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The effect of a jet stream on the generation of mountain wave-induced mean flows and turbulence near the tropopause

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Observational evidence indicates a higher incidence of turbulence near the tropopause, especially over mountainous terrain. Previous work by McHugh and Sharman (2013) indicate this may be due to nonlinear amplification of topographically-induced gravity waves as they impinge on the tropopause. However, that study did not consider nonlinear topography amplification effects, nor did it consider the more realistic case of a jet stream in the vicinity of the tropopause. This study extends the McHugh and Sharman study by considering these effects using fully nonlinear simulations with the jet modeled as a sech**2 profile. Sensitivity studies are performed to study such effects as the location of the nose of the jet relative to the tropopause height, the jet width, the height of the tropopause, and the size and shape of the obstacle. Momentum and energy flux profiles are used to deduce those configurations most conducive to gravity wave amplification, breakdown and turbulence near the tropopause.

McHugh J., Sharman R., 2013: Generation of mountain wave-induced mean flows and turbulence near the tropopause. Q. J. R. Meteorol. Soc. 139: 1632-1642. DOI:10.1002/qj.2035