

# *The Absent Solar Cycle Responses of the Polar Mesospheric Clouds*

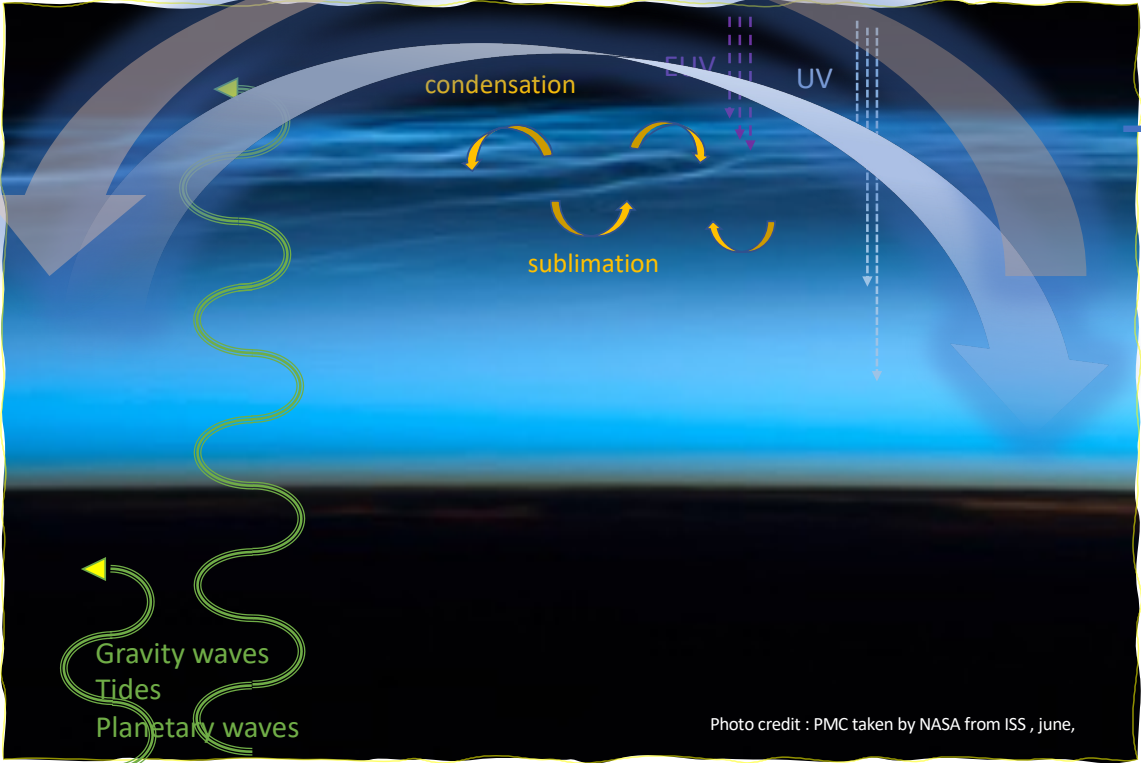
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# What is Polar Mesospheric (Noctilucent) Cloud?



- 82 km
- low temperature (T)
- sufficient water vapor (H<sub>2</sub>O)

Photo credit : PMC taken by NASA from ISS , june,

# "When The Sky Ran Red: The Story Behind *The Scream*"

Olsen, D. W., R. L. Doescher and M. S. Olson, 2004 (*Sky & Telescope*)

1893



1883



1885

July 16, 1885]

NATURE

be so well plotted on this last survey that the amount of gorge excavated since 1750 should be knowable to an acre. The west fall, then, only slightly the larger, has ever since been widening, lowering its edge, and getting more of the stream; so that the east one, comparatively stationary, retaining its height and decreasing in volume, must dry up, and its bed and all the isles become part of New York State. E. L. GARRETT  
July 11

#### Sky Glows

EVER since the sunsets of 1883 and last year there has been at times an abnormal glare both before and after sundown. But I have seen nothing in the way of twilight effect so strange as that of Monday evening, the 6th, when about 10 p.m. a sea of luminous silvery white cloud lay above a belt of ordinary clear twilight sky, which was rather low in tone and colour. These clouds were wave-like in form, and evidently at a great elevation, and though they must have received their light from the sun, it was not easy to think so, as upon the dark sky they looked brighter and paler than clouds under a full moon. A friend who was with me aptly compared the light on these clouds to that which shines from white phosphor paint. This effect lasted for some time after 10 p.m., and extended from west to north, the lower edge of the clouds, which was sharply defined, was about 12° above the horizon. ROBT. C. LESLIE  
6, Moira Place, Southampton, July 8

#### Black and White

My daughter has two terriers, one black, the other white; she has noticed that in the dusk of the evening the black dog is much more visible than the white one, and has asked me the reason for this fact. I cannot properly explain why a white or light coloured garment shows much less in the dusk than a dark coloured dress, but this is a well-known fact to all sportsmen who shoot ducks at night, when it is their custom to wear a night shirt or other white dress over their ordinary costume.

well considered, at now refer to some have already been bility of the chan change should be l Among the first Astronomer-Royal of Greenwich. M: date and forwarded U.S. Navy to the order of Commodore U.S. Naval Obsc January 1, 1885 Newcomb, the Sur *Almanac*, and drt which we make th  
“(1) The Confer be practical the astro everywhere to begin  
“(2) That east lon longitudes as minus.  
“The first of thes the method of counti to us from antiquity, nomers. The practi which the hours were This practice is not Conference seem to convenience to the as but was adopted bec measuring solar time. by the motion of the angle. By uniform meridian of the plac day is counted from the meridian of the pl

*E. Munch's the Scream as part of The Frieze of Life Oslo, Norway*

*Krakatoa Volcanic eruption, Indonesia*

# Where PMCs are formed?

NH

SH

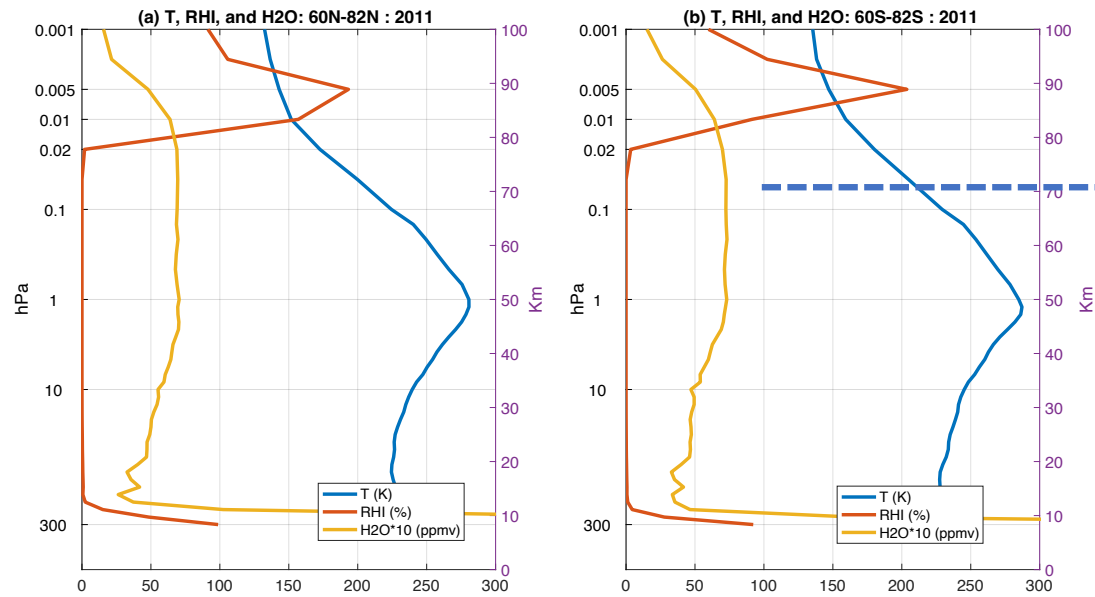


Figure1. Profiles of MLS T (K), RHI(%), and H2O\*10(ppm)

## - PMC (Polar Mesospheric Cloud) DATA

1. AIM/CIPS : since 2007

Aeronomy of Ice in the Mesosphere / Cloud Imaging and Particle Size

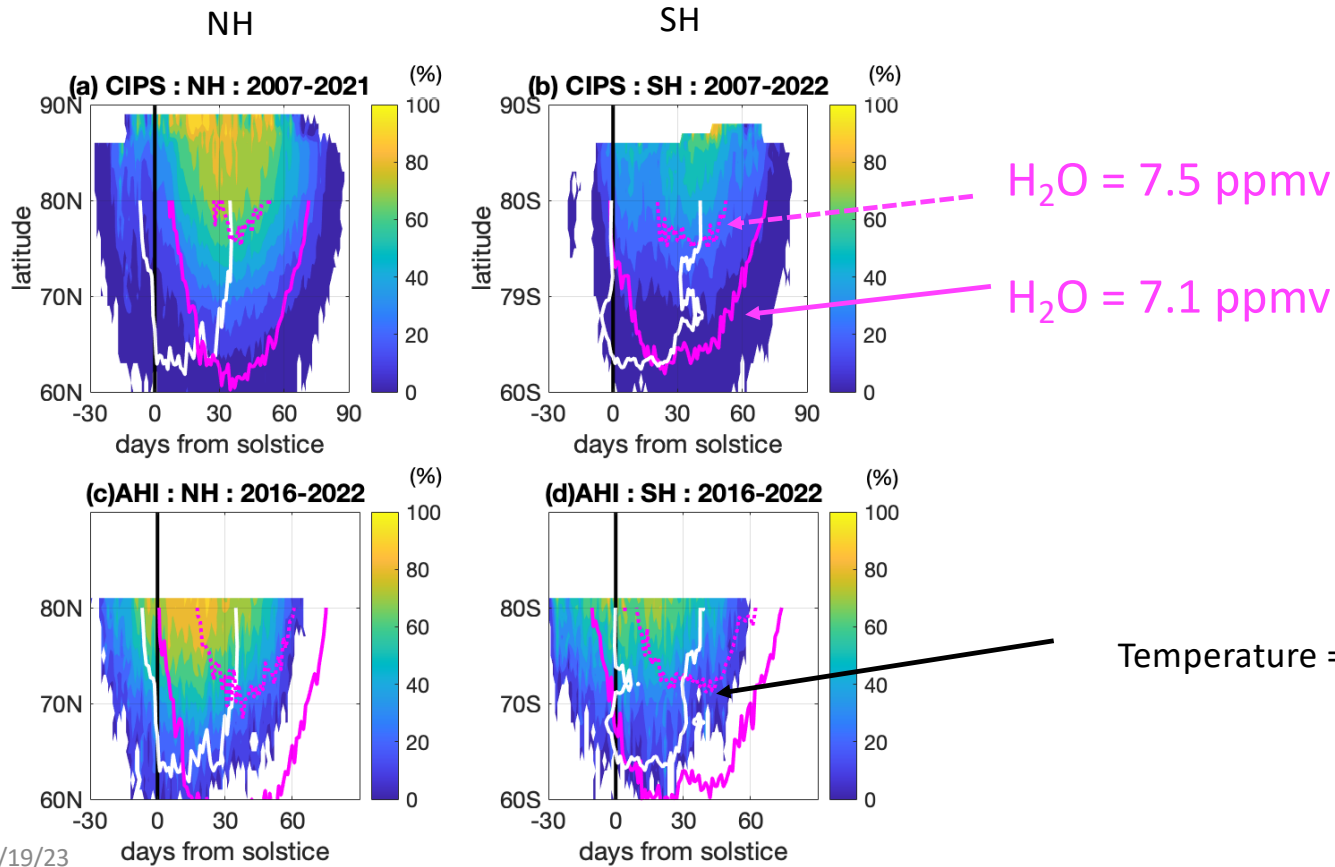
2. Himawari-8/AHI : since 2016

Advanced Himawari Imager

3. MLS DATA : since 2005

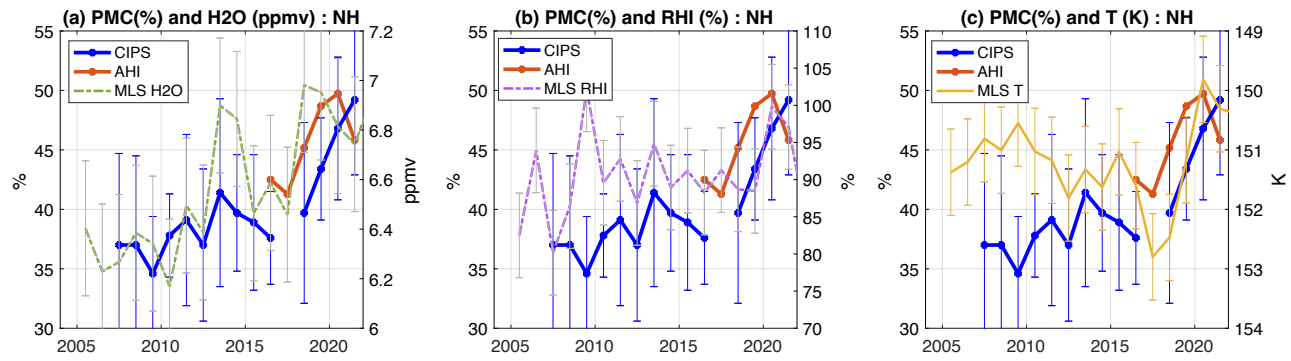
Microwave Limb Sounder

# Hemispheric Asymmetry in PMC Occurrence Rate

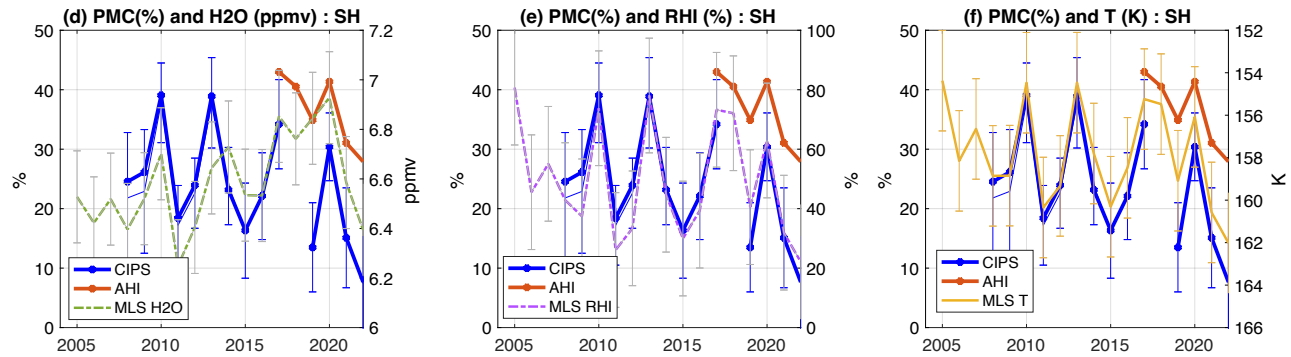


# Interannual variation of the PMC Occurrence Rate

NH



SH



# Interannual variations of onset date of the PMC



Missing?  
or Absent?  
or Diminished?

1. What is the role of solar variability in a rapidly changing climate?
2. How can we understand the “Sun and climate change”, together.
3. Implementation of the accurate TSI and SSI is more important than ever (Funke et al., 2023).

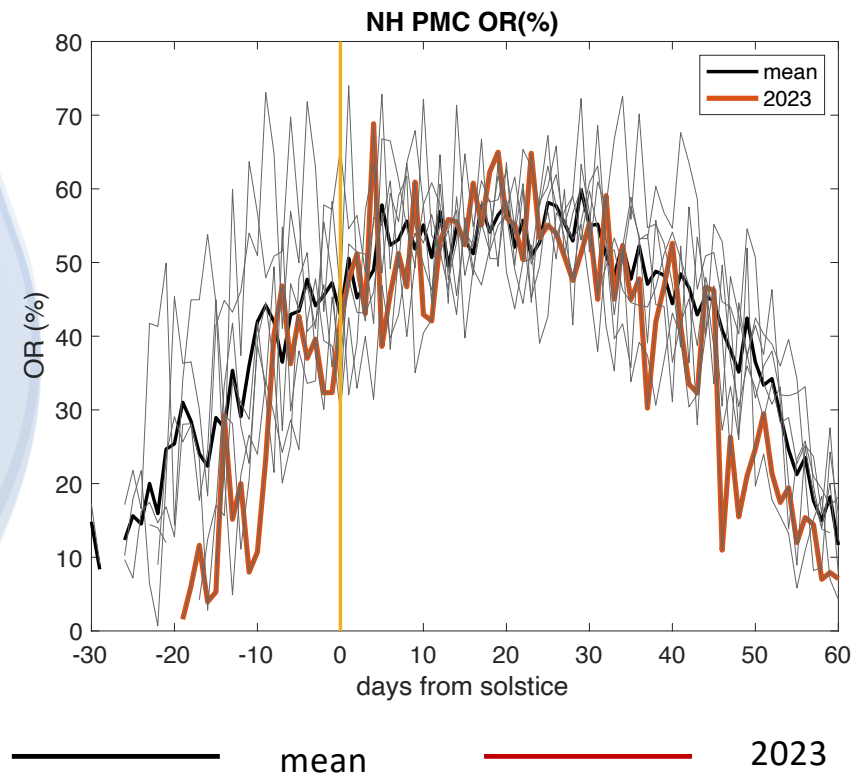


Is there a sign of HTHH eruption in PMC, in 2023?

H<sub>2</sub>O is injected, T is cooled, so PMC is expected to be increased?

10/19/23

Himawari/AHI PMC (%) : NH

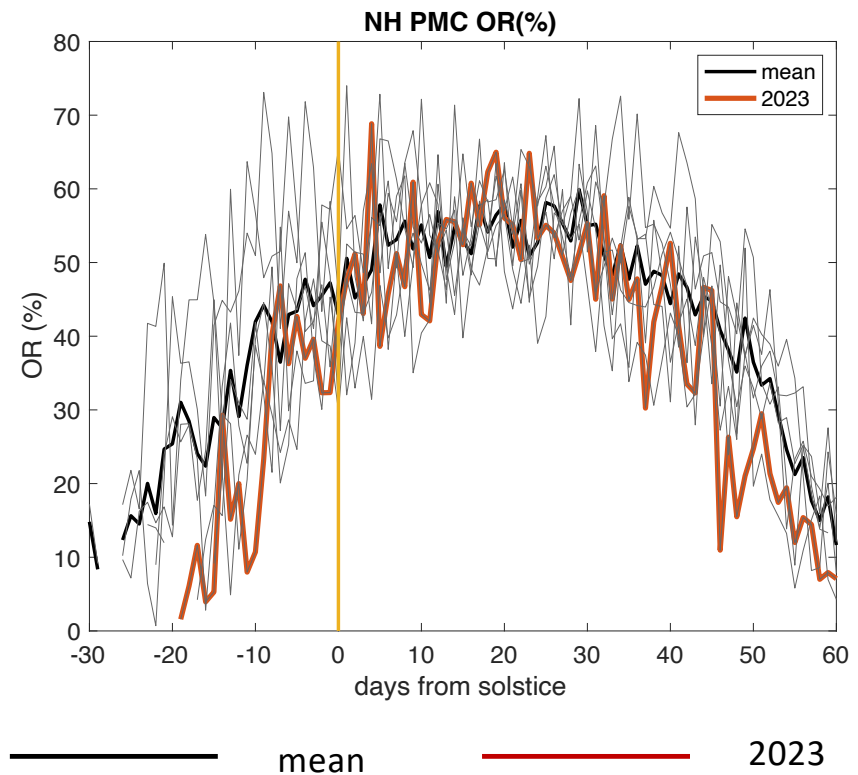


No! or Yes, but not yet!

Is there a sign of HTTS eruption in PMC, in 2023 ?

10/19/23

Himawari/AHI PMC (%) : NH



# Summary



PMC OR shows high sensitivity to mesospheric T and H<sub>2</sub>O.



PMC OR shows little solar cycle signal but quasi quadrennial(4-5yrs) oscillations during last decade. Global increase of H<sub>2</sub>O may be partly responsible for the missing solar cycle variation.

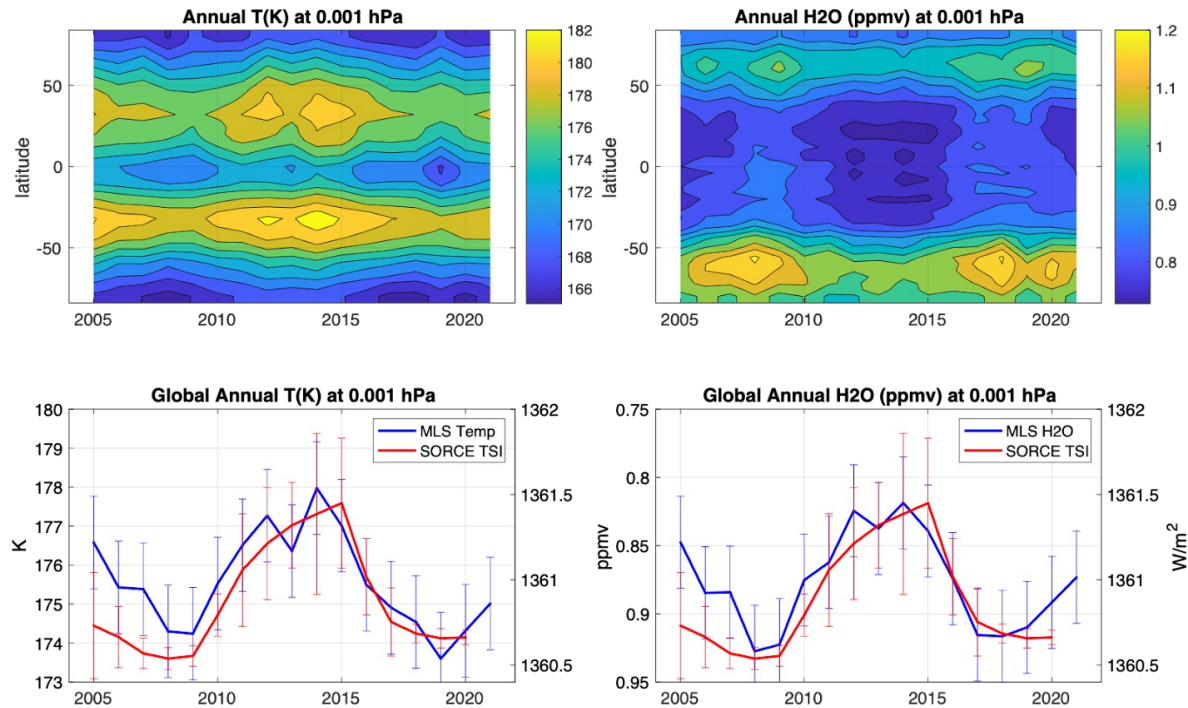


PMC OR does not show a sign of anomalous features in 2022 and 2023 after the HTHH volcanic eruption.

Special acknowledgement: David Gathright who wrote ground system software for AIM/CIPS ~20yrs ago.

10/19/23

# 11-year solar cycle signals in T and H<sub>2</sub>O



Annually averaged  
global T and H<sub>2</sub>O