Further Studies of the Notch Feature in Unstable Layers in the Tropics

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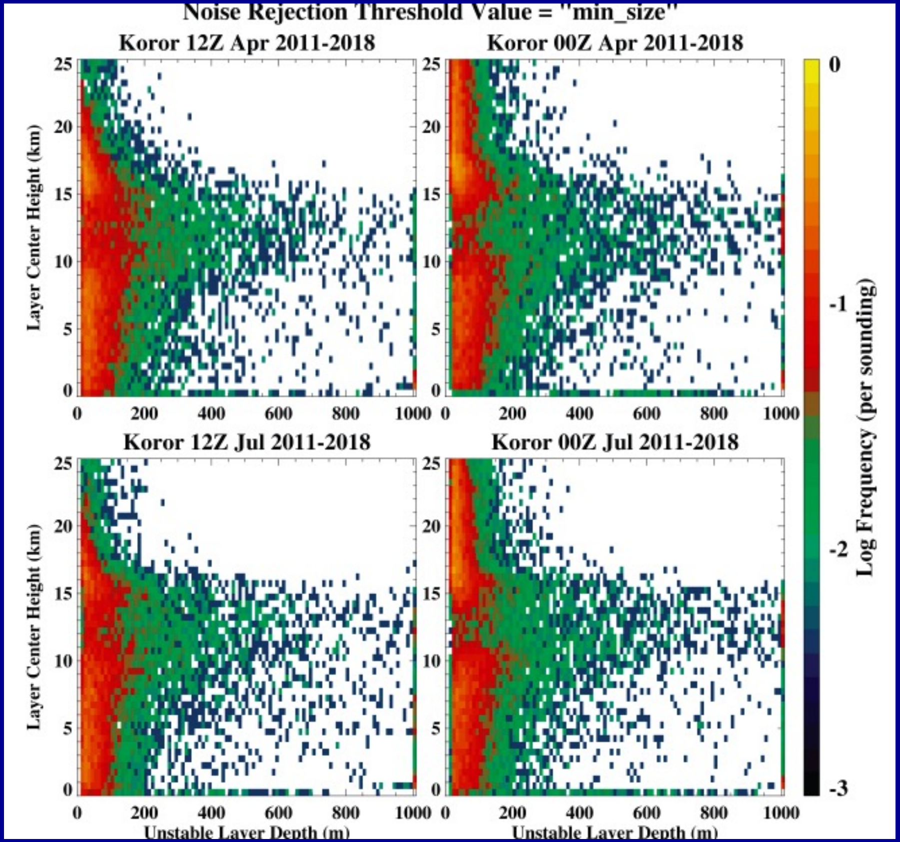
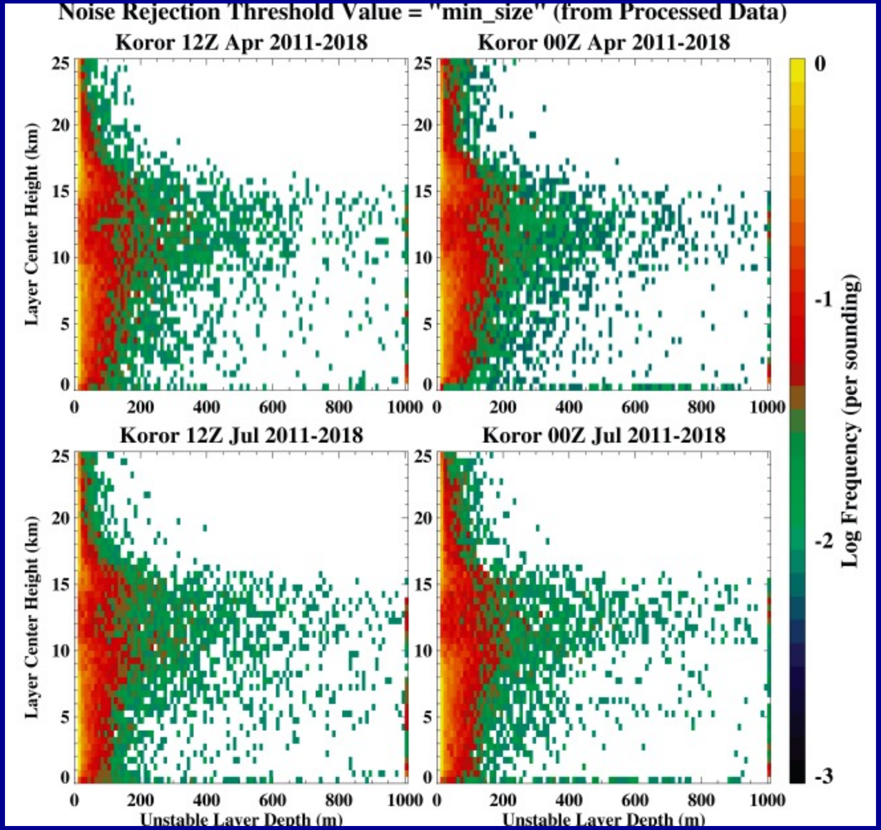
At Koror, a radiosonde station in the deep tropics, a "notch" was seen at altitudes near 12 km in which there were fewer thin unstable layers at those altitudes and more thick unstable layers at those altitudes.

RAW



NIGHT DAY

PROCESSED



NIGHT DAY

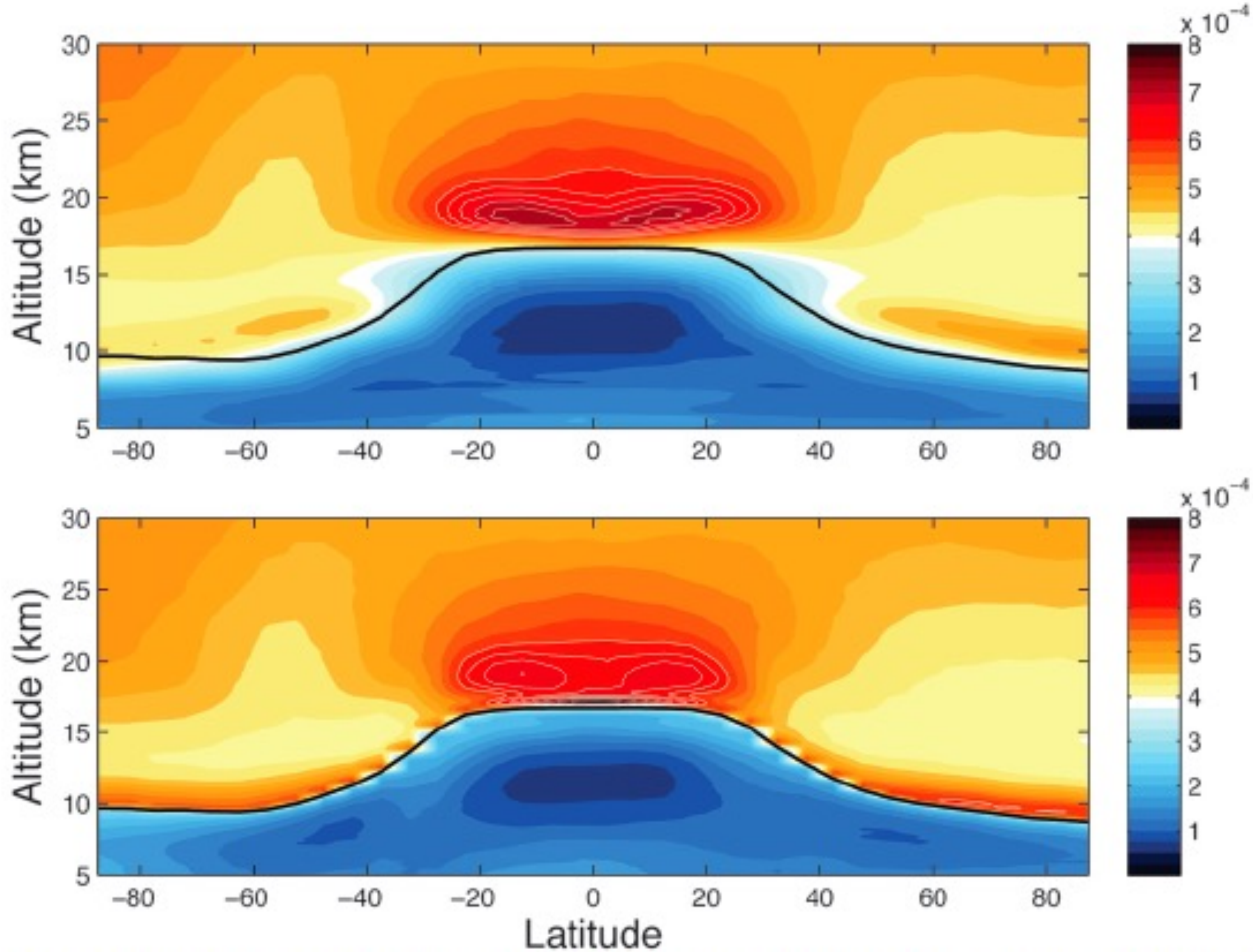
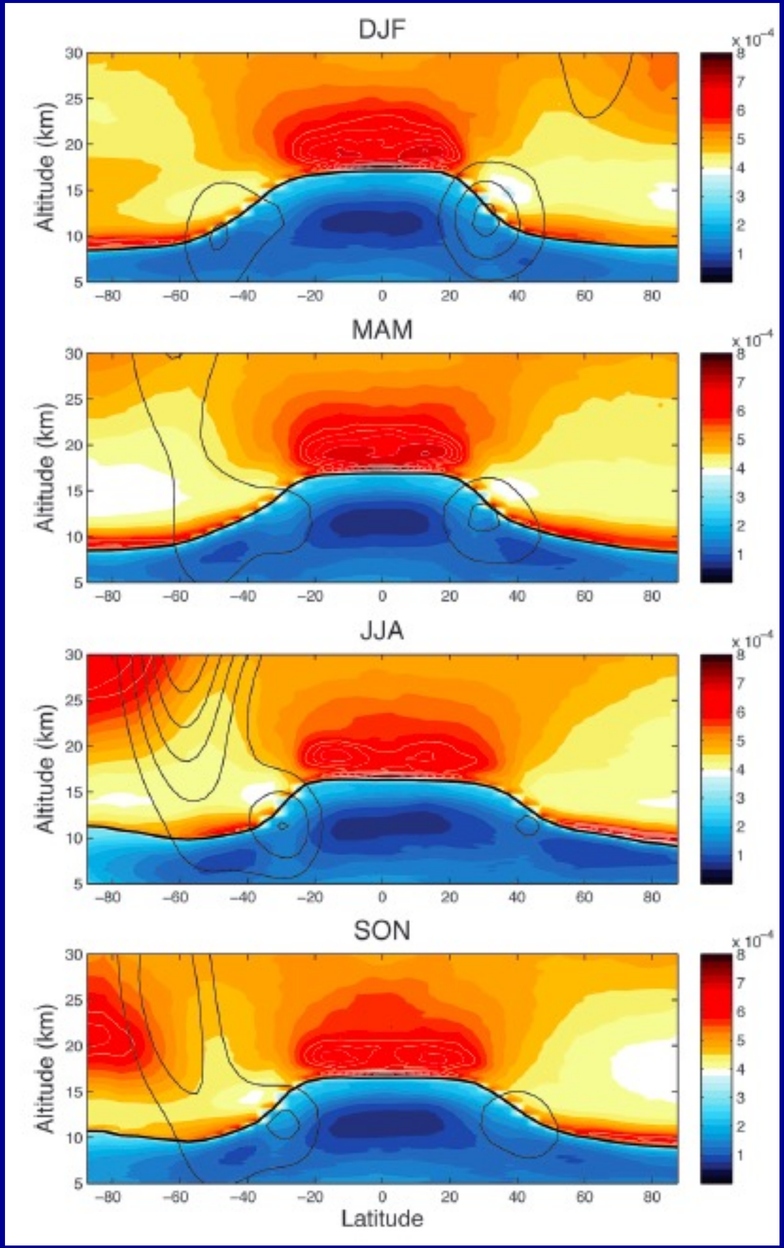


FIG. 1. Annual-mean, zonal-mean static stability (N^2) in (top) conventional vertical coordinates and (bottom) tropopause-relative vertical coordinates. The shading interval is 2.5×10^{-5} s^{-2}. The thick solid black line is the annual-mean, zonal-mean thermal tropopause height. The thin white contours highlight the shading intervals for values greater than or equal to 6.0×10^{-4} s^{-2}. The annual mean is based on data averaged over April 2002–March 2008. In all figures, static stability is calculated using the GPS temperature profiles from the CHAMP satellite.

From Grise et al. (2010, *J. Climate)*

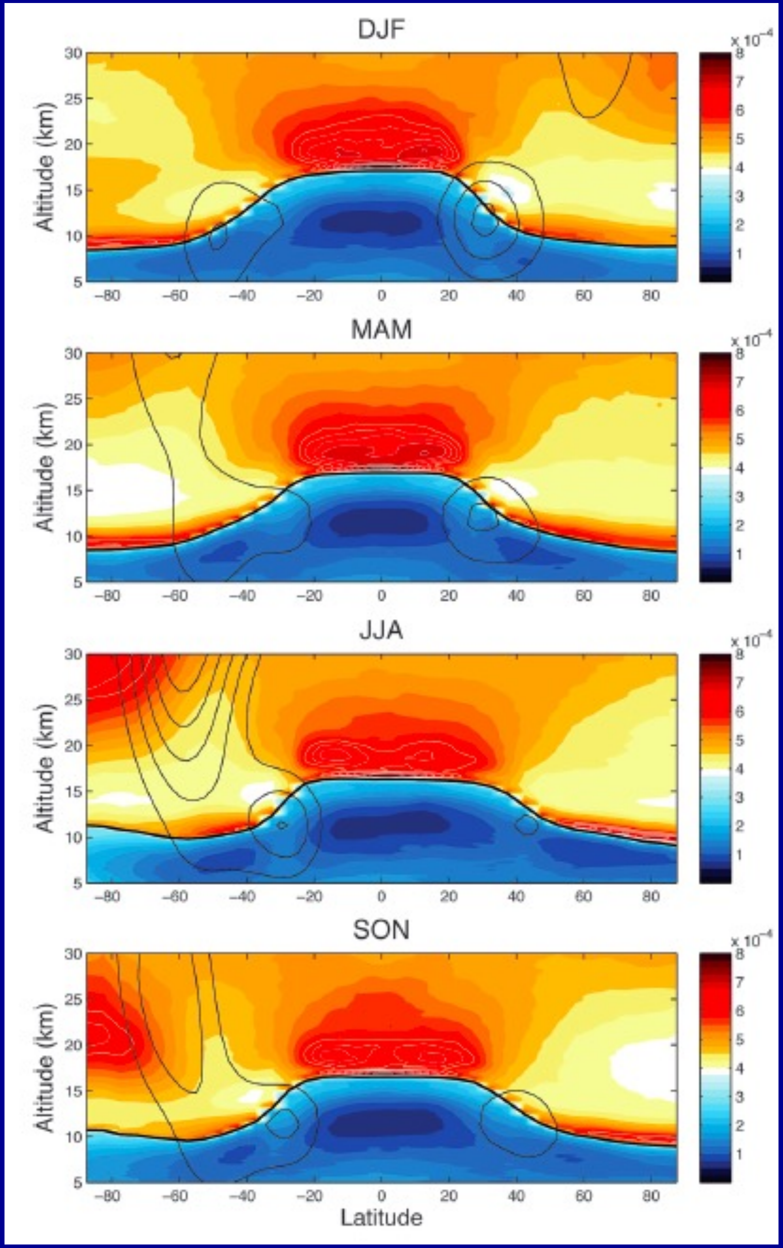


From Grise et al. (2010, *J. Climate*

In this study, we pose two questions.

1. Do other stations in the deep tropics show similar “notch” features?

2. Do other tropical stations not in the deep tropics show seasonal variation of the “notch” features as expected from the seasonal migration of the tropical stability minimum?



Pago Pago – 14.3 ^{0}S

Ponape – 7.0 ^{0}N

Majuro – 7.1 ^{0}N

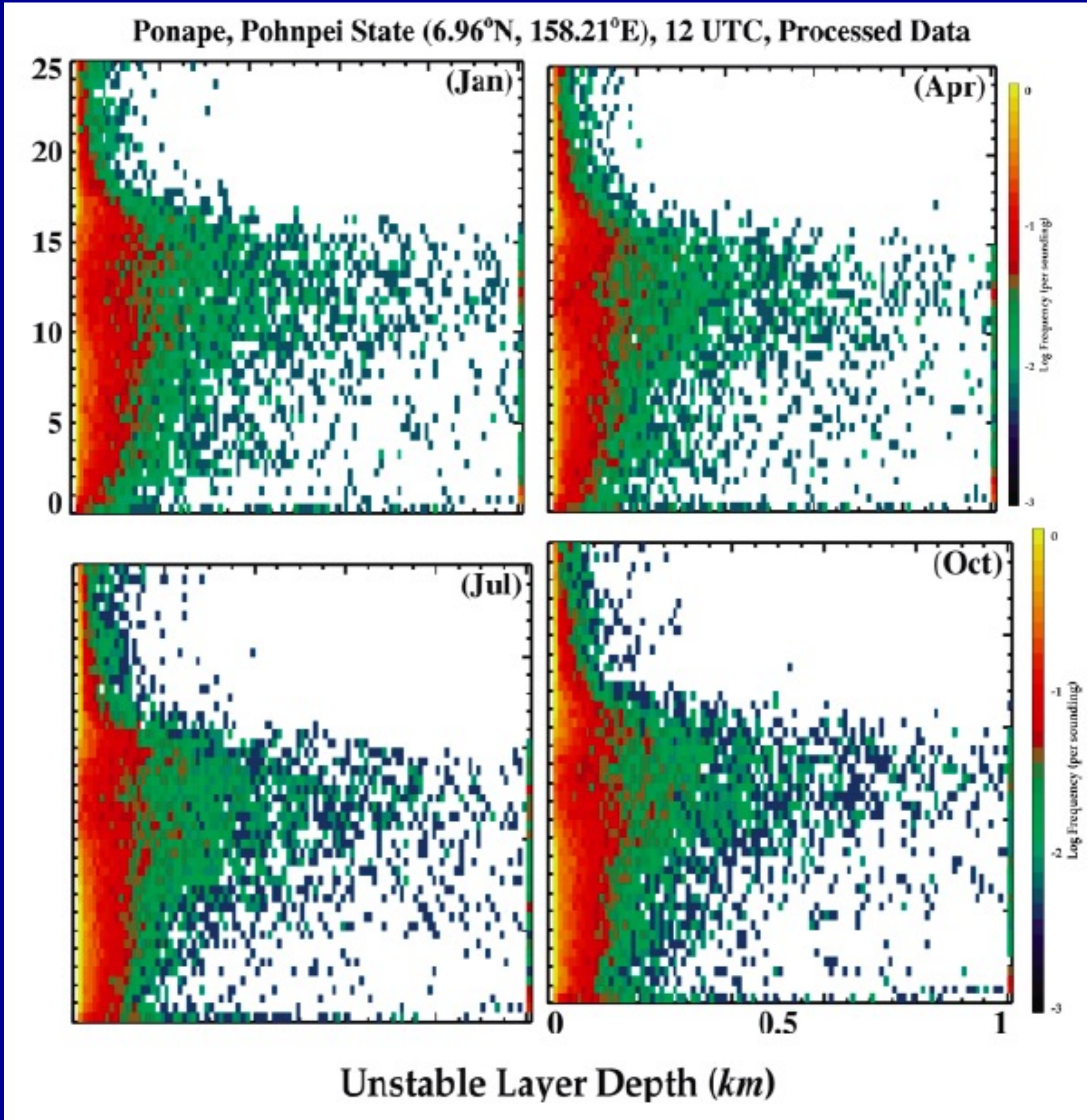
Koror – 7.3 ^{0}N

Chuuk – 7.5 ^{0}N

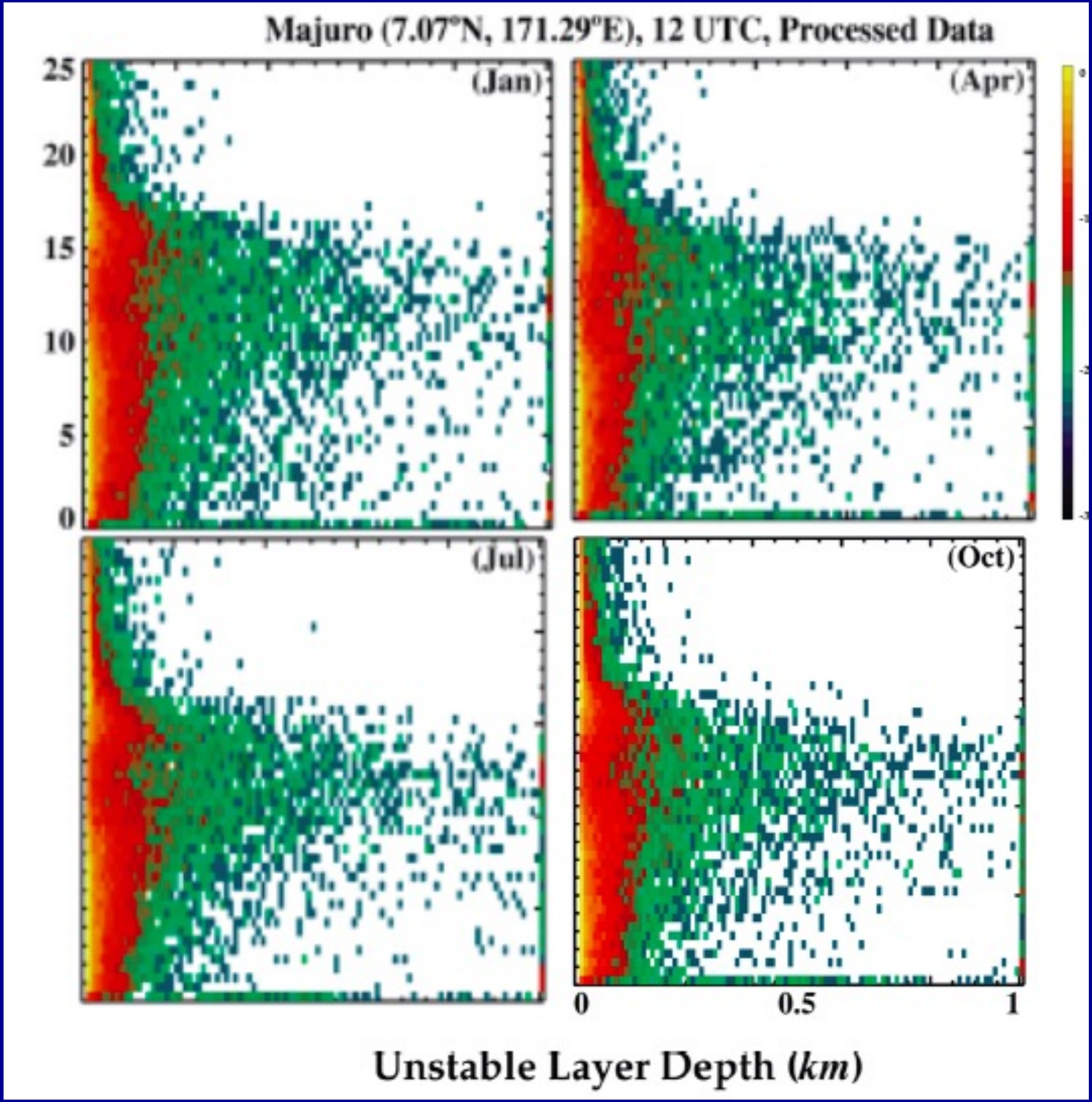
Yap – 9.5 ^{0}N

Guam – 13.5 ^{0}N

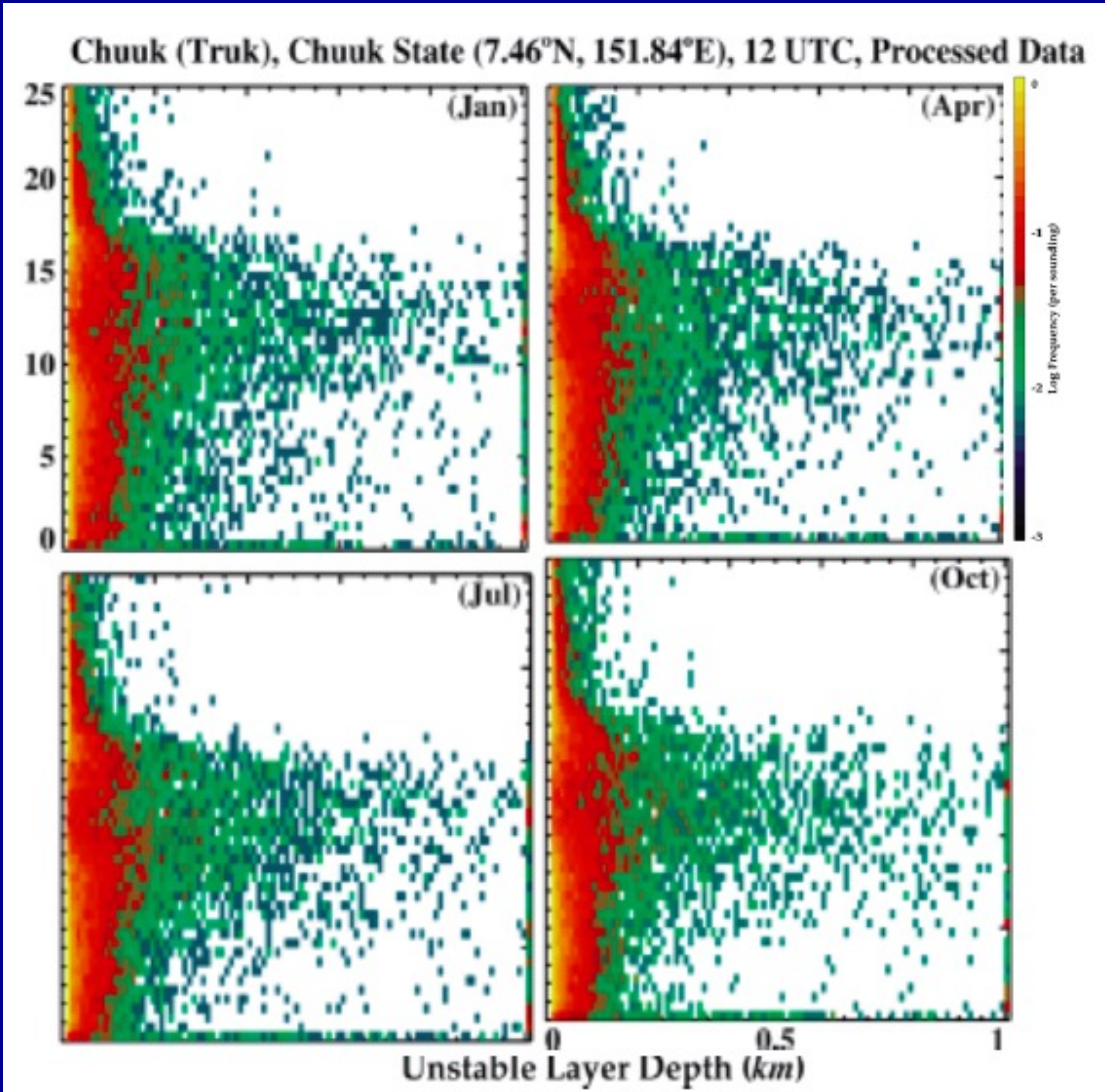
San Juan – 18.4 ^{0}N



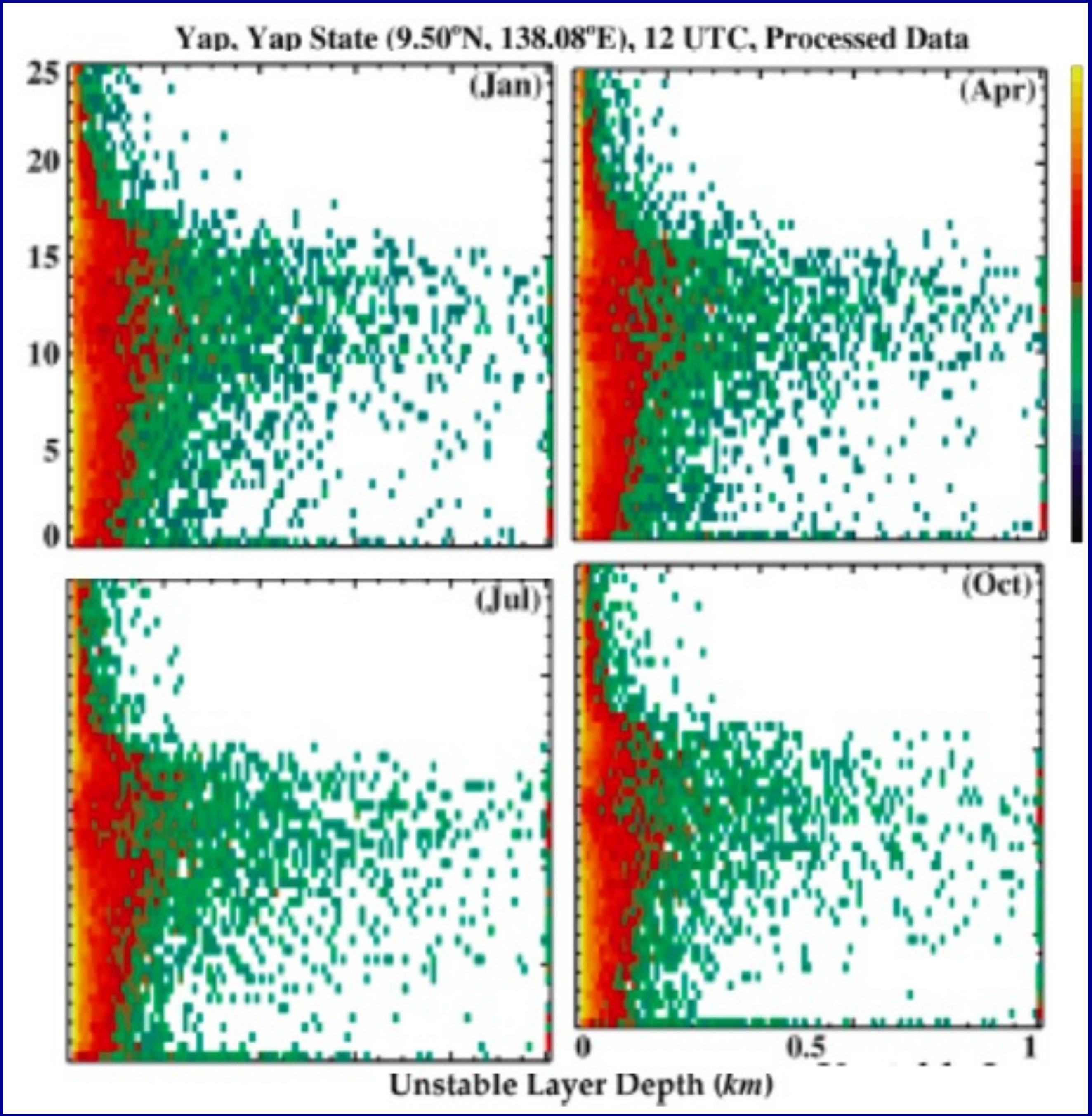
Same “notch” feature as seen at Koror



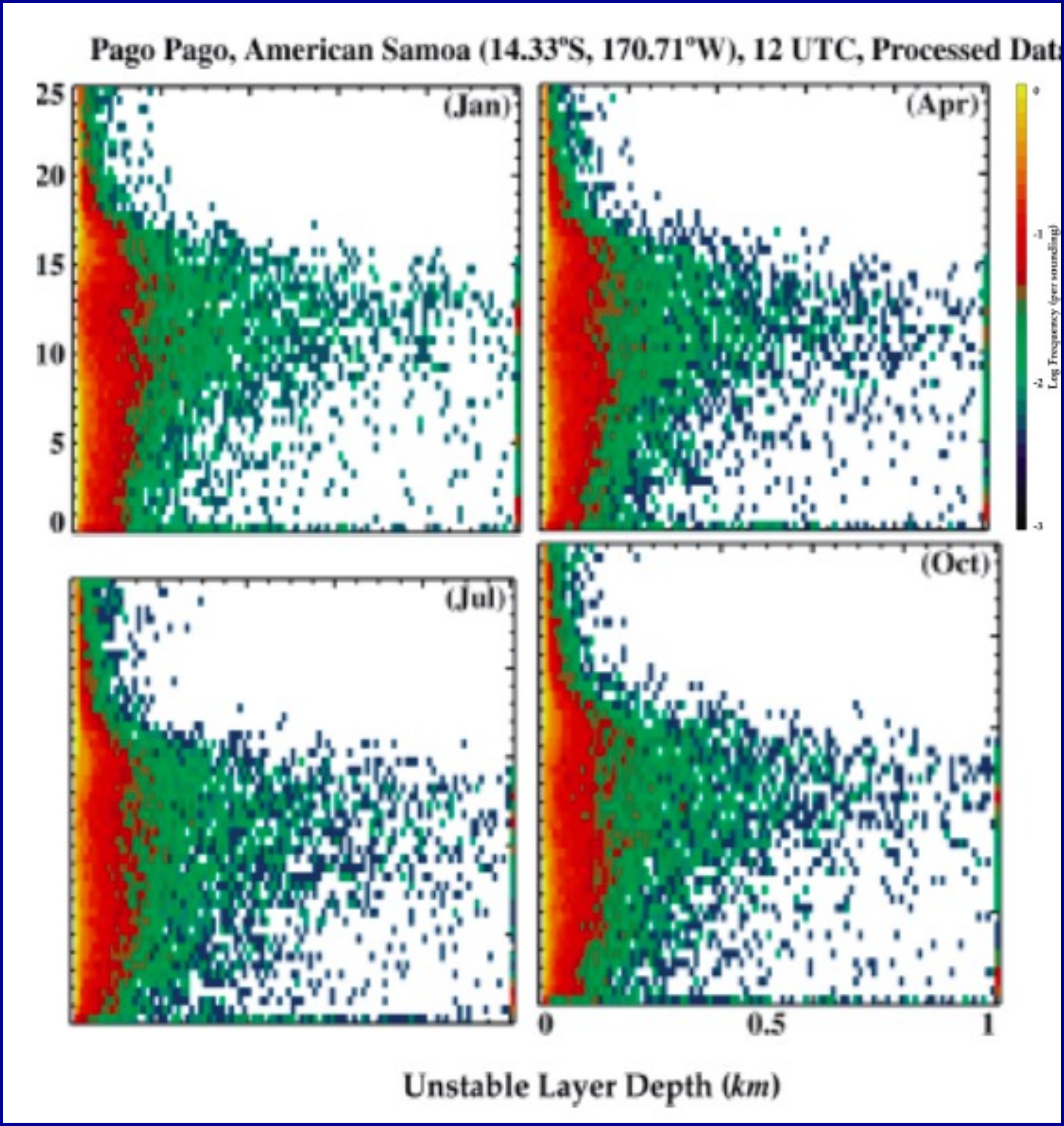
Same “notch” feature as seen at Koror



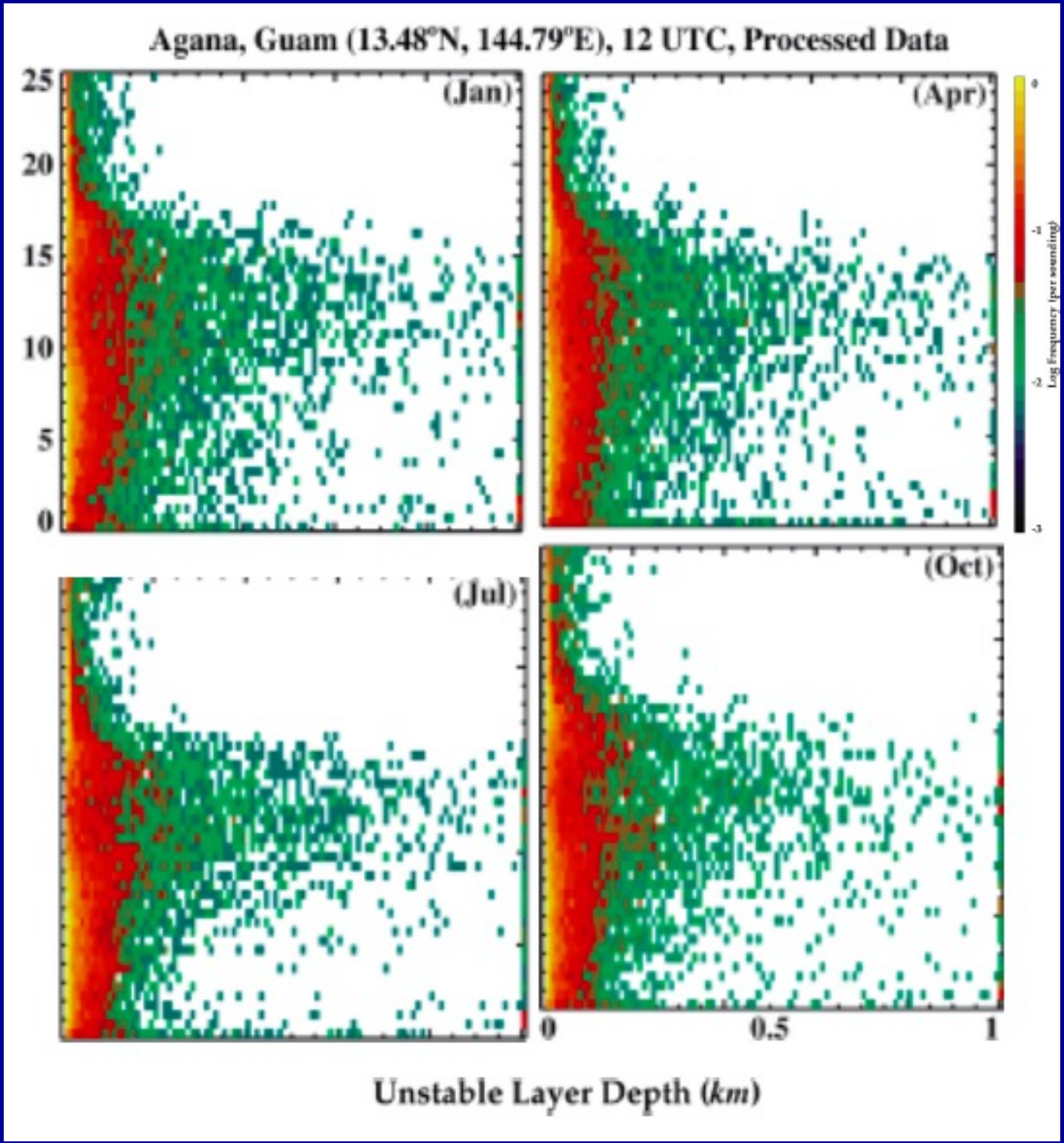
Same "notch" feature as seen at Koror



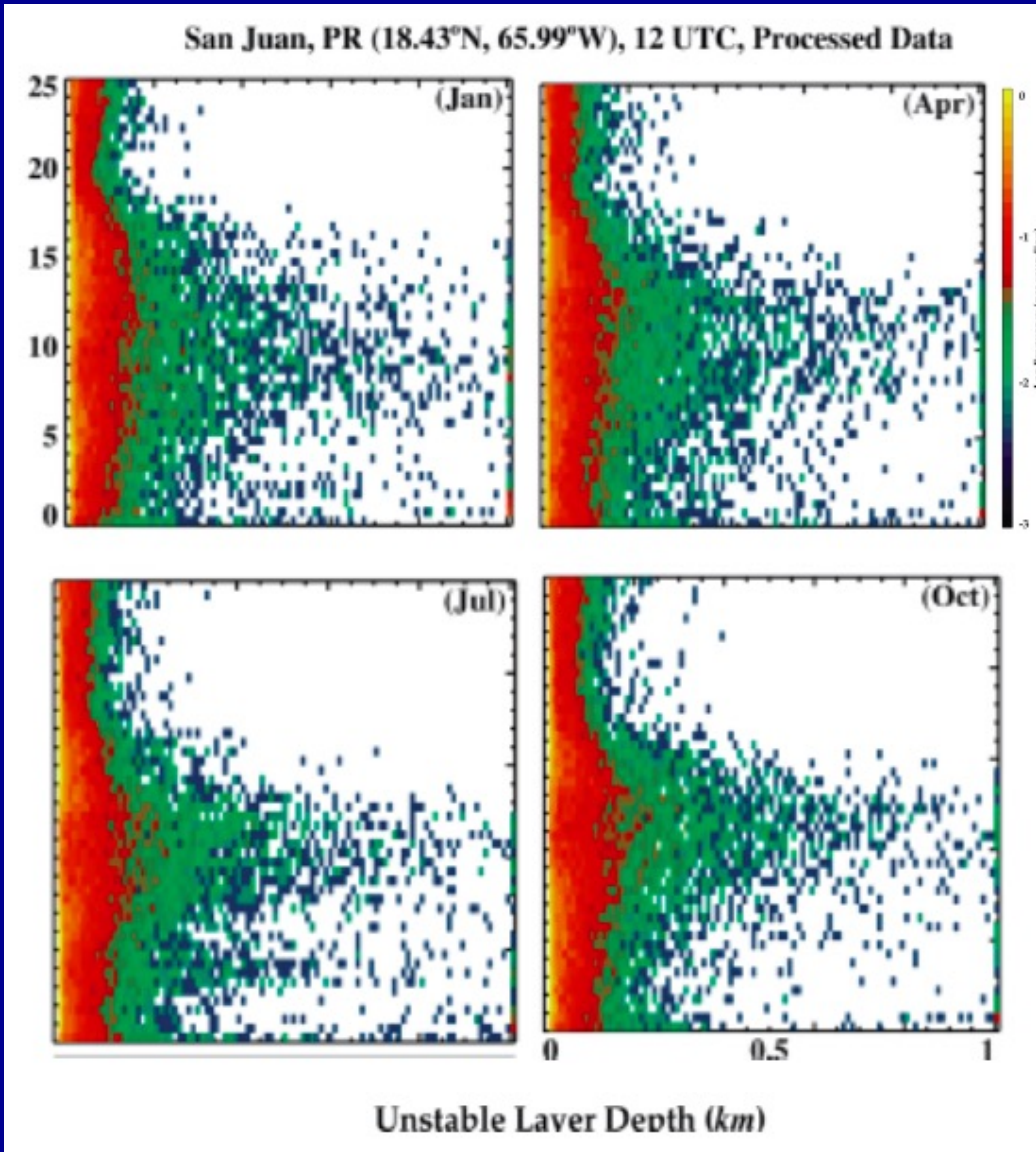
Same "notch" feature as seen at Koror



"Notch" most prominent in January, but present in all months.



"Notch present in all months, but most prominent in July and October.



"Notch" most prominent in July and October in that more thicker layers are present around 12 km.

In this study, we have looked further into the "notch" feature noted in Geller et al. (2021). We find the following.

1. The "notch" feature is seen in all the deep tropical stations analyzed.
2. At other tropical stations analyzed, not in the deep tropics, we see the seasonal variation of thinner and thicker unstable layers consistent with the seasonal migration of the tropical stability minimum.

3. This is consistent with the hypothesis that was in Grise et al. (2010) that this stability minimum is due to blow-off from cloud tops. The larger eddies from the turbulence at cloud top then produce mixing that obliterates many of the thin unstable layers.