The Vorticity Experiment 2022
VortEx – an update

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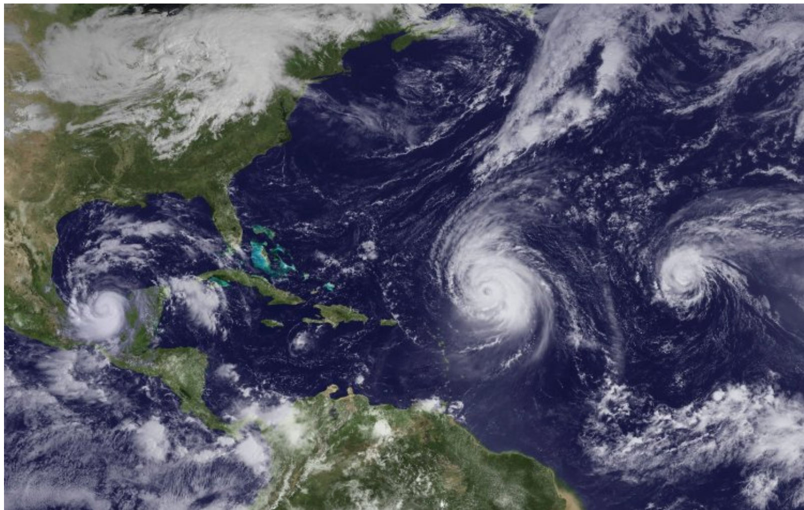
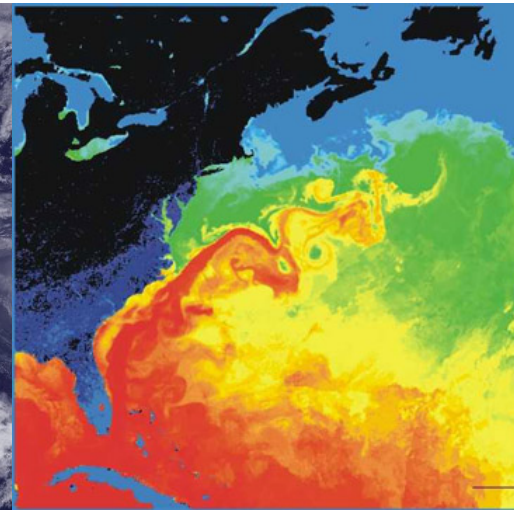
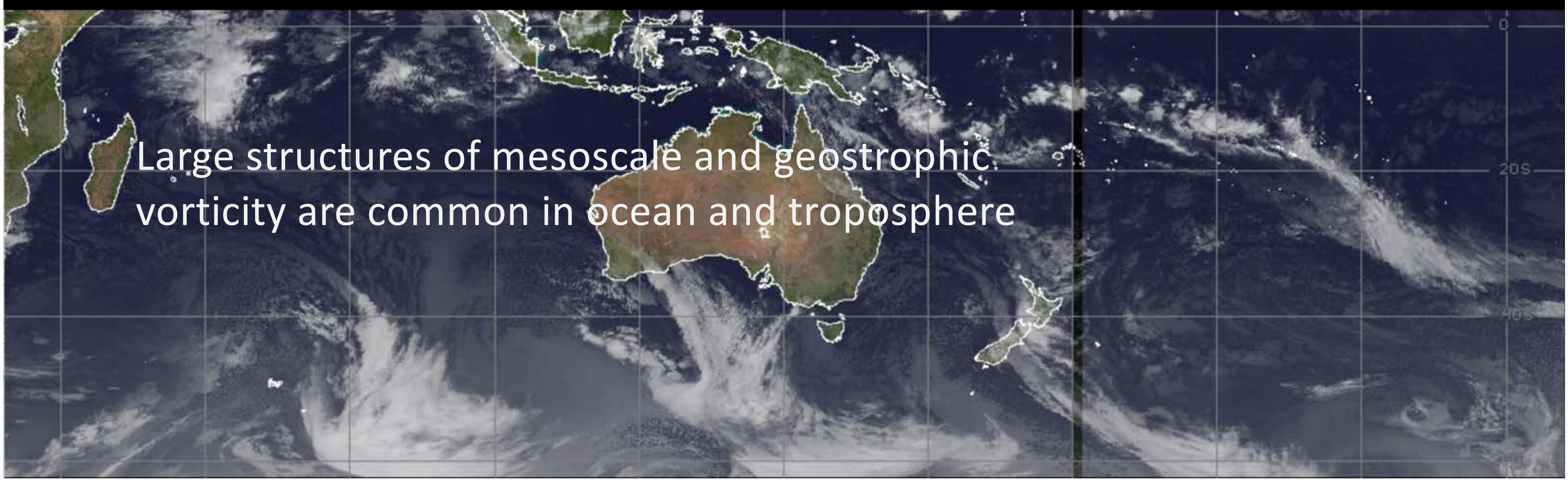
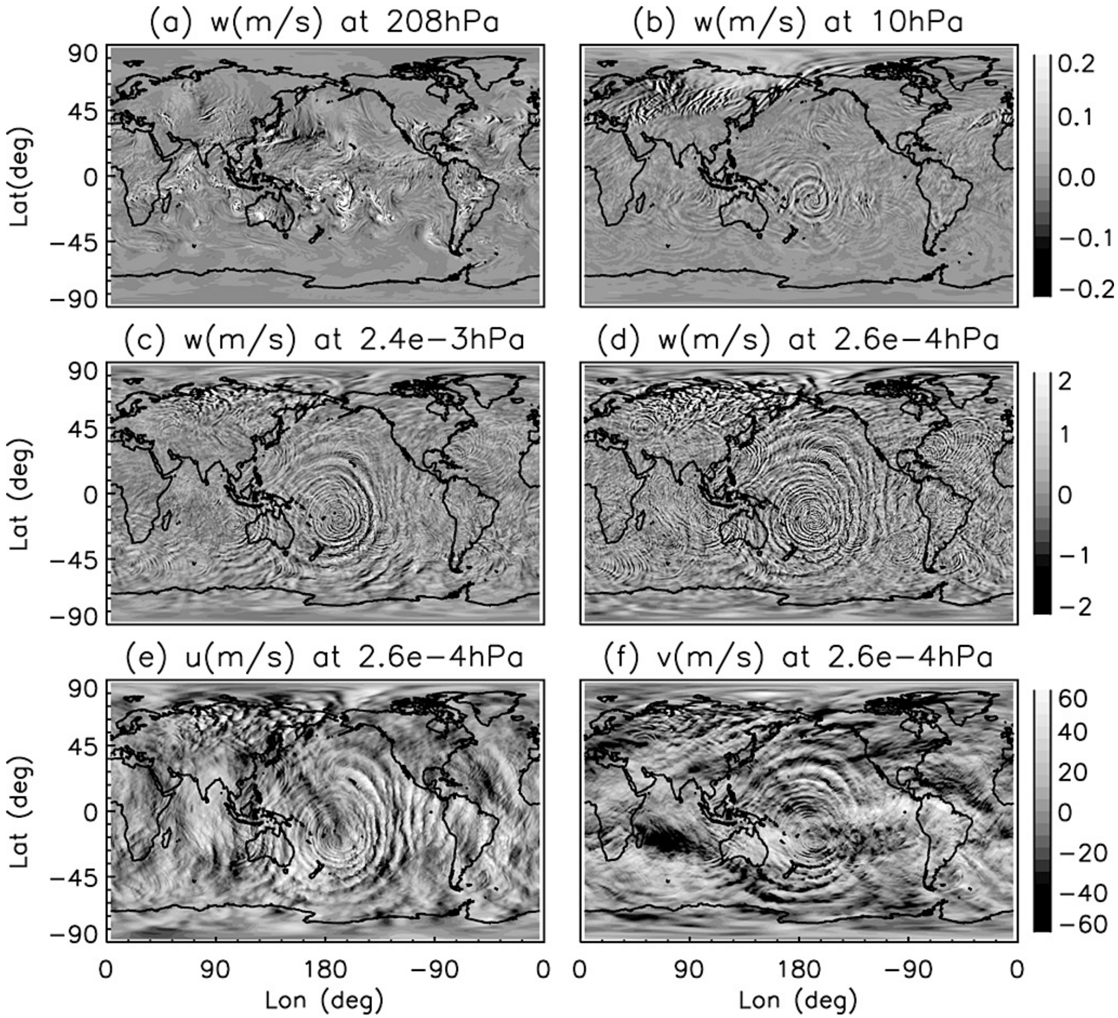





Large structures of mesoscale and geostrophic vorticity are common in ocean and troposphere



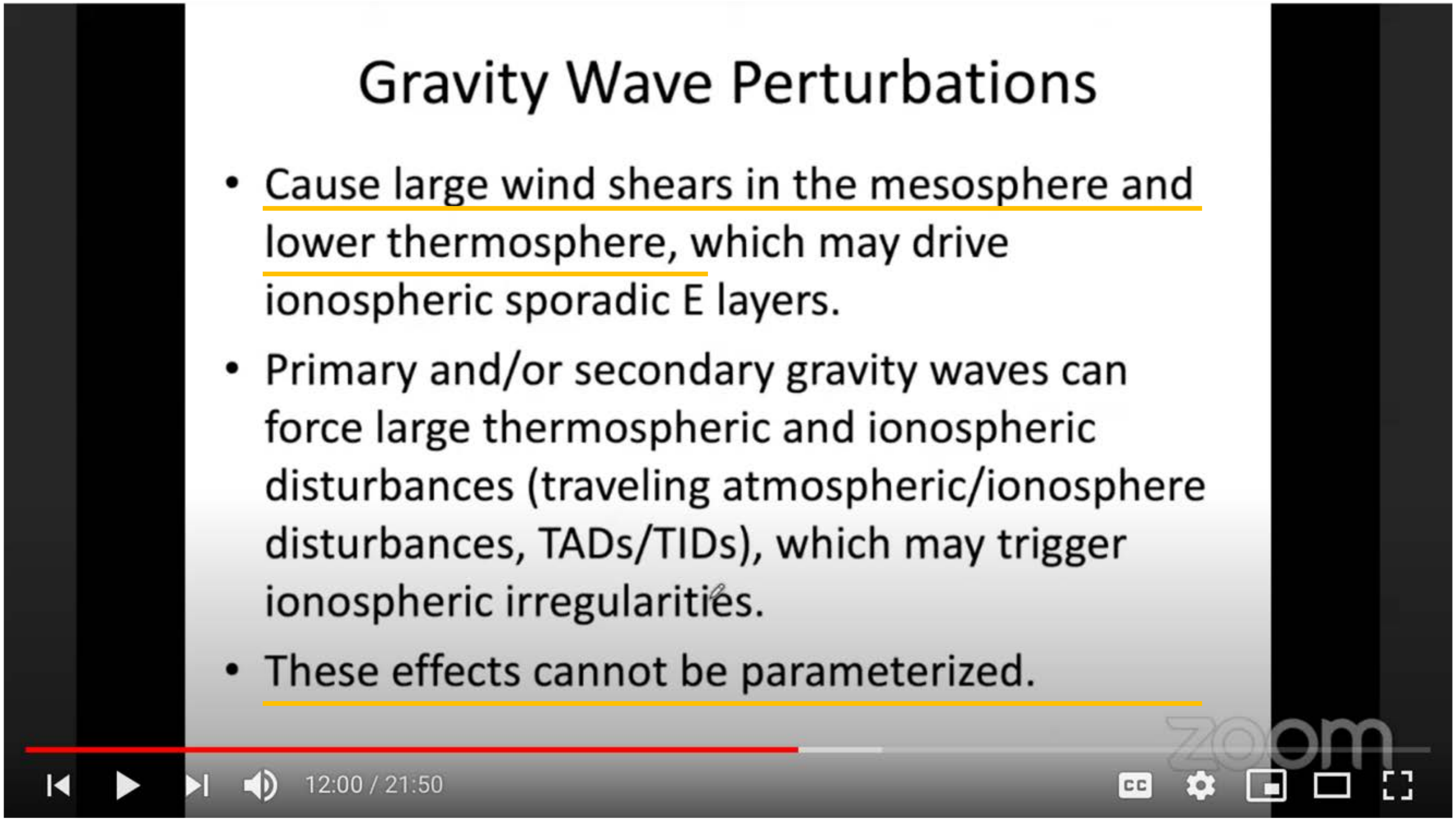
WACCM GW: Liu et al., 2014

What is the importance of vorticity (ω_z or ζ) and the spectral characteristics of mesoscale stratified turbulence (ST) in the M/LT?

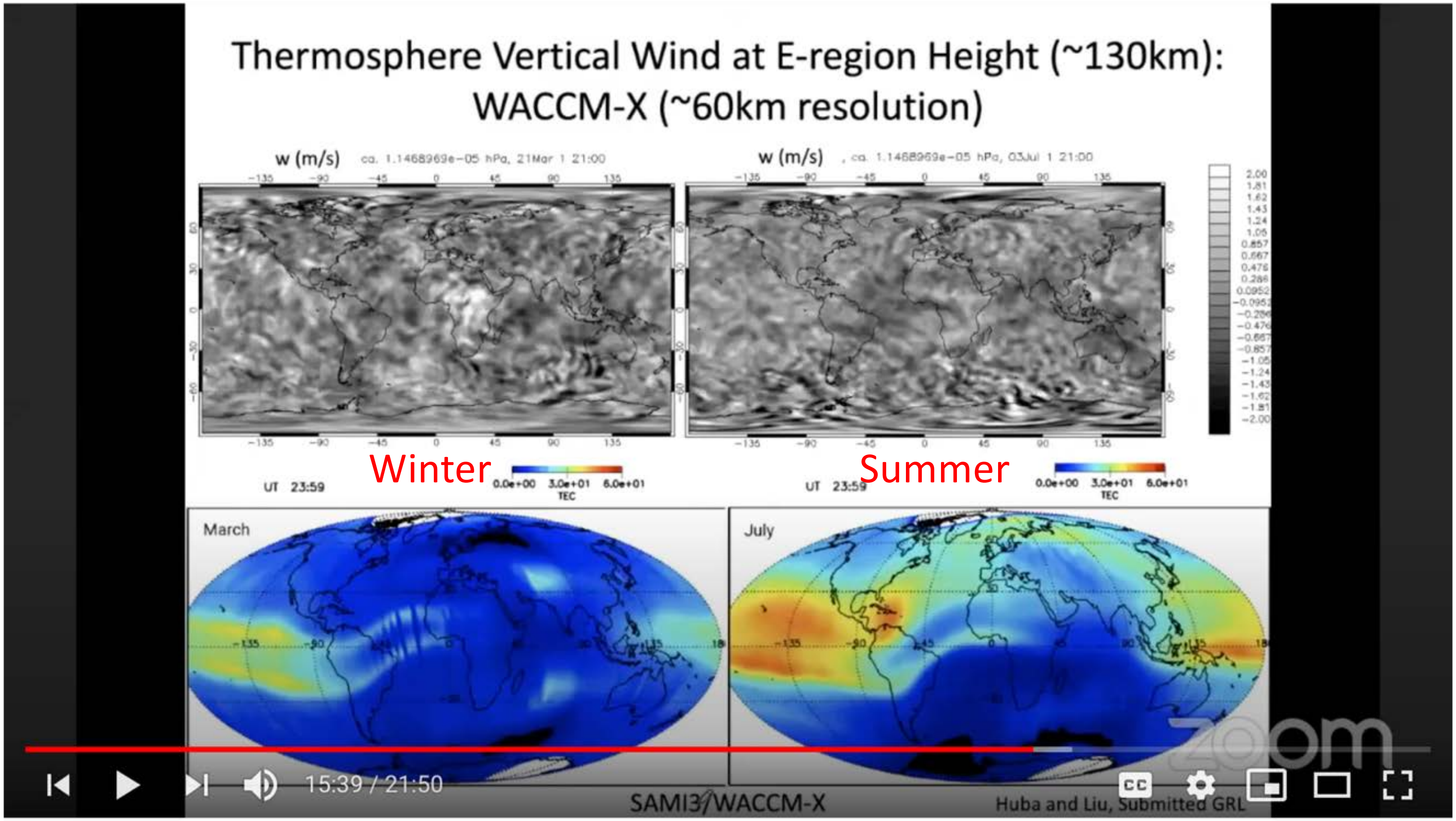
What is the relative role of gravity waves and ST?

Is there a reverse energy cascade (from smaller to larger scales) and mean-flow acceleration (as for tropical cyclones, e.g., *Rhines, 1971*)

Importance of GW forcing has been explained in *Hanli Li*u's Daedalus talk on 3/8/2020: https://youtu.be/Df_Ewp5I5wE



Hanli Liu, 2020



Hanli Liu, 2020

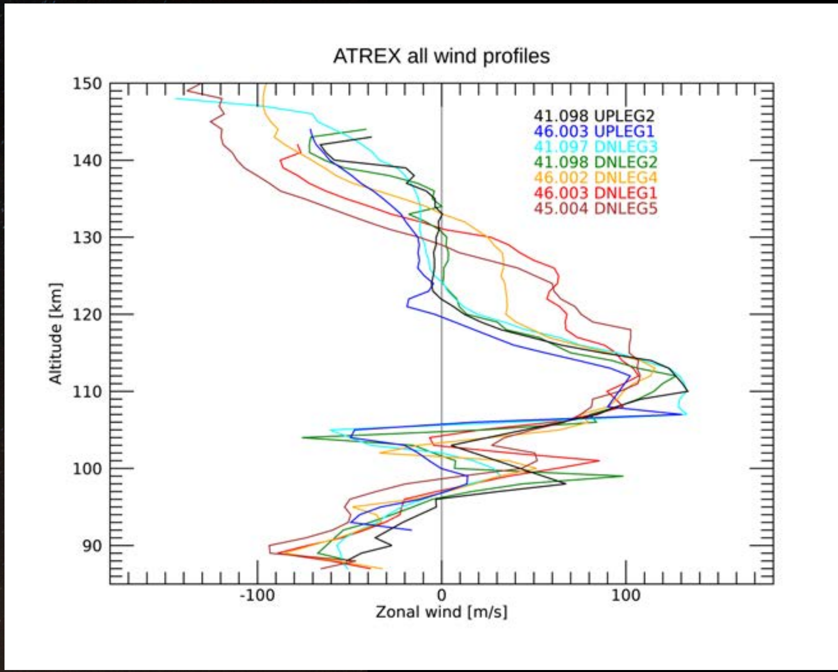
Anomalous Transport Experiment (ATREX)

27 March 2012, Wallops Island

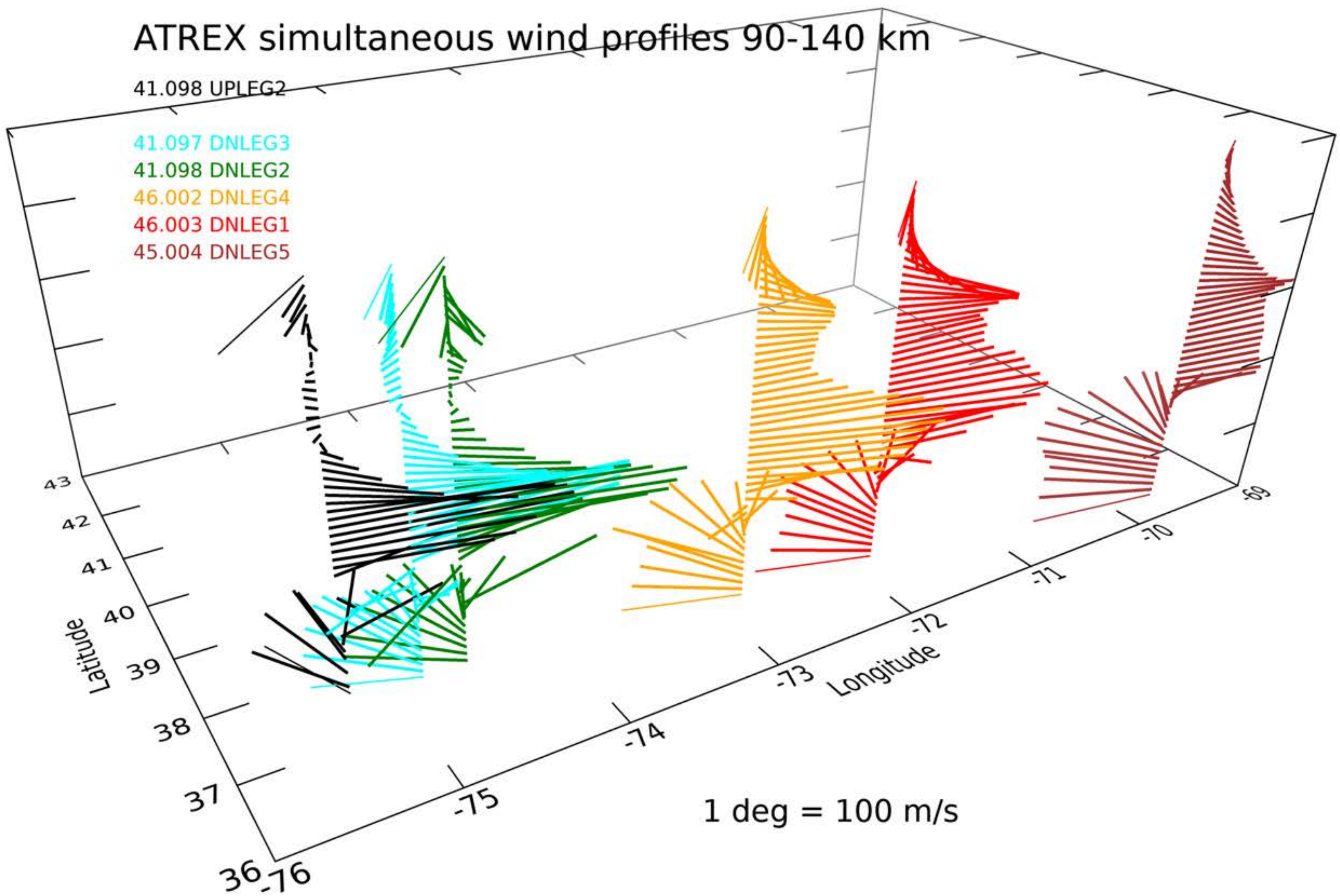
Seven simultaneous TMA wind profiles spaced horizontally ~100-600 km

TMA structure function analysis shows evidence for universal transition from 3-D to quasi 2-D stratified macro-turbulence for horizontal scales of 100-200 km

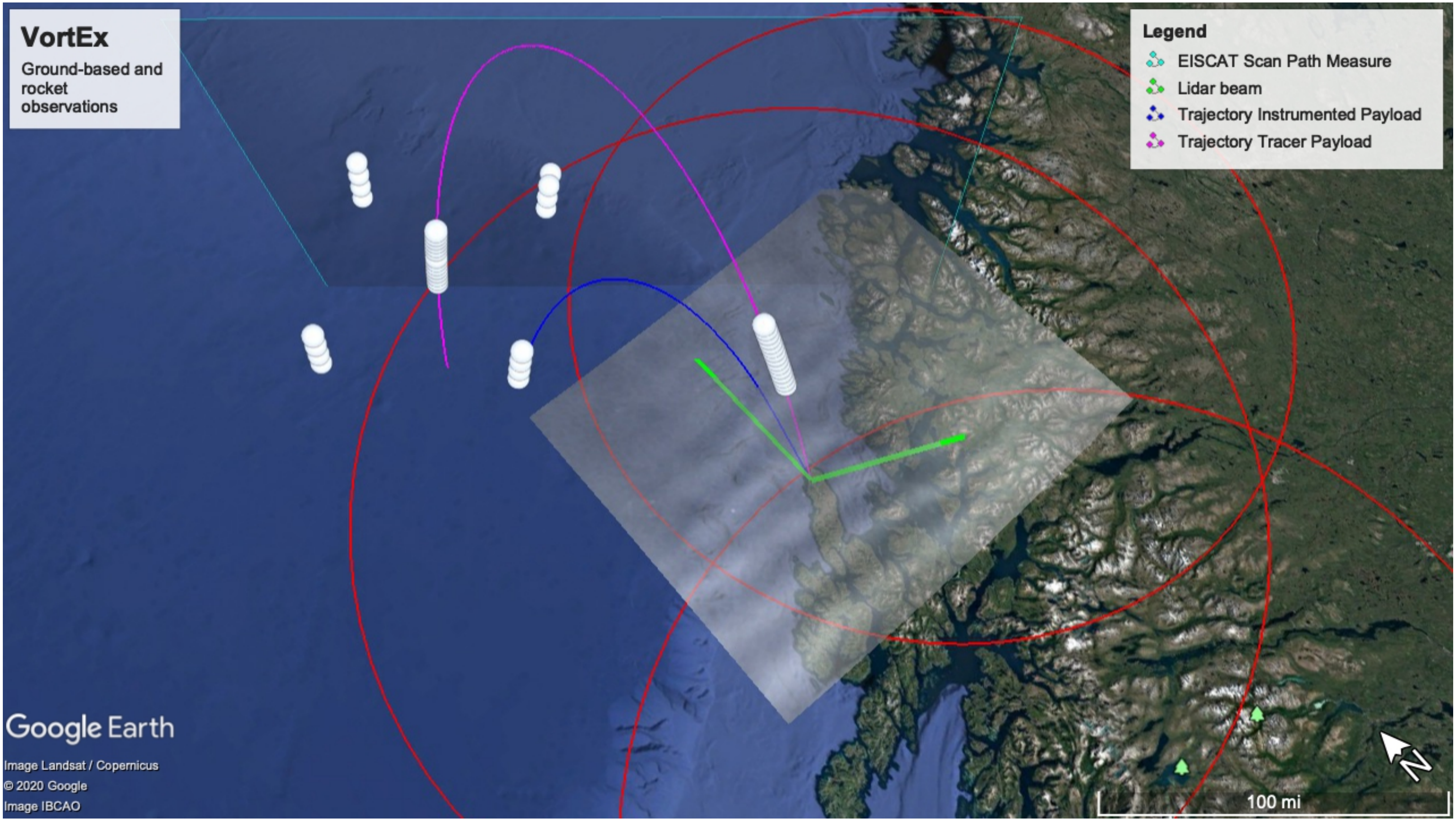
Roberts and Larsen (2015)

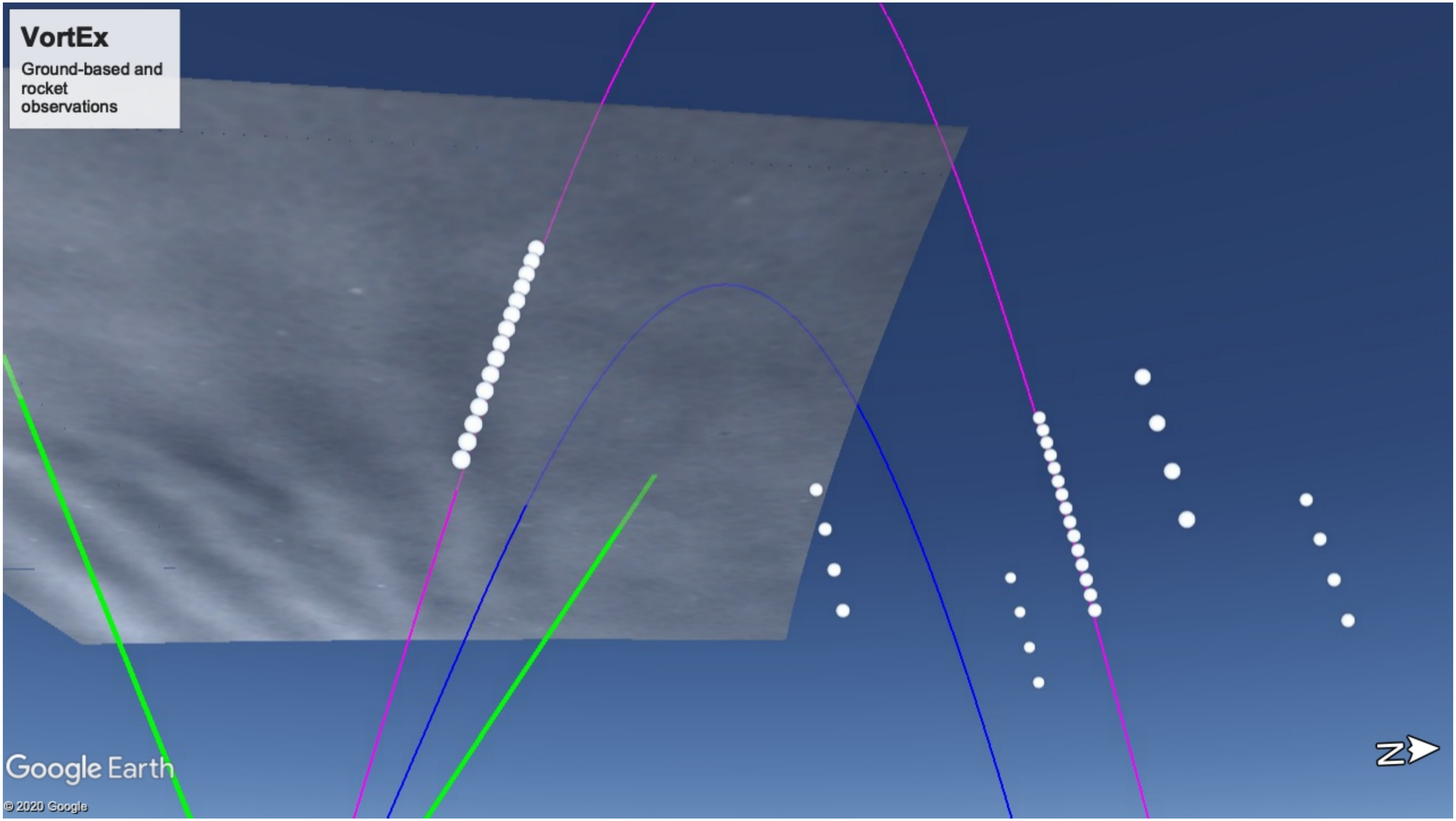


Wind profiles show coherent wave structures, but also randomness, structure function analysis forthcoming


ATREX simultaneous wind profiles 90-140 km
41.098 UPLEG2
41.097 DNLEG3
41.098 DNLEG2
46.002 DNLEG4
46.003 DNLEG1
45.004 DNLEG5
Latitude
36
37
38
39
40
41
42
43
Longitude
-76
-75
-74
-73
-72
-71
-70
-69
1 deg = 100 m/s


VortEx
Ground-based and rocket observations
MR TX Andenes
MR TX Ramfjordmoen
MR TX Straumen
Google Earth
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image IBCAO
N
200 mi


VortEx
Ground-based and rocket observations
Legend
EISCAT Scan Path Measure
Lidar beam
Trajectory Instrumented Payload
Trajectory Tracer Payload
Google Earth
Image Landsat / Copernicus
© 2020 Google
Image IBCAO
100 mi
N



VortEx
Ground-based and rocket observations
Google Earth
© 2020 Google
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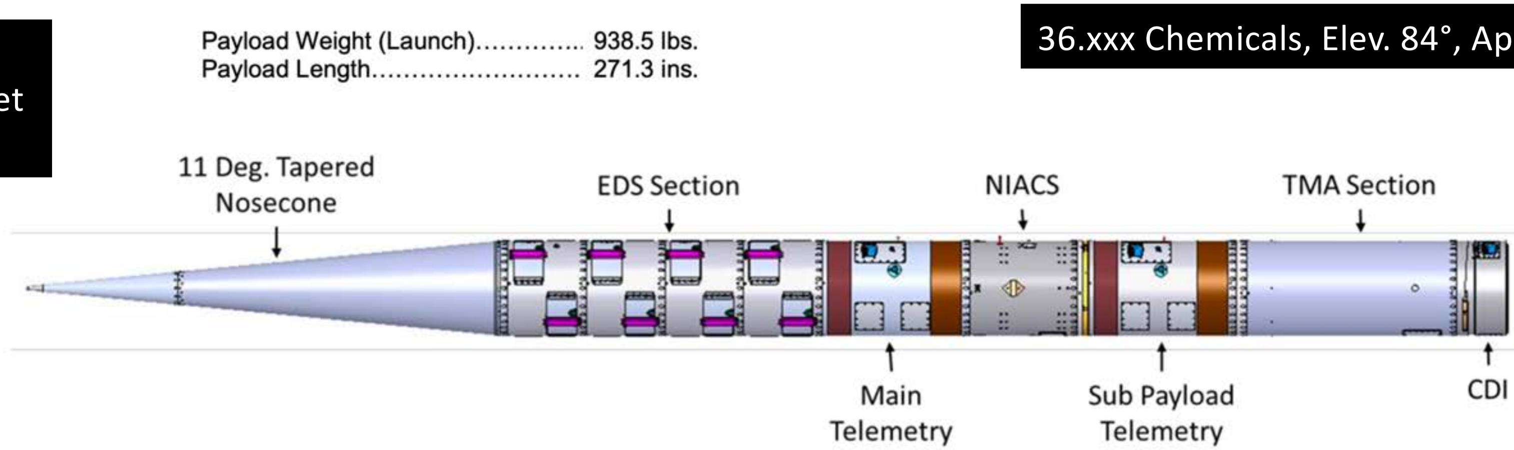
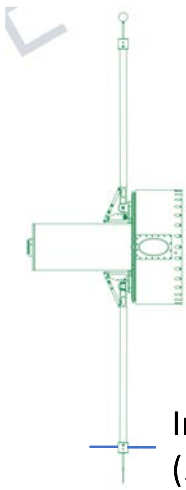
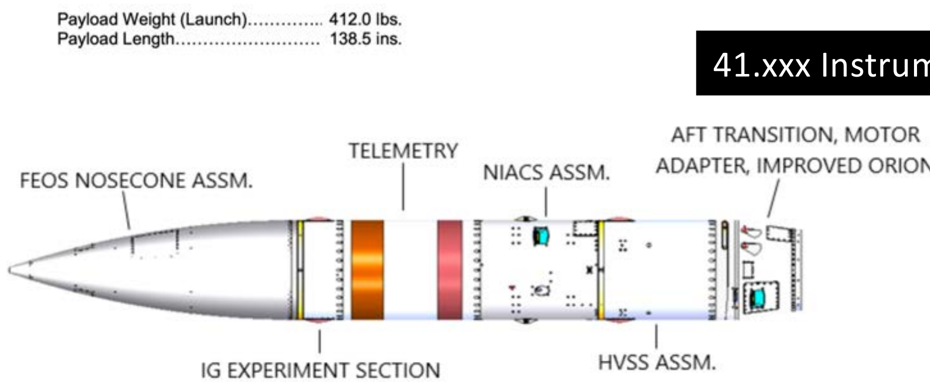
Two x two-rocket salvoes

36.xxx Chemicals, Elev. 84°, Apogee 281 km

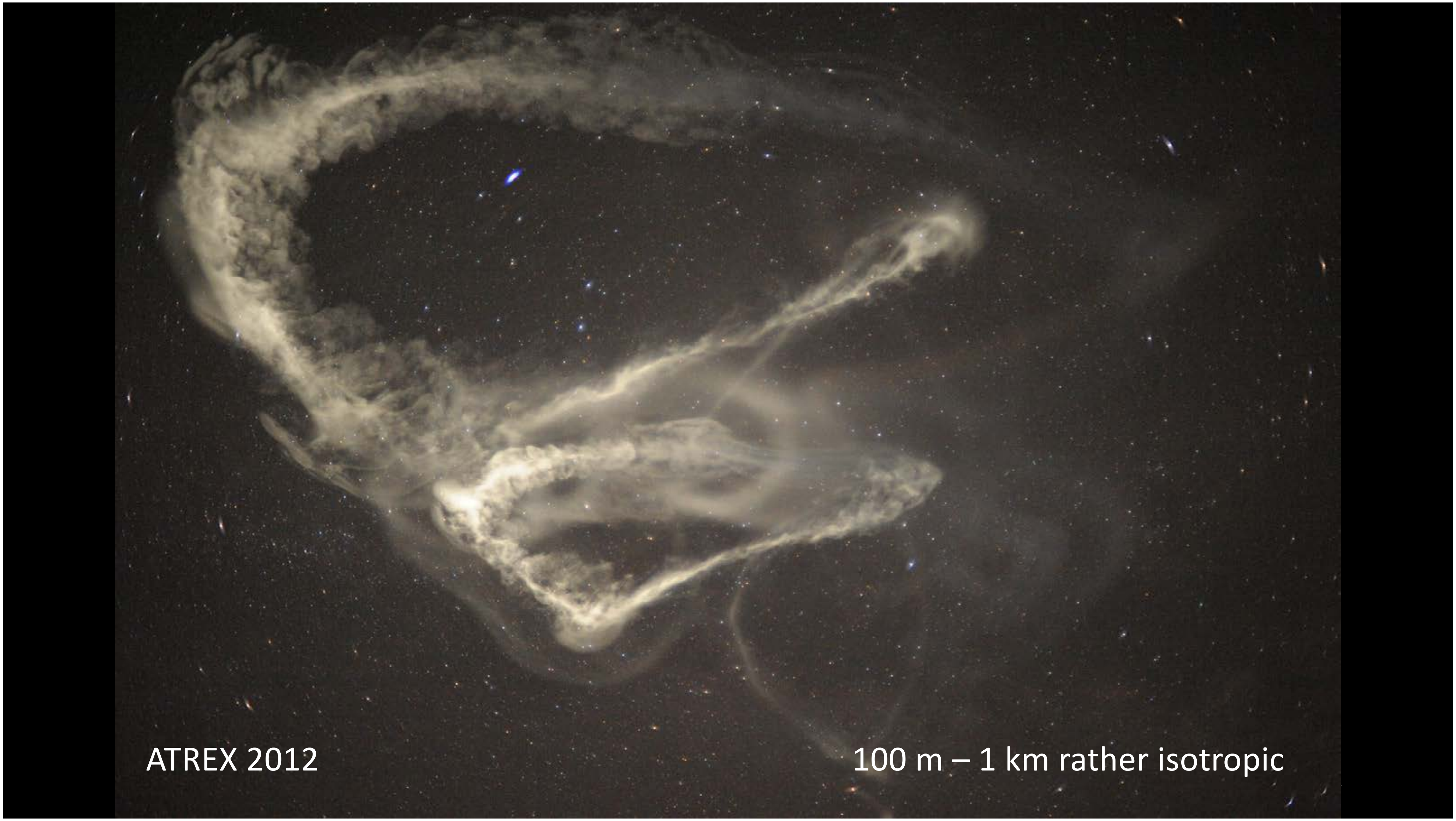


41.xxx Instrumented, Elev. 80°, Apogee 150 km





Instruments deployed
(2 ionization gauges, electron and ion fixed-bias probes


ATREX 2012
100 m – 1 km rather isotropic


ATREX 2012

some Clemson instrument parts (Michael Denz, Lamar Durham)

Milestones (planned)

8/6/2020 Design Review

9/6/2021 Integration and Testing

1/20/2022 – 2/9/2022 Moon down launch window

(early morning preferred, e.g. 0100-0500)

Additional support

request EISCAT scans

See also

Lehmacher et al., Proc. ESA-SP 742, Nov. 2019