

Instability of Ekman pumping

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This study derived Ekman pumping velocity without assuming that the velocity in the free atmosphere is not slow to be neglected and not homogeneous. Unlike the classic solution that is widely recognized, the solution can be unstable when the flow in the free atmosphere satisfies some conditions. The solution shows that the flow is more likely unstable when the velocity is fast and spatial variation of relative vorticity is large. One example that would be applied to Earth's atmosphere is secondary eyewall formation in tropical cyclone, which has been one of the hottest topics in typhoon research field in the last decades. The authors successfully showed the secondary eyewall formation in simulated cyclones is attributed to the Ekman pumping instability.

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