# Kelvin–Helmholtz Instability Waves: A Natural Seeding Mechanism for Orographic Clouds

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Image credit @breckenridgemtn

#### Cloud-top KH Waves (Fluctus)



(Section 2.2.2.4.8)

Via World Meteorological Organization (WMO):

#### Fluctus

A relatively short-lived wave formation, usually on the top surface of the cloud, in the form of curls or breaking waves (Kelvin-Helmholtz waves).

Occurs mostly with Cirrus, Altocumulus, Stratocumulus, Stratus and occasionally Cumulus.





Grasmick and Geerts (2020)

#### At cloud top: ???

Barnes et al. (2018)

#### **Previous KH Wave Studies**



(c) Below

bright band



JOI

#### Research Area: Payette Mountains, Idaho









Doppler On Wheels (DOW) dual-pol radar



Credit: L. Oolman (top), J. Aikins (bottom)







#### Rawinsonde Analysis (2200 UTC)





#### **KH Wave Identification**



#### **DOW Dual-polarization Interpretations**







#### **UWKA and DOW Composites**





### **Contoured Frequency by Altitude Diagrams**



#### In-situ Cloud Observations (4.25 km MSL)



#### Summary

— w > 0.5 (1) m s<sup>-1</sup>

- w < 0.5 (1) m s<sup>-1</sup>

7.0

6.5

Height MSL (km)

5.0

4.5

7.0

5.0

4.5<del>1</del> 10

а шШ 12

Plates

0

 $\rho_{hv} < 0.5$   $6.5 - Z_{DR} < 0 dP$   $T_{W}$   $f_{S.5}$   $F_{V}$ 





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## Thanks for your attention!

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