

Interannual & Diurnal Variability of PMCs Using 10 years of Lidar and 14 years of CIPS Observations at McMurdo, Antarctica

Introduction

Polar Mesospheric clouds (PMCs) are water ice particles occurring in polar mesopause regions during summer. They are a "canary in the coal mine" - potential tracers of global climate change in the upper and middle atmosphere.

Why do we need to study PMCs?

- Unique tracers for climate change decreased heating and photolysis of water vapor in MLT
- Natural laboratory for MLT excellent indicators of the mesospheric upwelling strength.
- Variability of PMC centroid altitude is within 1.02 km; thus, they can be used for testing atmospheric models.
- Mysteries surrounding PMCs!
- Does solar cycle effect PMCs?
- ➢ How do PMCs affect the surrounding mesospheric environment?



Mean Characteristics of AIM/CIPS PMCs over 14 years

Mean Characteristics

Albedo, (× $10^{-6} sr^{-1}$) Ice Water Content (g/km^2) Radius (nm) **PMC** Images Total CIPS Images **PMC Occurrence** frequency

McMurdo (2007-2021)

 8.63 ± 0.14 (5.54) 57.64 ± 0.88 (36.13) $46.56 \pm 0.23 \ (9.40)$ 1556 images 4213 images

36.9 %

PMC Occurrence period 23 Nov to 20 Feb



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CIPS PMC observation





Preliminary analysis of direct correlation between β_{total} and solar flux (Sunspot number) agreed with Hervig et al. (2019), a lack of solar cycle signature!

PMC are heavily affected by dynamics, which may overpower the solar cycle signature.



Polar vortex breakup is the dominating driver in PMC albedo variability, Solar cycle is a minor driver!

Lidar PMC brightness correlation **CIPS** albedo

 $\mathbf{R} = 0.82 (98.77\%)$ **CIPS IWC** R = 0.82 (98.77%)for the entire dataset

Lidar PMC brightness correlation

CIPS albedo R = 0.92(99.96%)**CIPS IWC** R = 0.92 (99.96%)

in the dominant PMC period (15th Dec – 15th Jan for each

Effects mesospheric T, upwelling wind, H_2O PMC β_{total} , albedo, IWC, onset, etc.



 \Box T and H₂O optimal conditions are key to PMC formation. Upwelling winds cause higher PMCs at higher latitude.

□Investigate diurnal variability of PMCs. Study the impact of the wave-induced temperature oscillations on PMC formation

Explore possible teleconnection for interhemispheric studies.

Future Work