Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

On the Periodicity of Atmospheric von Kármán Vortex Streets[1]
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— For over one hundred years, a similarity relationship between Strouhal number (Sr), a non-dimensional metric for vortex shedding frequency (N), and Reynolds number (Re) has been aggressively pursued in the context of von Kármán vortex streets (VKVSs). In this study, we document the $Sr-Re$ relationship of atmospheric VKVSs (i.e., in the extremely high Re regime) in order to gain new insight into a regime of the similarity theory which has never before been investigated. Through quasi-idealized numerical simulations of realistic atmospheric VKVS events, we observe a range of Re in which mesoscale VKVSs are clearly present yet Sr remains in a steady range of 0.15 - 0.22 (irrespective of Re). This relationship resembles what has been observed for VKVSs in the much lower $10^2 < Re < 10^4$ regime suggesting eddy viscosity as a proxy for molecular viscosity with regards to $Sr - Re$ similarity theory at high-Re. In addition, we find the dominant length scale dictating the $Sr - Re$ relationship in the atmosphere to be the cross-stream mountain diameter, specifically at the height of the boundary layer thermal inversion.

[1]The authors acknowledge financial support received from the Department of Defense AFSOR grant under award number (FA9550-12-1-0449).

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Date submitted: 29 Jul 2013 Electronic form version 1.4