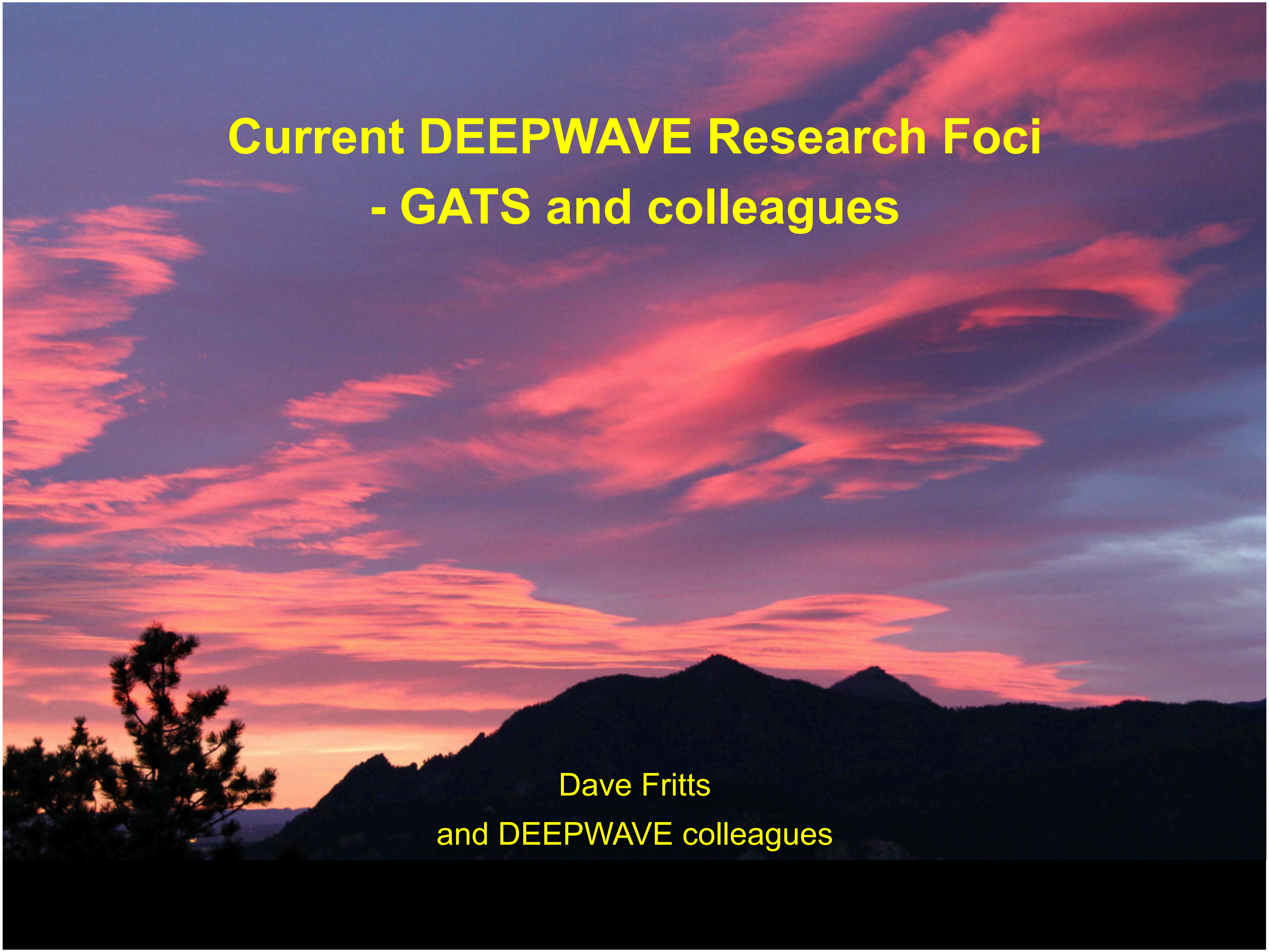
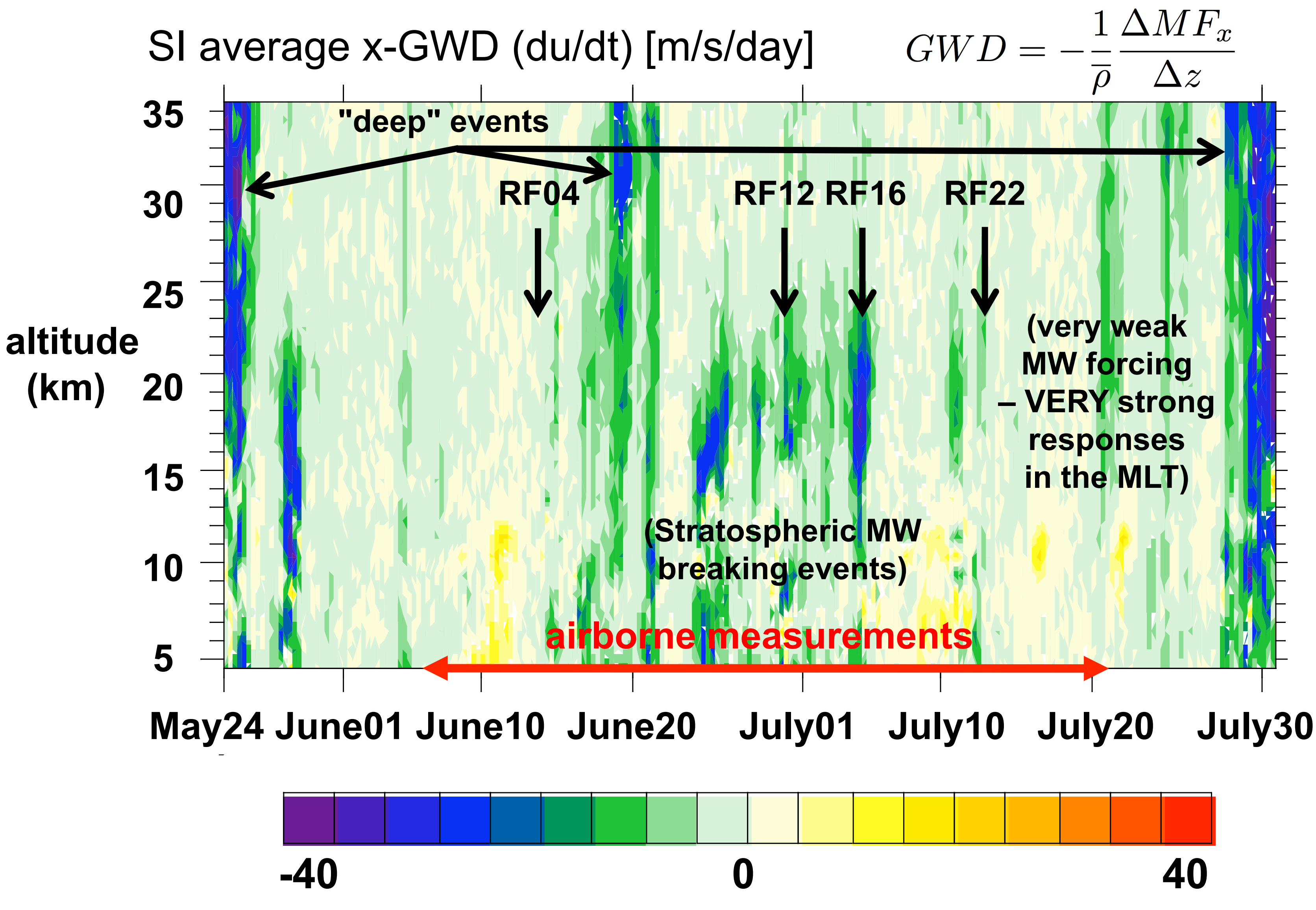


Current DEEPWAVE Research Foci
- GATS and colleagues

Dave Fritts
and DEEPWAVE colleagues

South Island average GWD – 6-km WRF model

6-km WRF forecast of OGWD with ECMWF boundary conditions

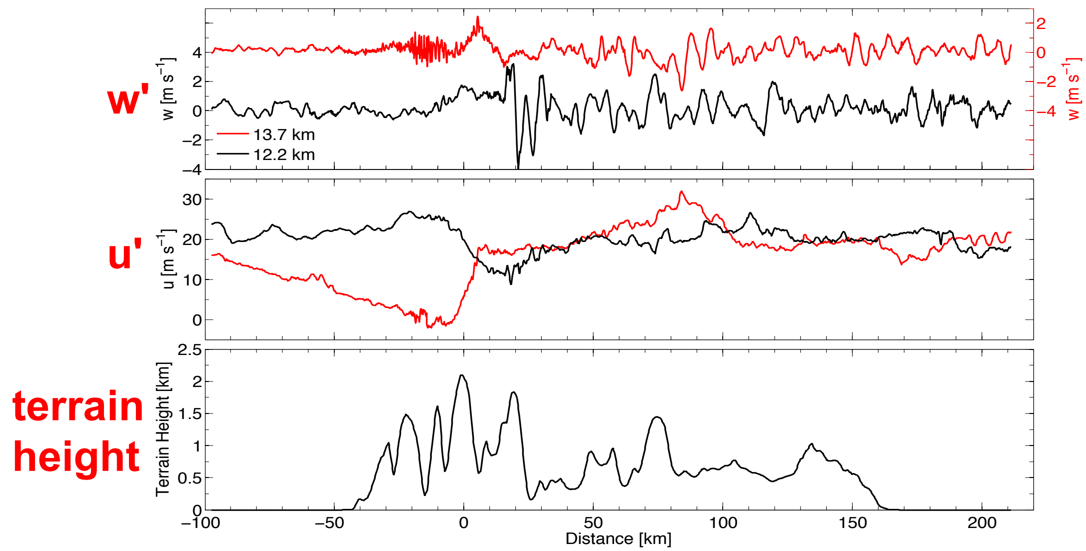


RF12 (29 June) – strong MW forcing, breaking at GV flight levels
- restricted penetration
- forcing weakening throughout and after the flight

Two flight segments over Mt. Aspiring

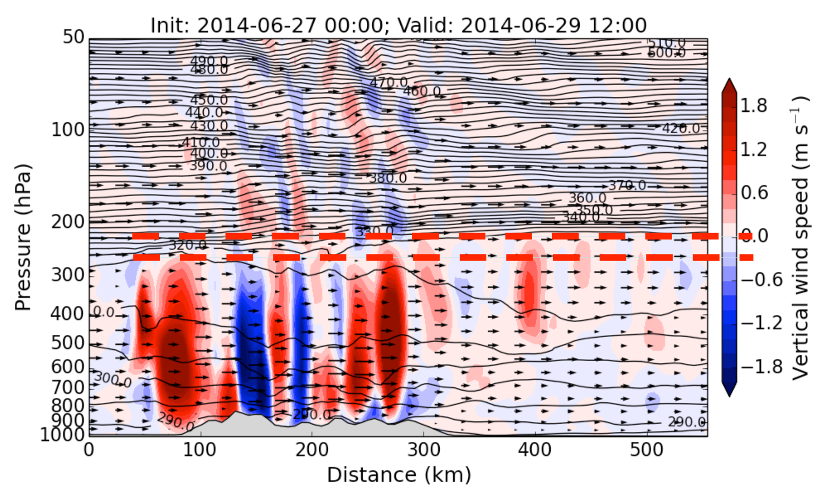
Segment 14: z=12.2 km

Segment 22: z=13.7 km



Flight segments occur where WRF predicted strong MW attenuation

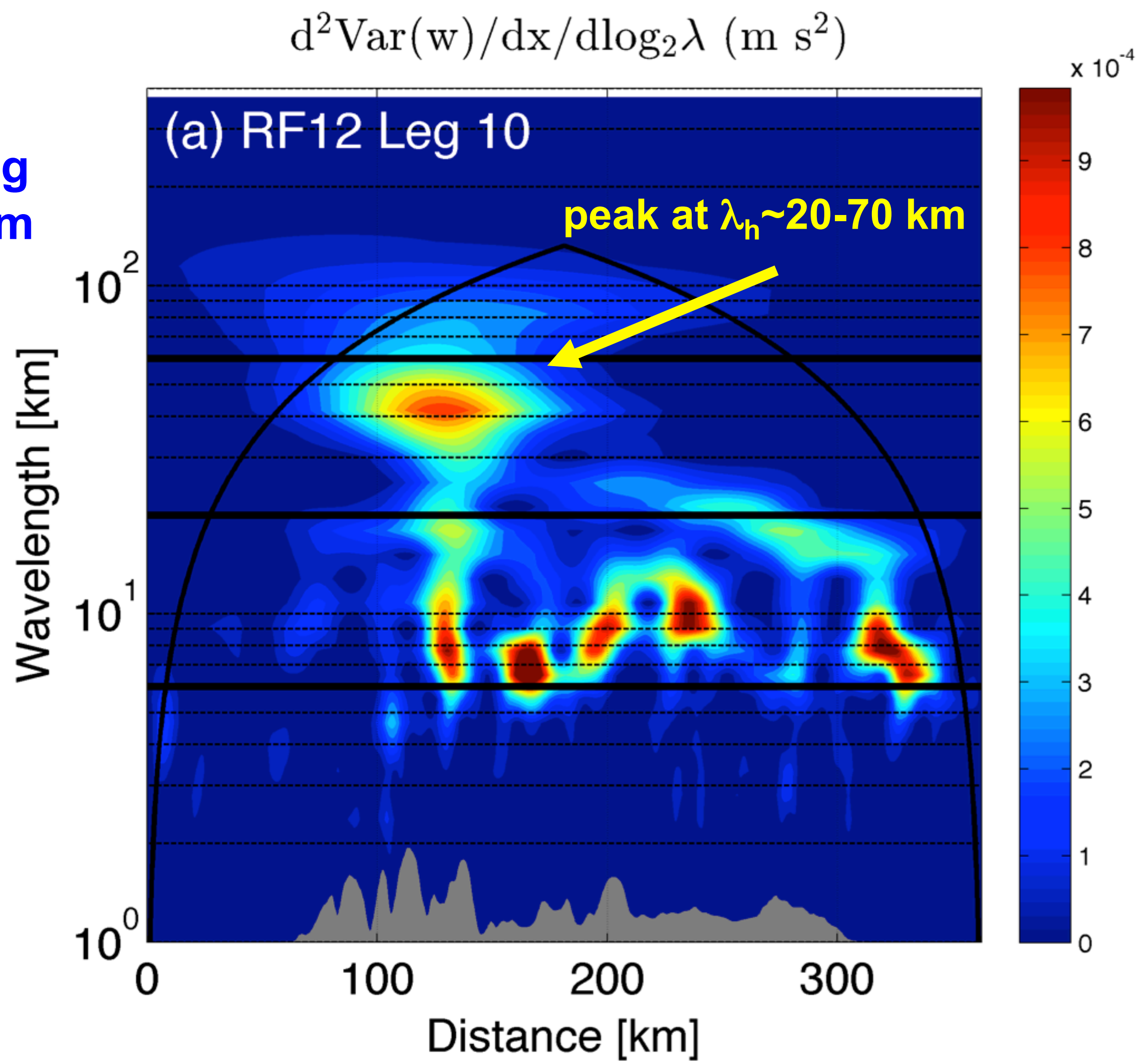
Flight-level data indicates consistency of horizontal scales



RF12 Flight-Level Wavelet Analysis

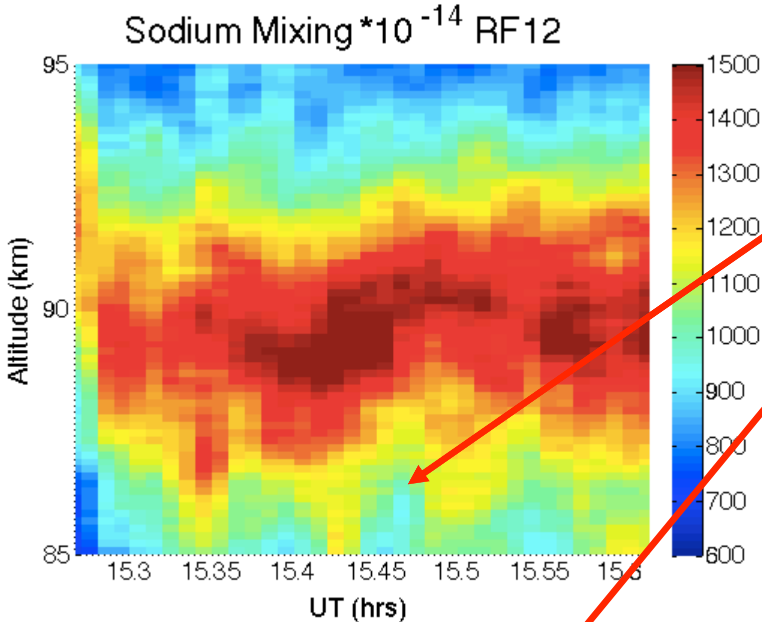
- apparent propagating MWs at λ_h ~20-70 km over terrain

- trapped lee waves at λ_h ~5-15 km over and leeward of terrain



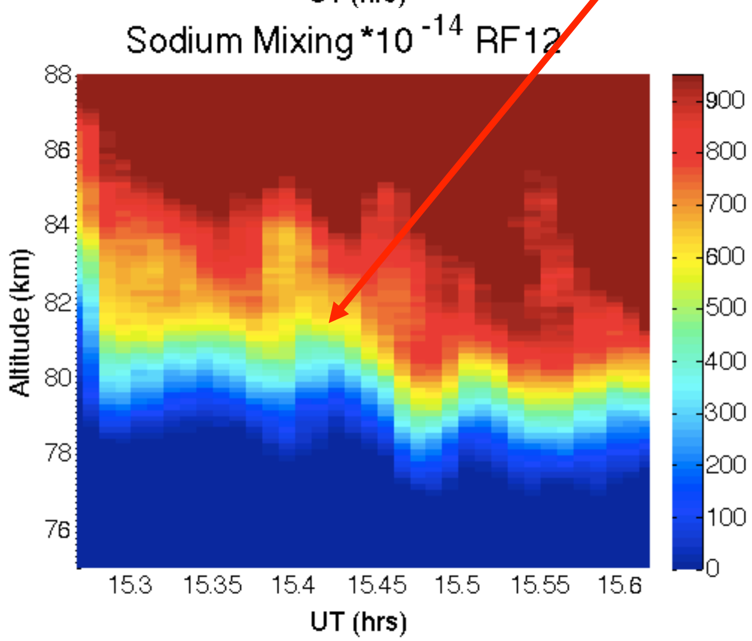
RF12 – strong MW forcing

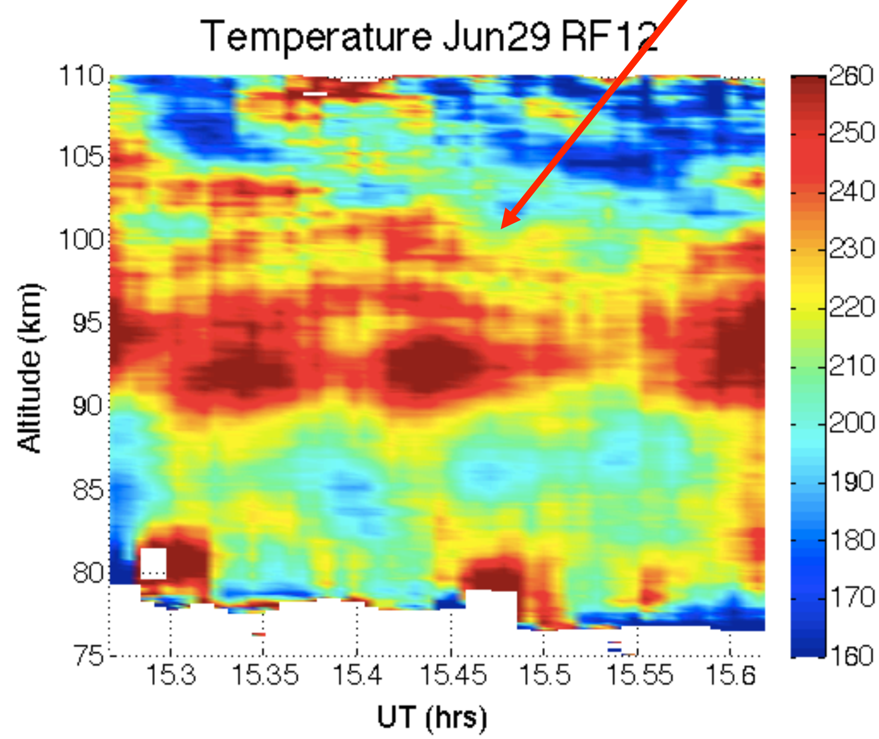
- breaking in lower stratosphere reduces MW amplitudes



- large-amplitude MWs in the MLT also at λ_h ~50-70 km
- overturning and instability observed at bottom side of sodium layer
- T(x,z) layering at altitudes of breaking

- peak MFs ~200-300 m^2/s^2

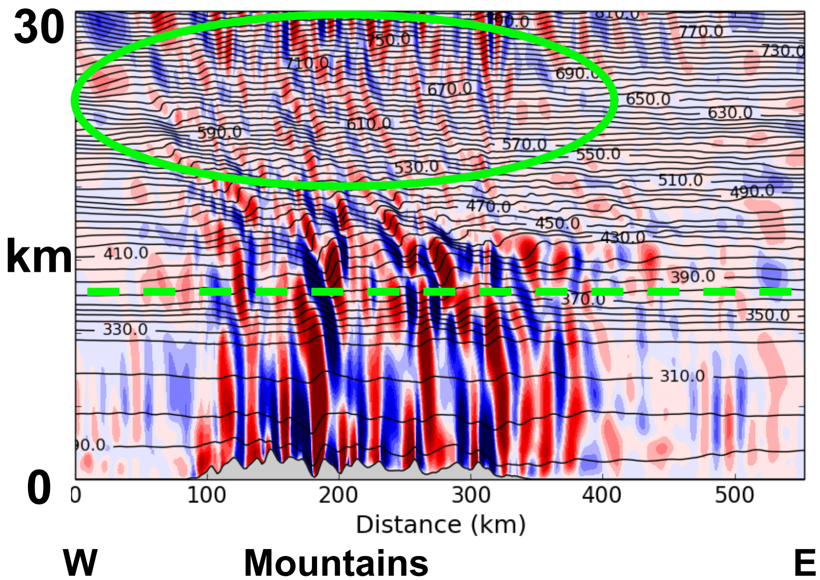




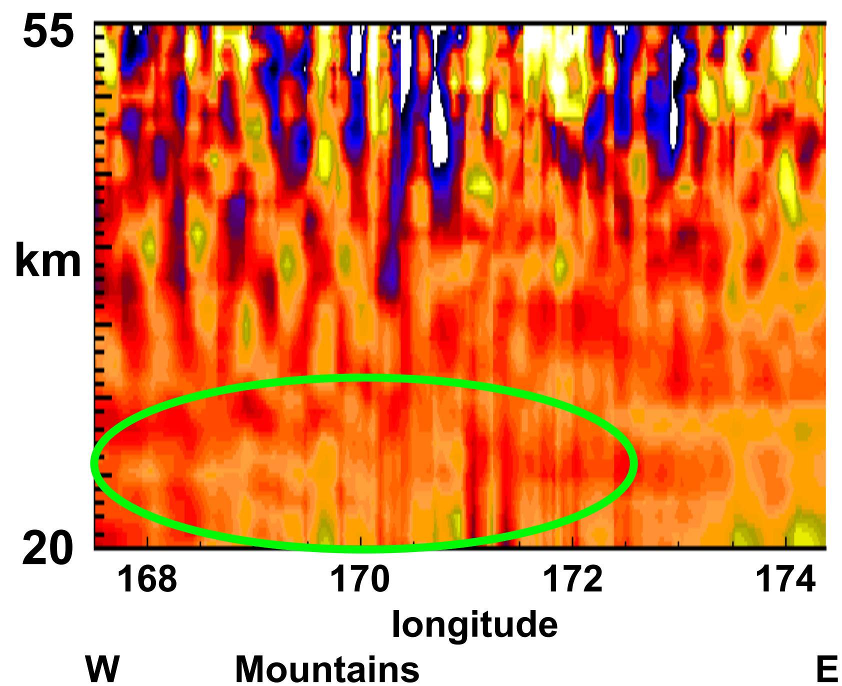
RF16 (4 July) – strong MW forcing, weak stratospheric winds

WRF forecast => MW breaking in weak stratospheric flow, radiation of secondary GWs

WRF w(x,z) – 2-km resol.



Rayleigh lidar T' (x,z), ±15 K, RF seg. 3



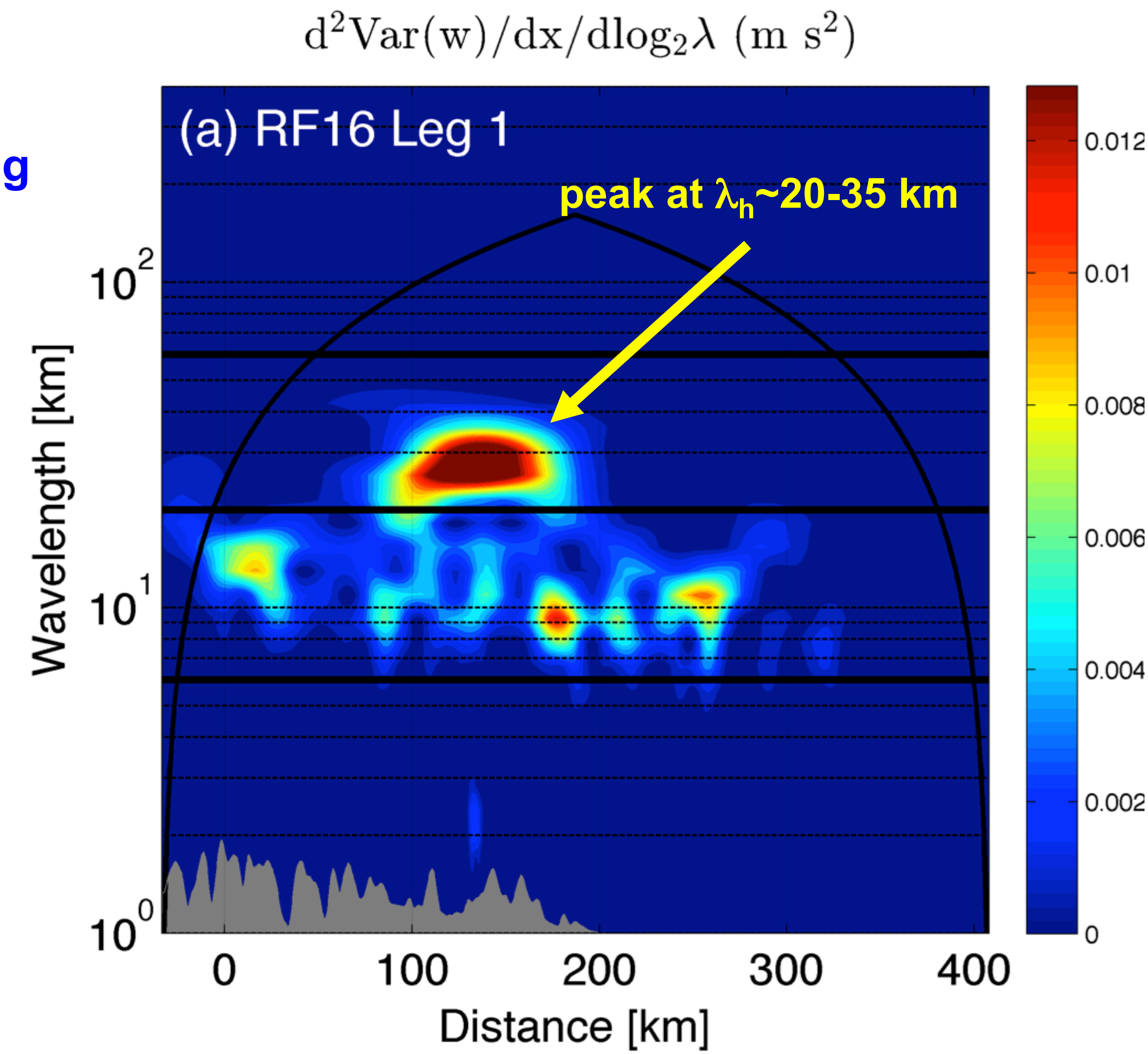
Raleigh lidar reveals:

- weak GWs at ~20-30 km
- increasing amps. above ~30 km
- both westward and eastward propagation over terrain at higher altitudes

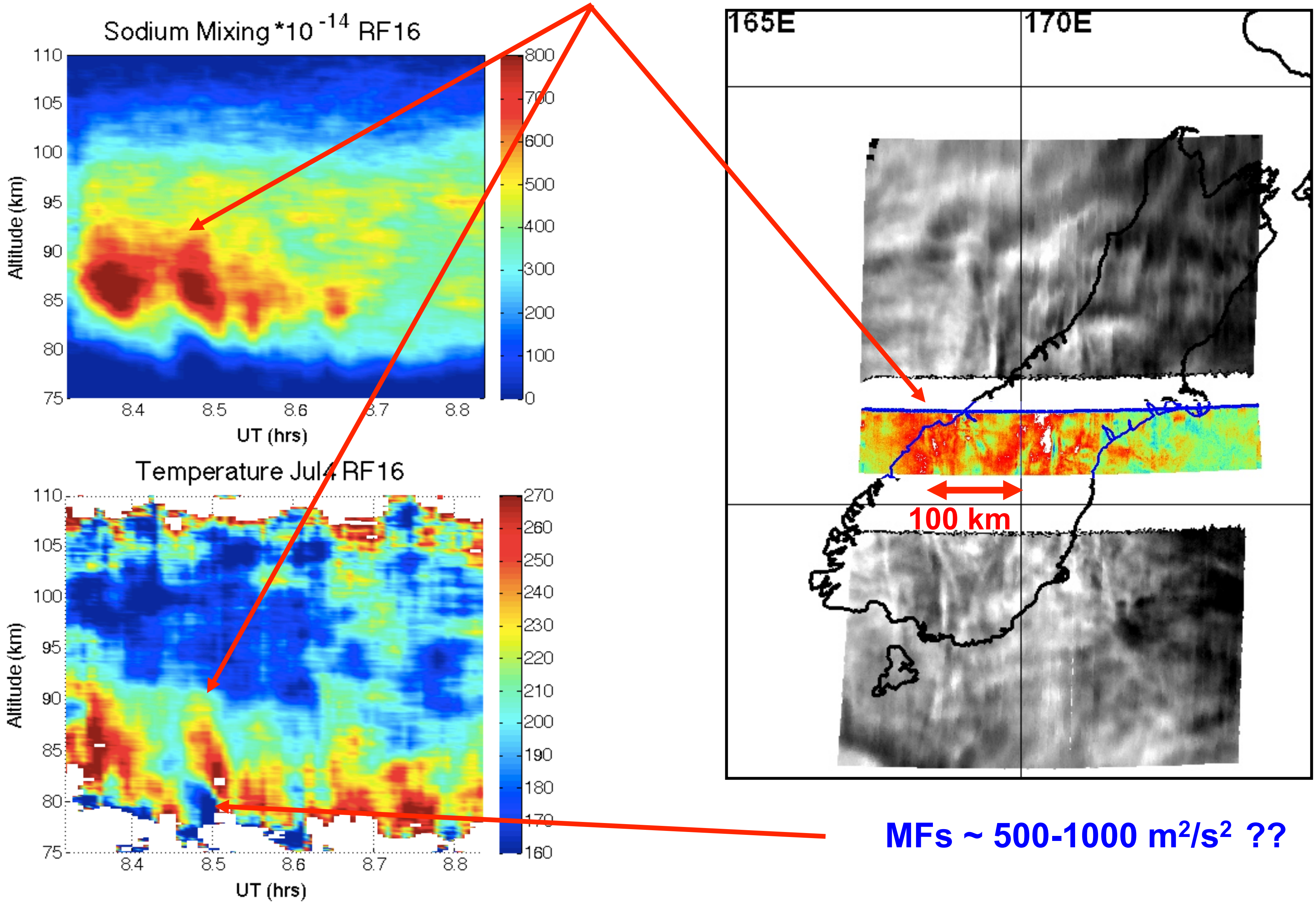
RF16 Flight-Level Wavelet Analysis along Mt. Asiring flight track (C. Kruse)

- **apparent propagating MWs at λ_h ~30 km over terrain**

- **trapped lee waves at λ_h ~5-15 km over and leeward of terrain**



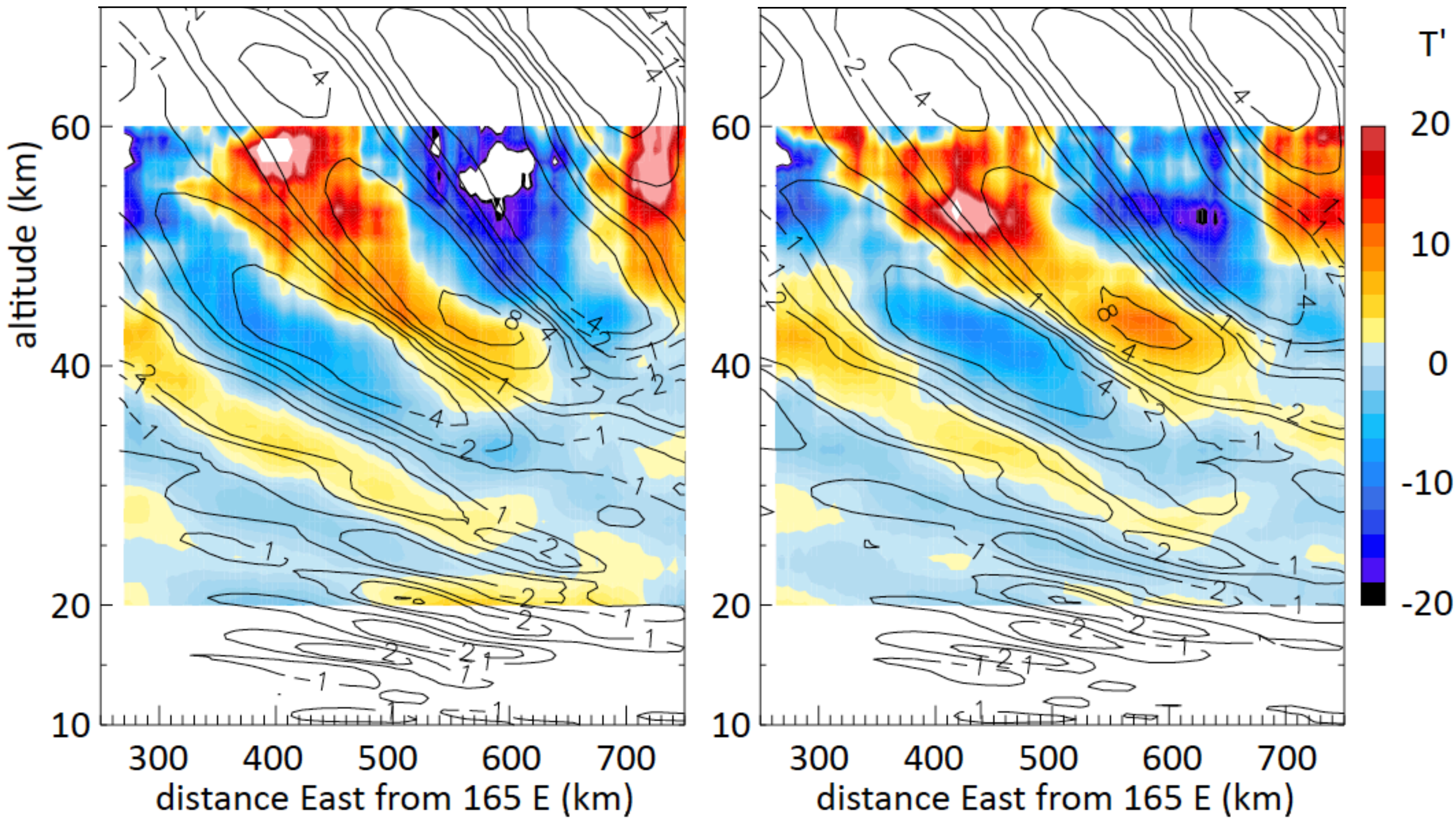
RF16 – strong MW forcing, strong stratospheric winds
- large-amplitude λ_h ~30-100 km MWs in the MLT



MFs ~ 500-1000 m^2/s^2 ??

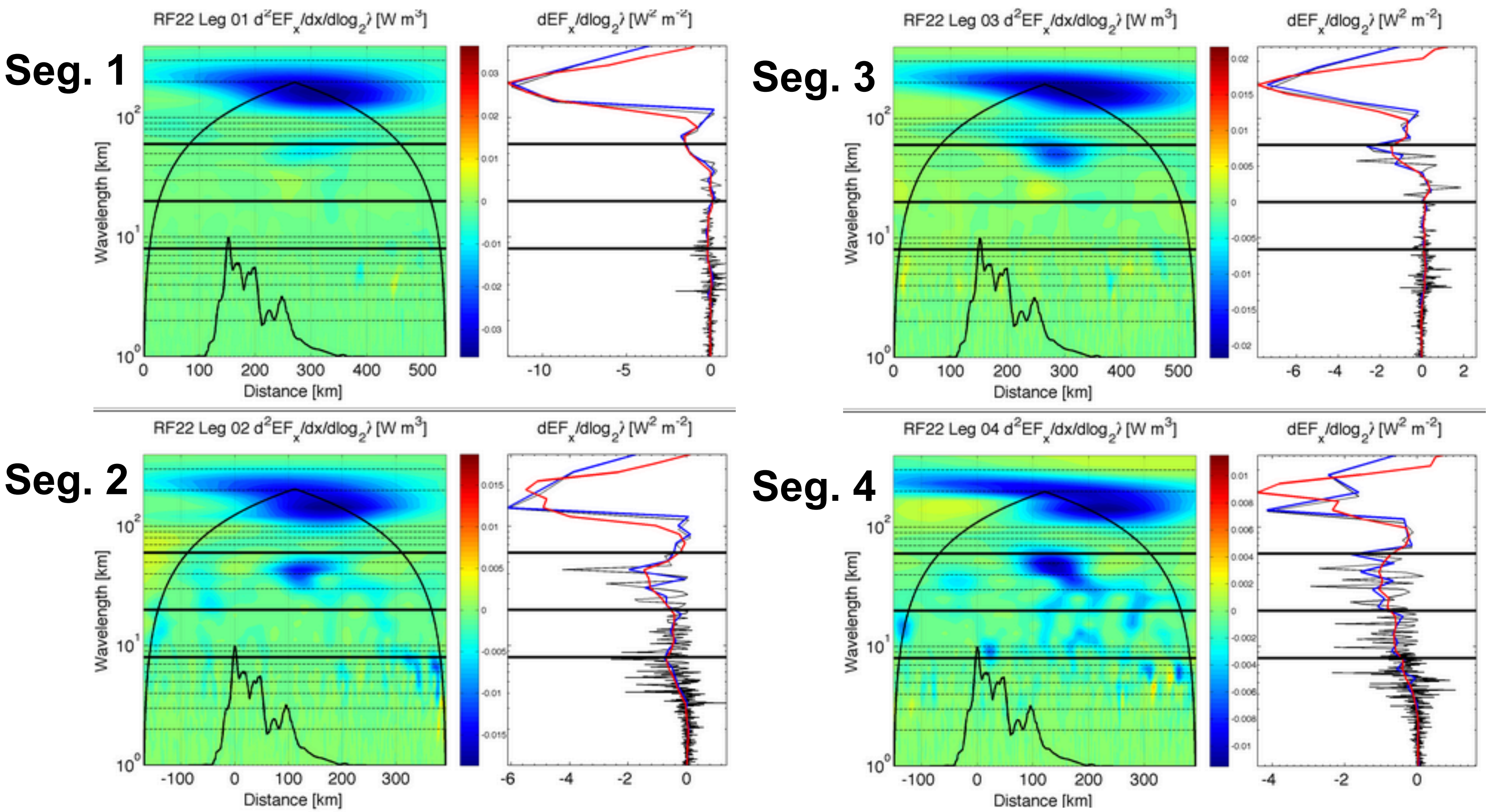
RF22 (13 July) – weak cross mountain forcing

- weak response expected in stratosphere, good propagation higher
- good agreement with ECMWF for the MW λ_h ~240 km, T' ~10-25 K
- ECMWF under-estimates T' by ~2-3 times



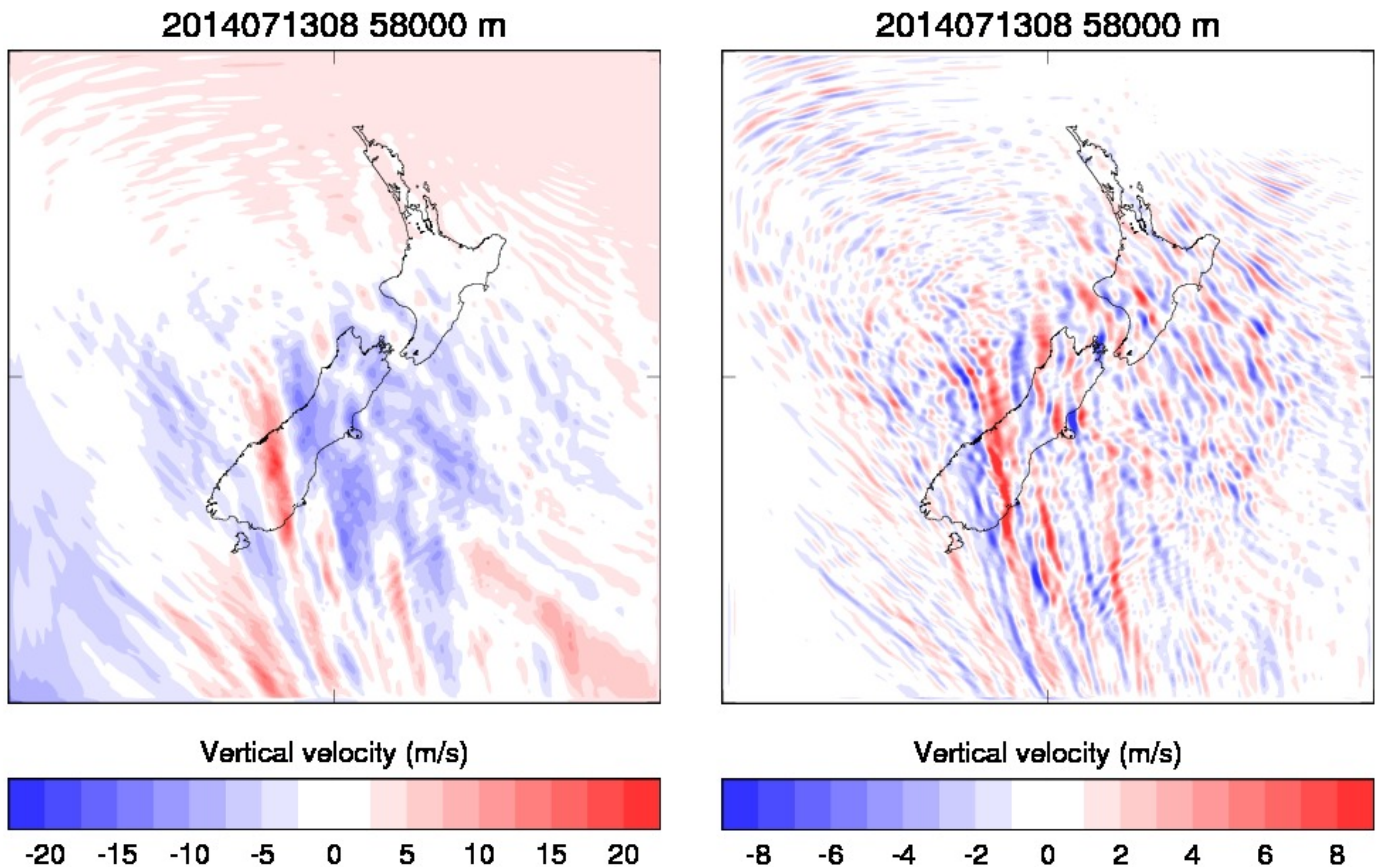
RF22 (13 July) – flight-level MWs (C. Kruse)

- major responses ~120-250 km, ~30-60 km as event evolves



RF22 UKMO UM 2-km mesoscale simulation to 80 km (S. Vosper)

- MWs have T' ~10-25 K, w' ~2-10 /s, λ_h ~25-240 km, λ_z ~15-30 km
- momentum flux varies as <u'w'> ~u'T' (so peaks at intermediate scales)

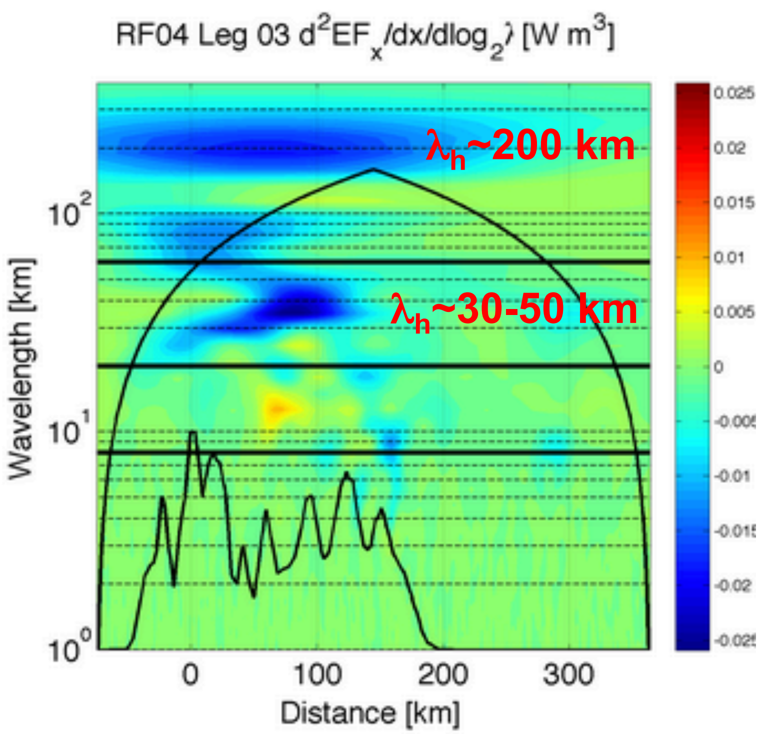


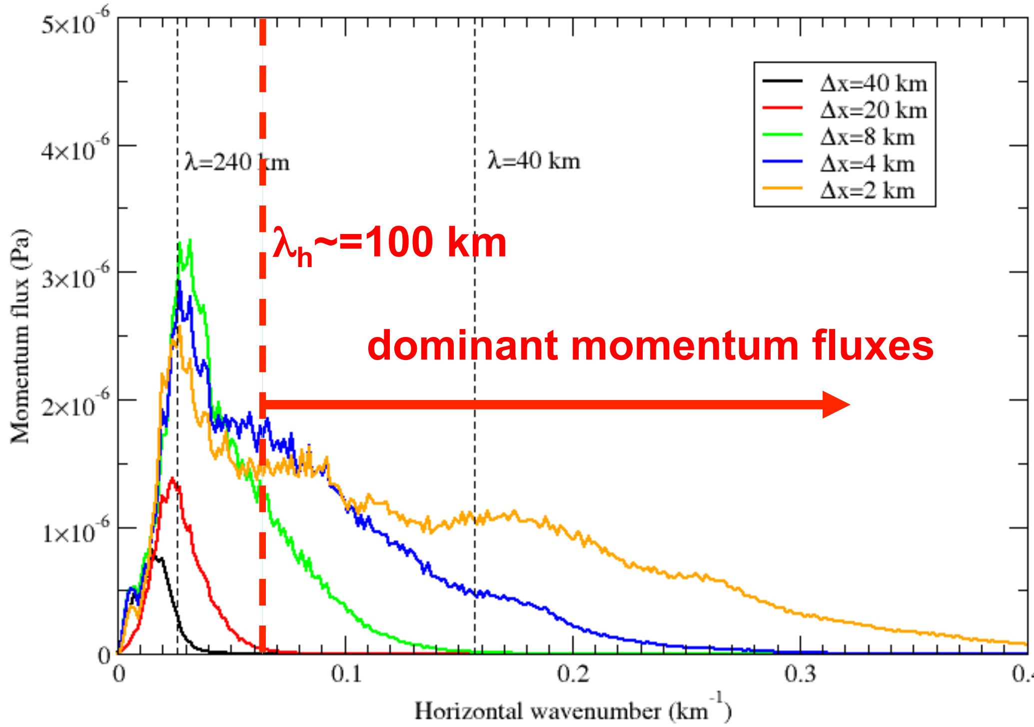
RF04 UKMO UM 2-km mesoscale simulation to 80 km (S. Vosper)

- weak forcing, very similar to RF22

- as in RF22, MW scales vary from ~30-250 km

- momentum fluxes occur primarily at λ_h < 100 km



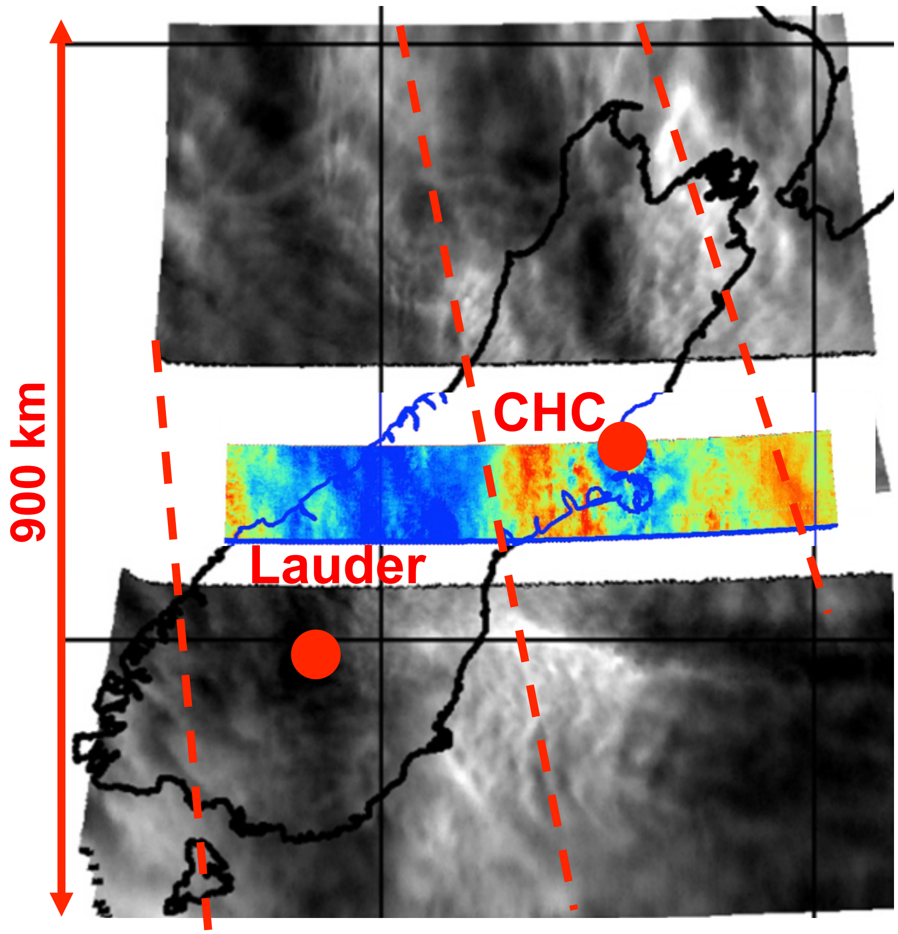


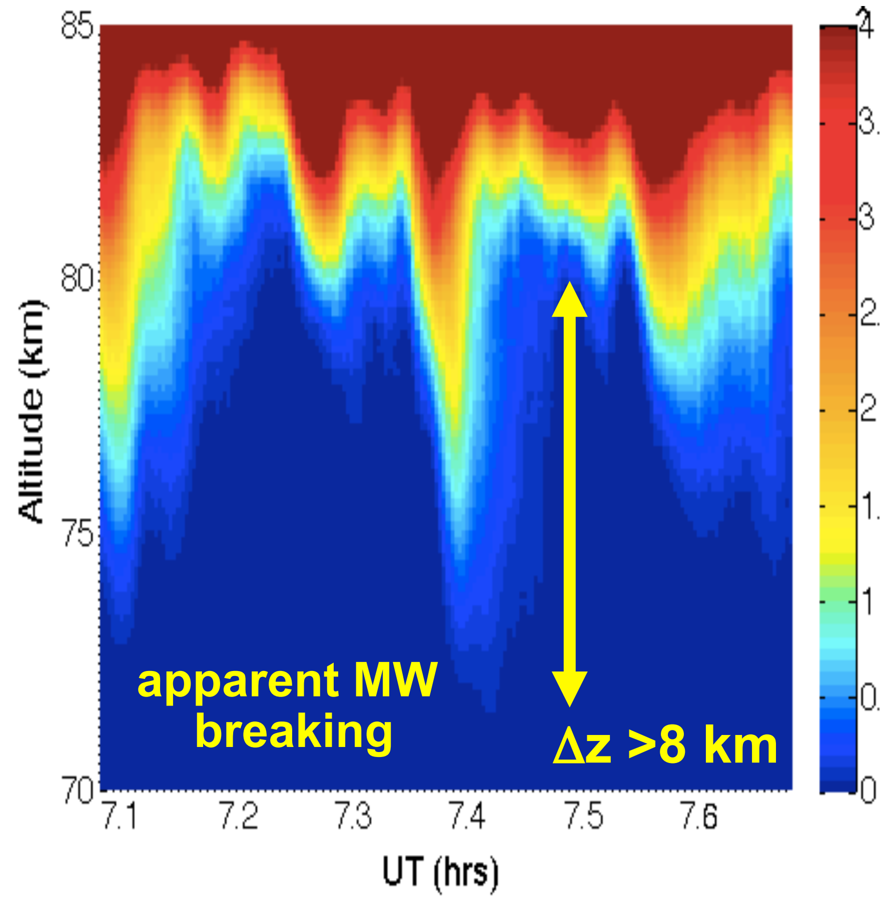
RF22 AMTM/IR Cam Keogram and Na mixing ratios

- MWs have δz ~1-3 km, T' ~10-25 K, λ_h ~30-240 km, λ_z ~15-20 km

- dominant MW below ~60 km has λ_h ~240 km

- λ_h ~25-80 km dominant in MLT

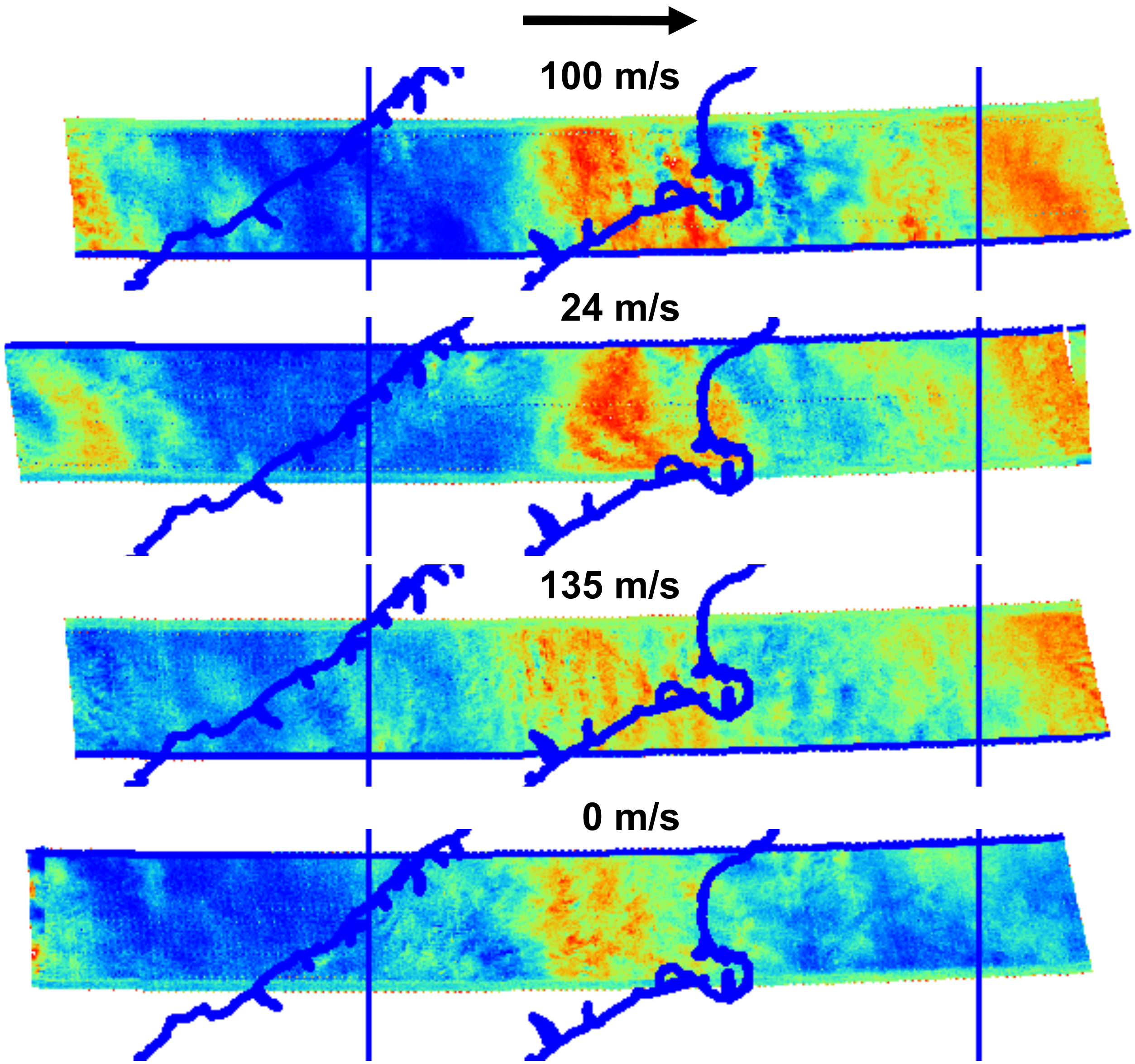




MLT <u'w'> ~700 m^2s^{-2}

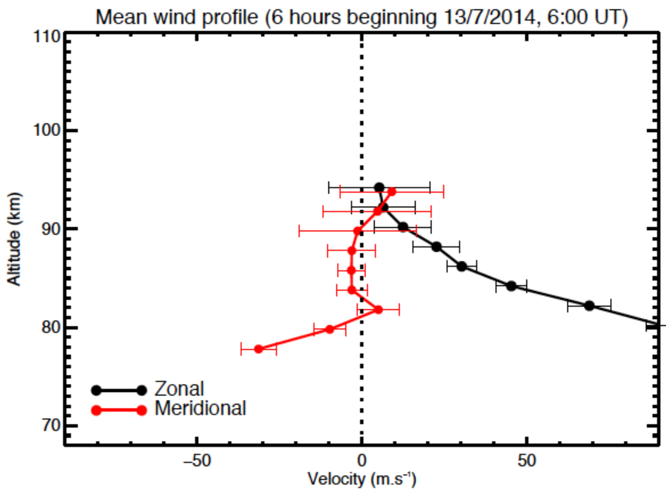
RF22 AMTM small-scale features (Bossert et al. 2015)

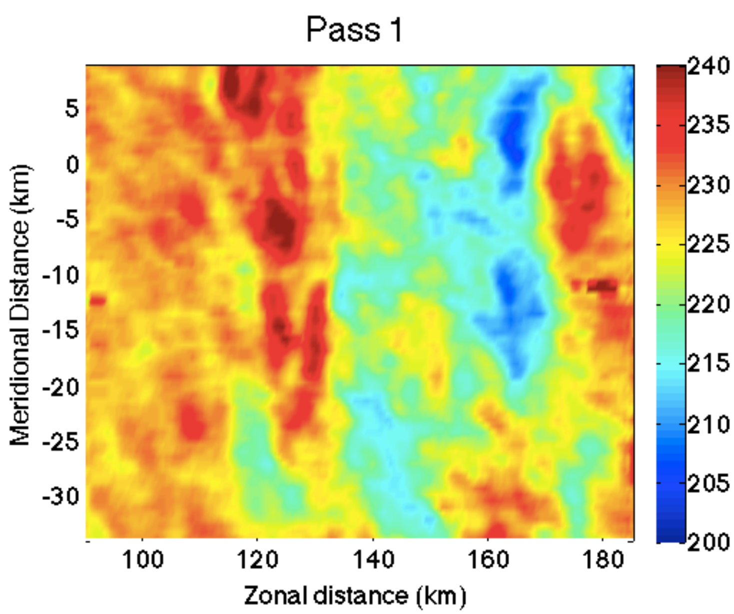
- AMTM waves have T' ~5-7 K, λ_h ~25-28 km, λ_z ~14-32 km
- phase speeds inferred in AMTM observations



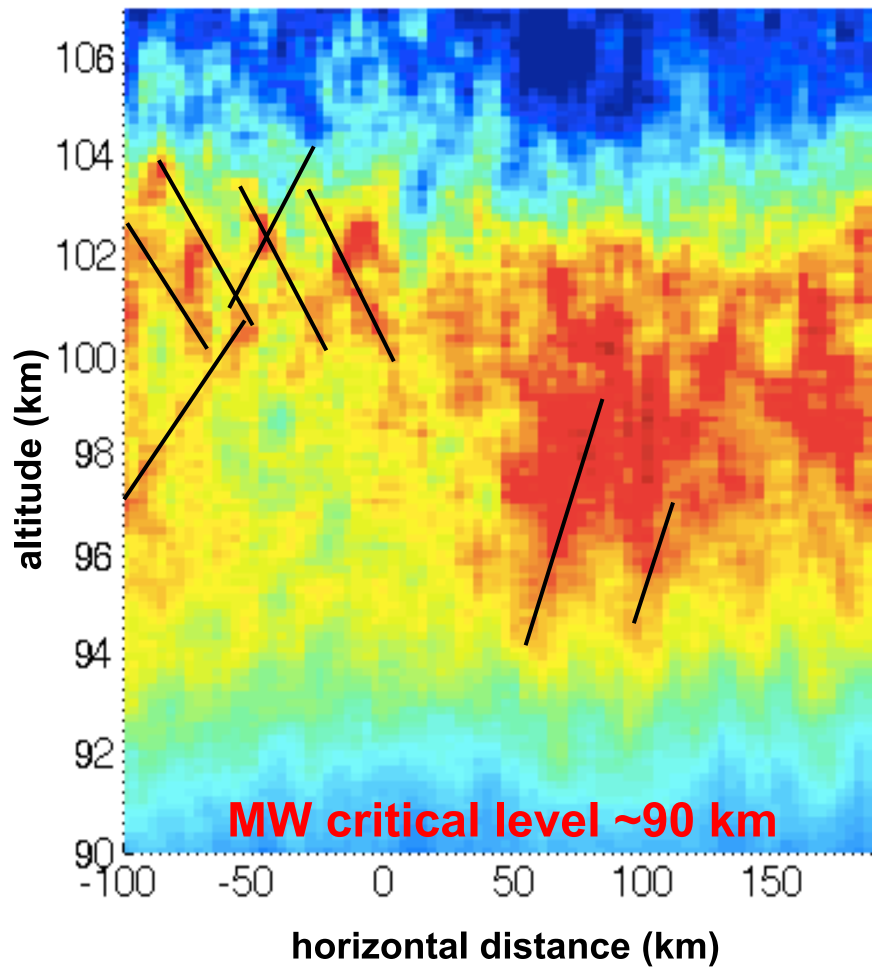
RF22 – MW breaking & secondary GW generation? (K. Bossert)

- Kingston meteor radar => critical level at ~90 km for MWs, MW breaking in OH layer ~86 km





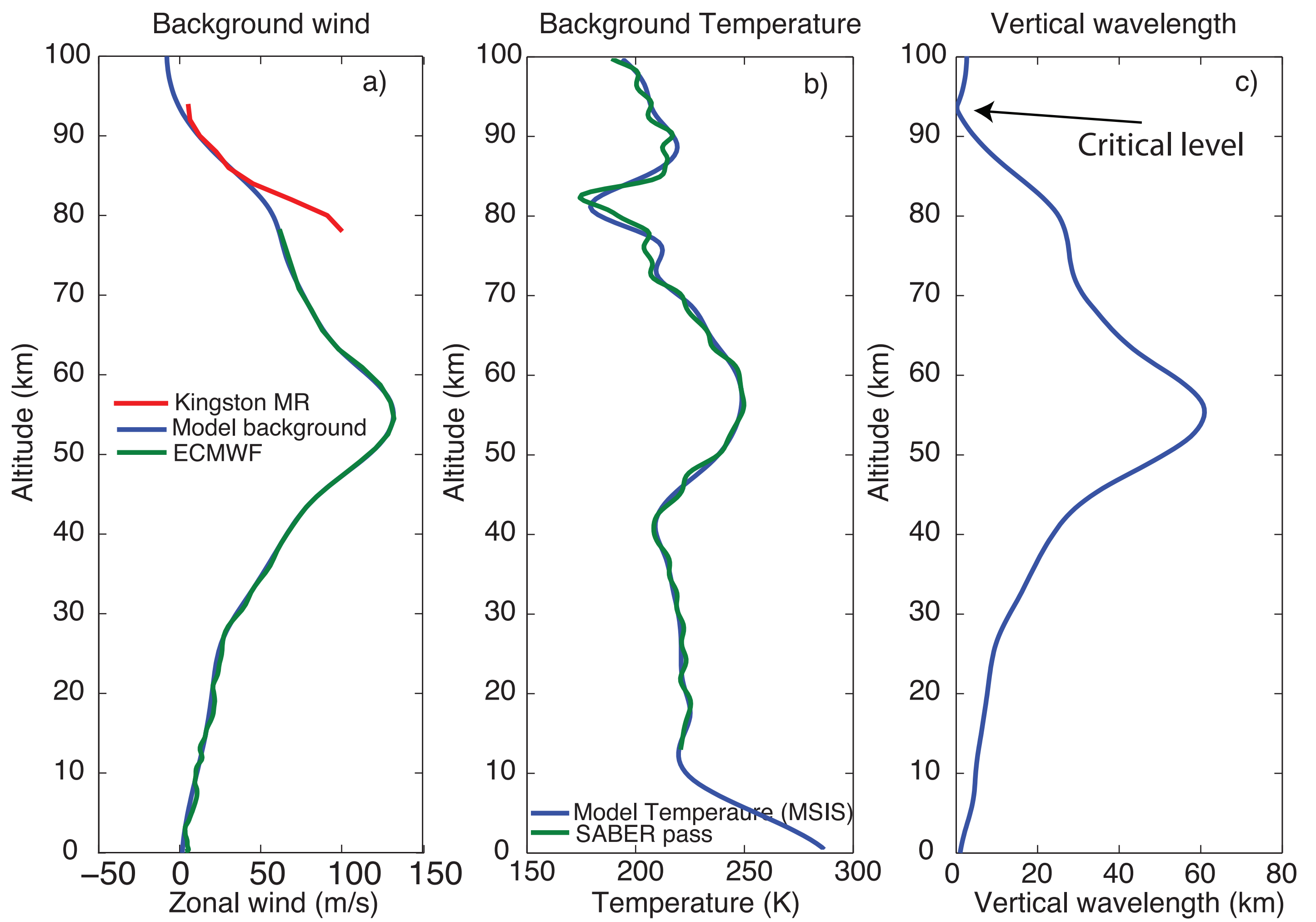
- larger apparent secondary GW amplitudes at smaller scales ~10-15 km higher



RF22 MW propagation and breaking (C. Heale/J. Snively)

- preliminary results with the Embry Riddle 2D model

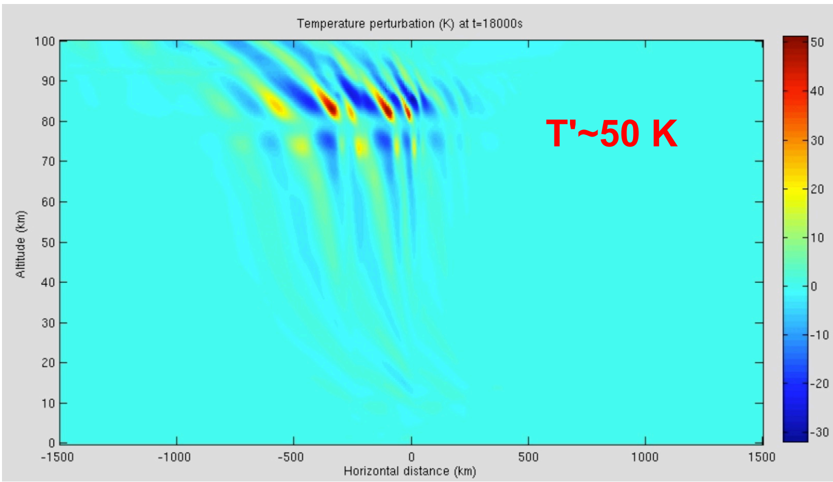
- initial conditions



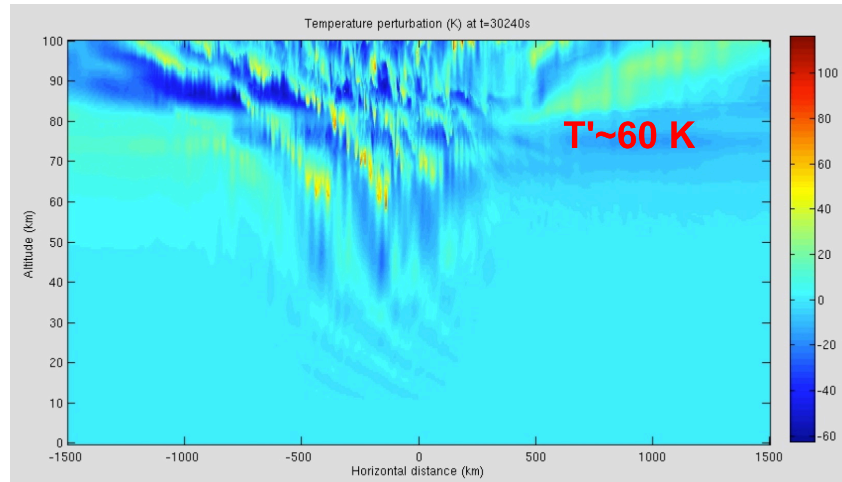
RF22 MW propagation and breaking (C. Heale/J. Snively)

- MWs, instabilities, and secondary GWs

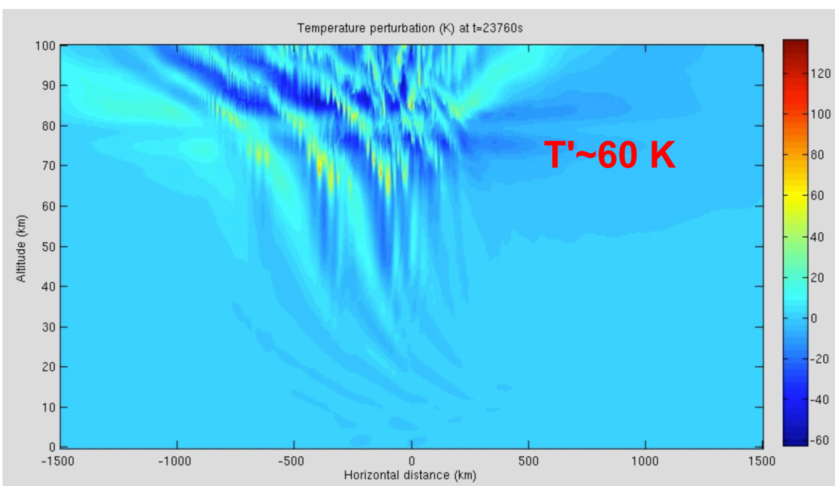
t~5 hr



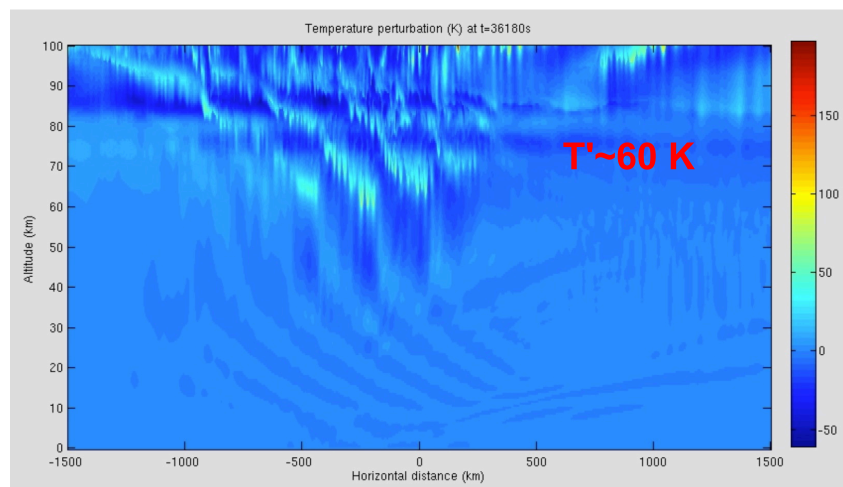
t~6.67 hr



t~8.33 hr



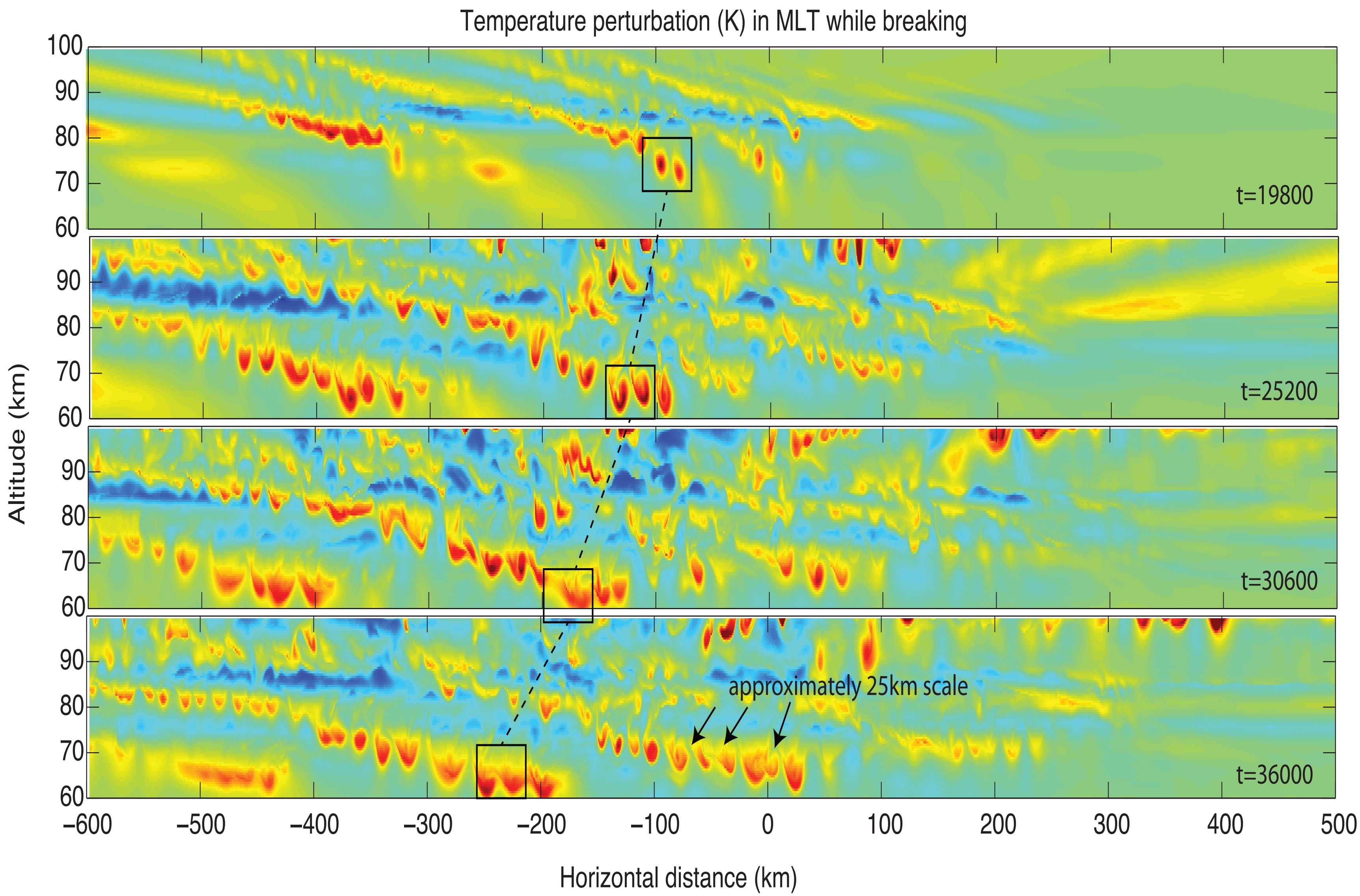
t~10 hr



RF22 MW propagation and breaking (C. Heale/J. Snively)

- large 2D instability scales dictate secondary GW scales

- need 3D simulation to define true instability and secondary GW scales



RF22 AMTM small-scale features

- mean profiles employed in the Embry Riddle model

- 25-km wavelength phase speeds at OH layer