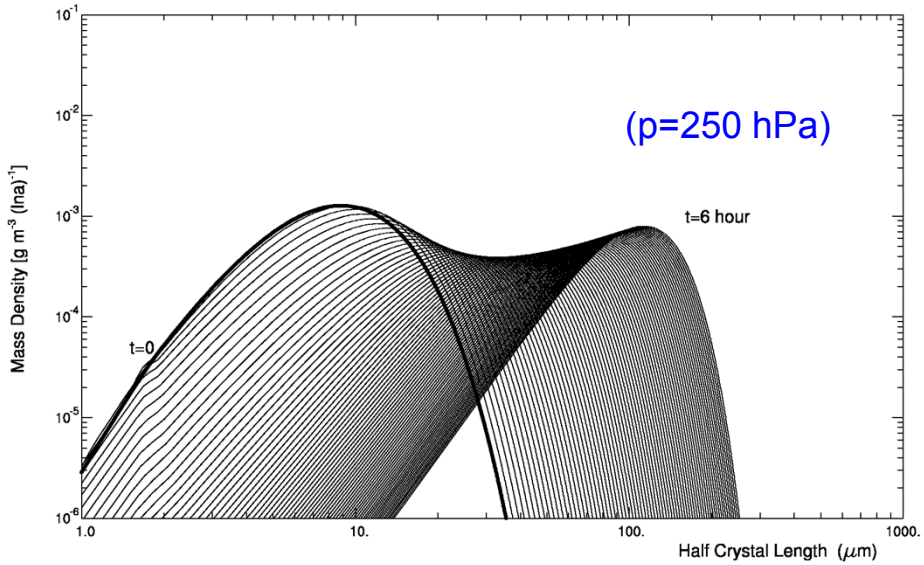
$$(1 - H_{ic}) \propto (1 - \eta)$$

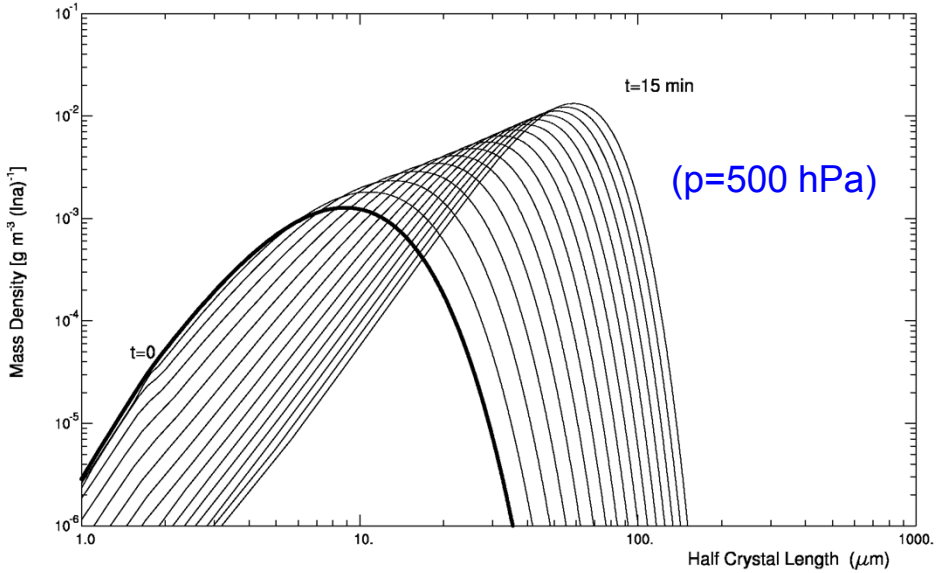


From Zeng (2008, QJ)

Direct Effect of Radiation on Ice Crystal Spectrum





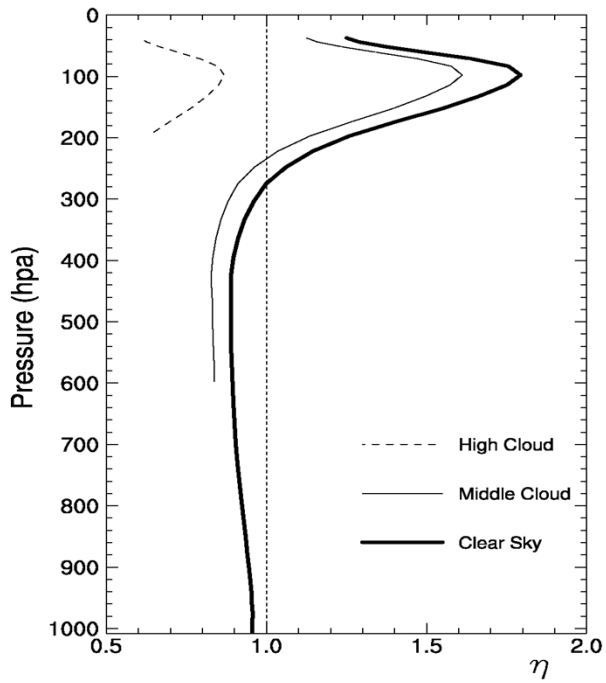


$\eta = 0.5$

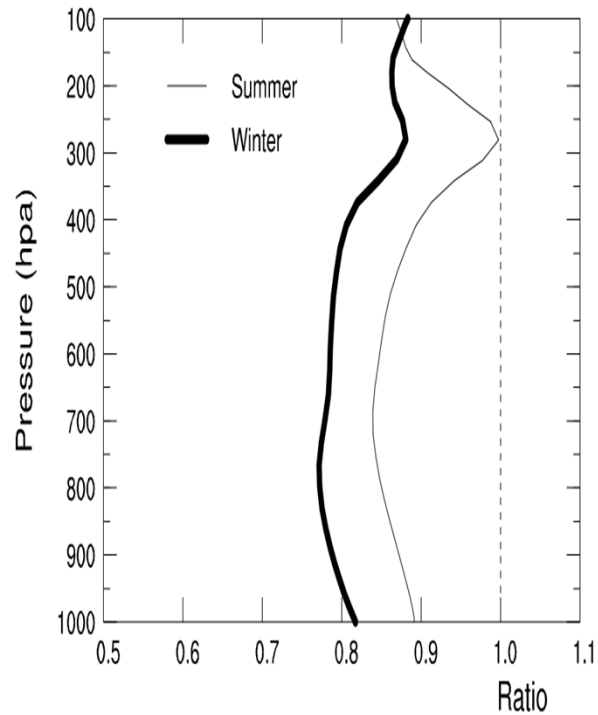
$w = 0$

$H < 100\%$

Vertical Profiles of η

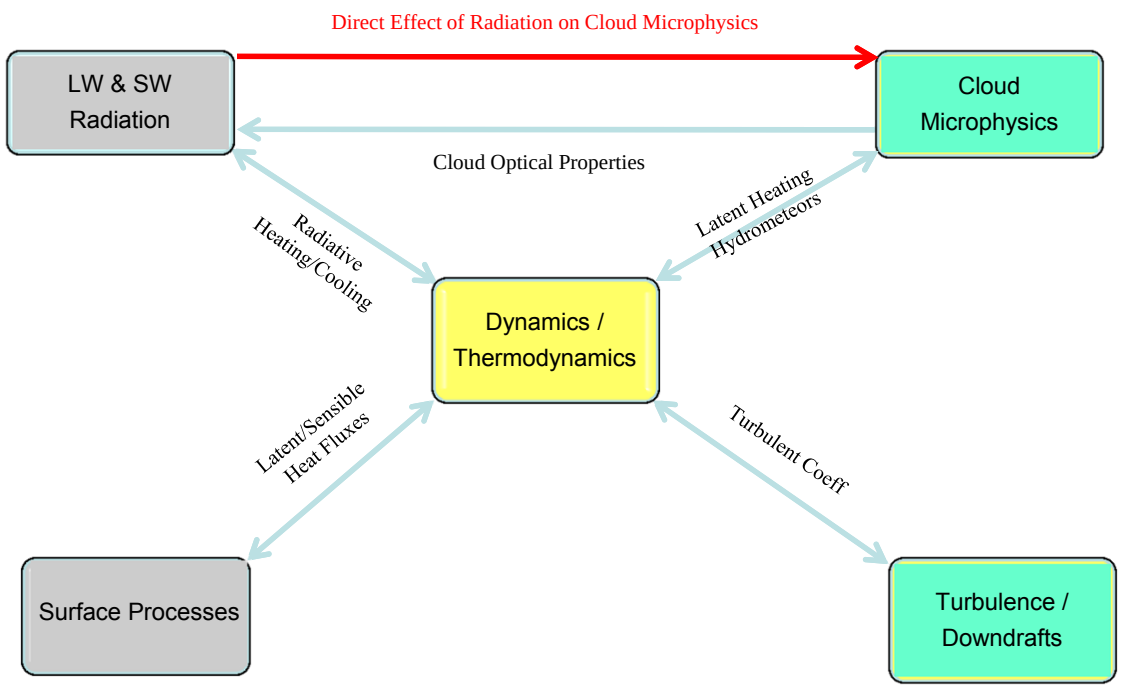


In the Tropics



In the Arctic

Phenomena Associated

- Subvisual clouds
- Dry stratosphere
- Diamond dust

Modeling other Arctic Clouds