Barotropic instability and traveling linear features detected in the near-infrared images from Akatsuki

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The Akatsuki IR2 camera provided images of the nightside of Venus, which captures cloud morphology illuminated by the near-infrared (NIR) thermal radiation from the lower part of the Venusian atmosphere. The nightside NIR features reveal the optical thicknesses of mid- and lower-level clouds as back-lit silhouettes. Previous studies using the nightside IR2 images reported rich features including those like barotropically unstable vortices [1] and sharp boundaries which are part of long-lasting planetary-scale waves [2]. Here, we report further morphologies indicative of dynamical processes in the cloud layer of Venus. We used data obtained on August 25, 2016. The data on this day have been difficult to treat, since the planetary limb in the images are particularly obscure, hindering the navigation-data correction needed for geographical mapping. In this study, we used a cloud tracking program to detect the apparent wind variation caused by the inaccurate mapping and corrected the navigation data to compensate it. It enabled us to study time evolutions in depth. We found gigantic (~2000 km) barotropic instability-like billows that actually exhibited rotation consistent with the shape. We also found many linear features that propagate westward relative to the motion of other features such as the billows. The linear features may be due to waves that potentially reside at relatively high altitudes.

[1] Peralta, J. et al. (2019) Icarus, 333, 177-182.

[2] Peralta, J., et al. (2020) Geophys. Res. Lett., 47, e2020GL087221.

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