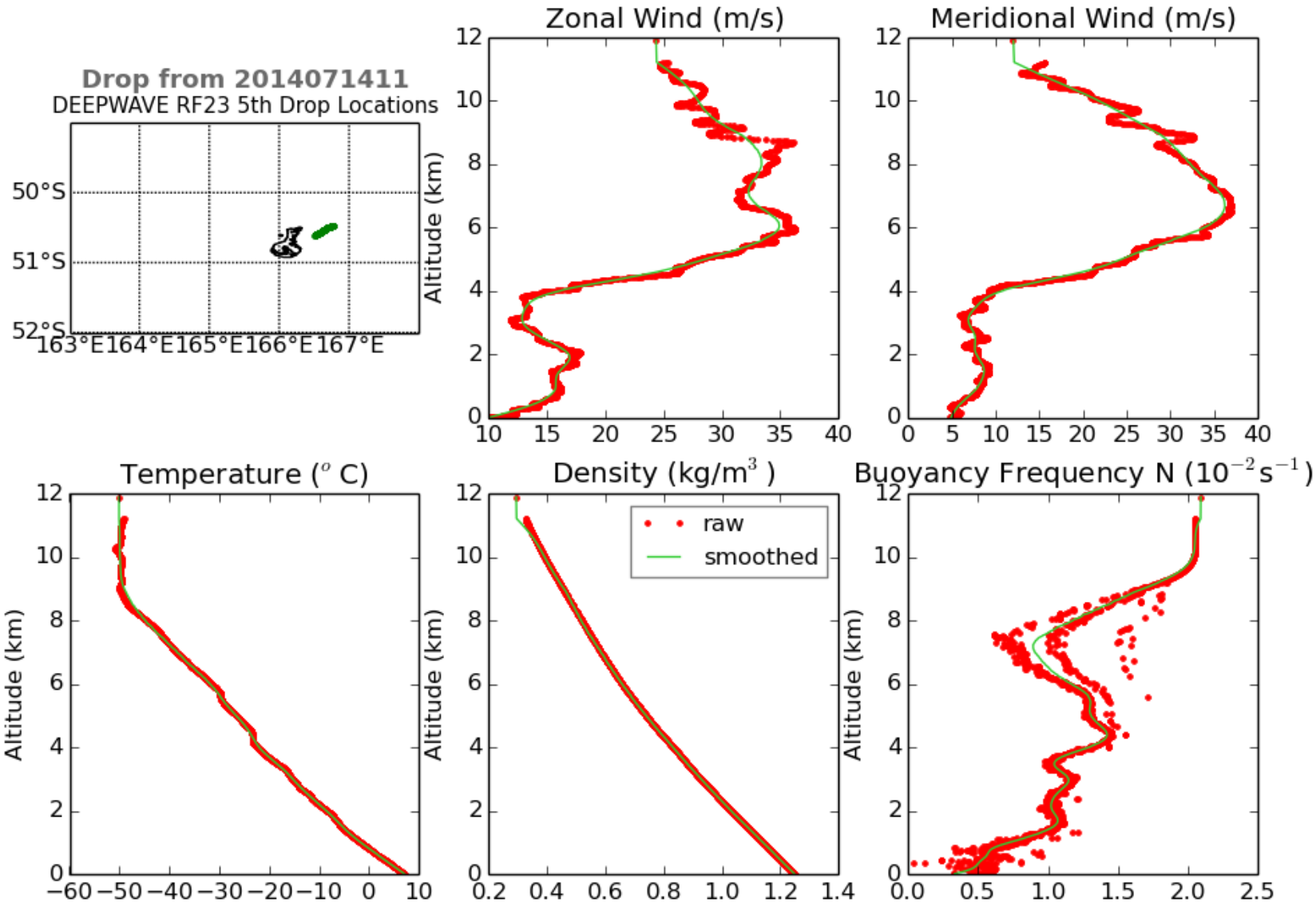
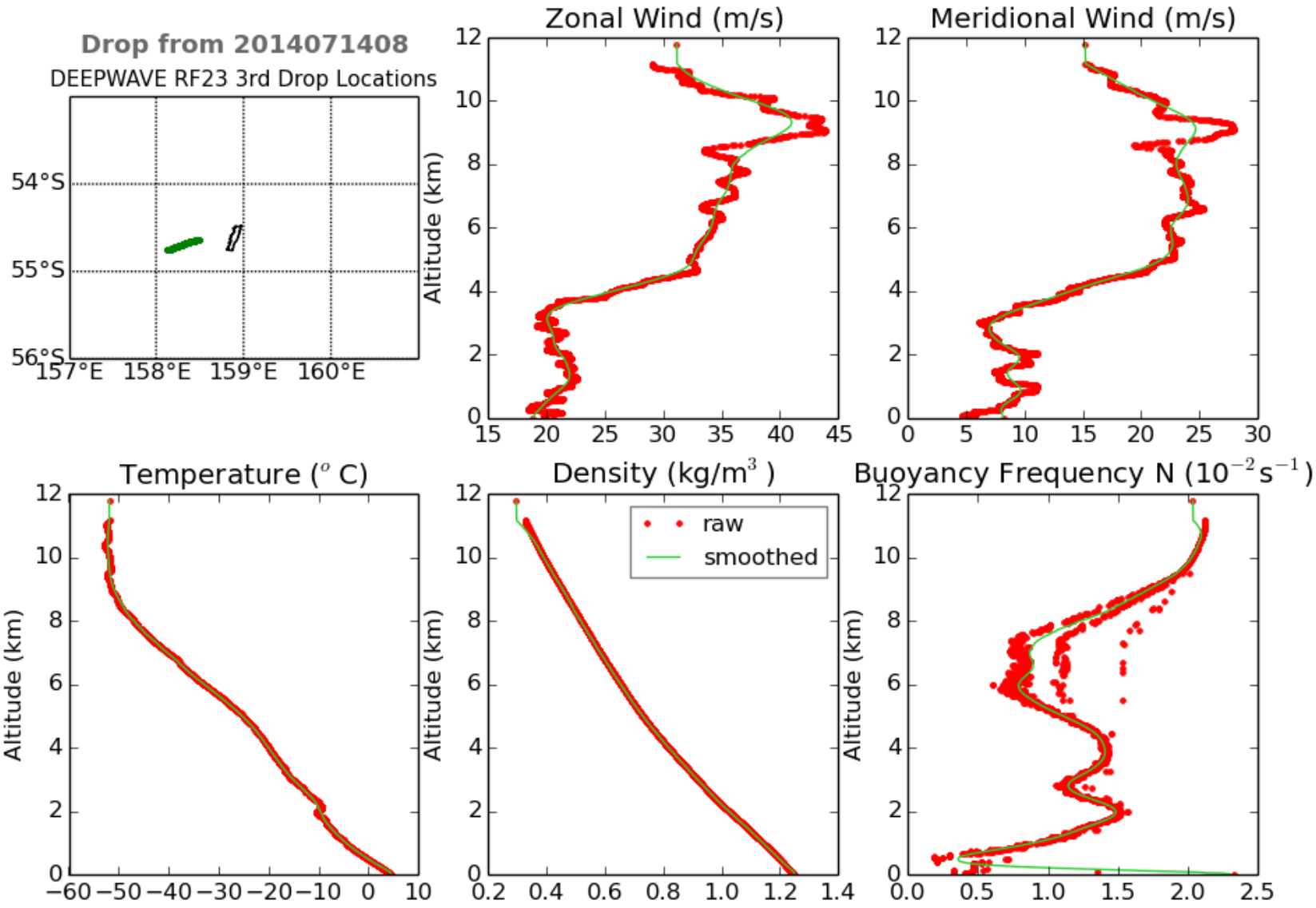
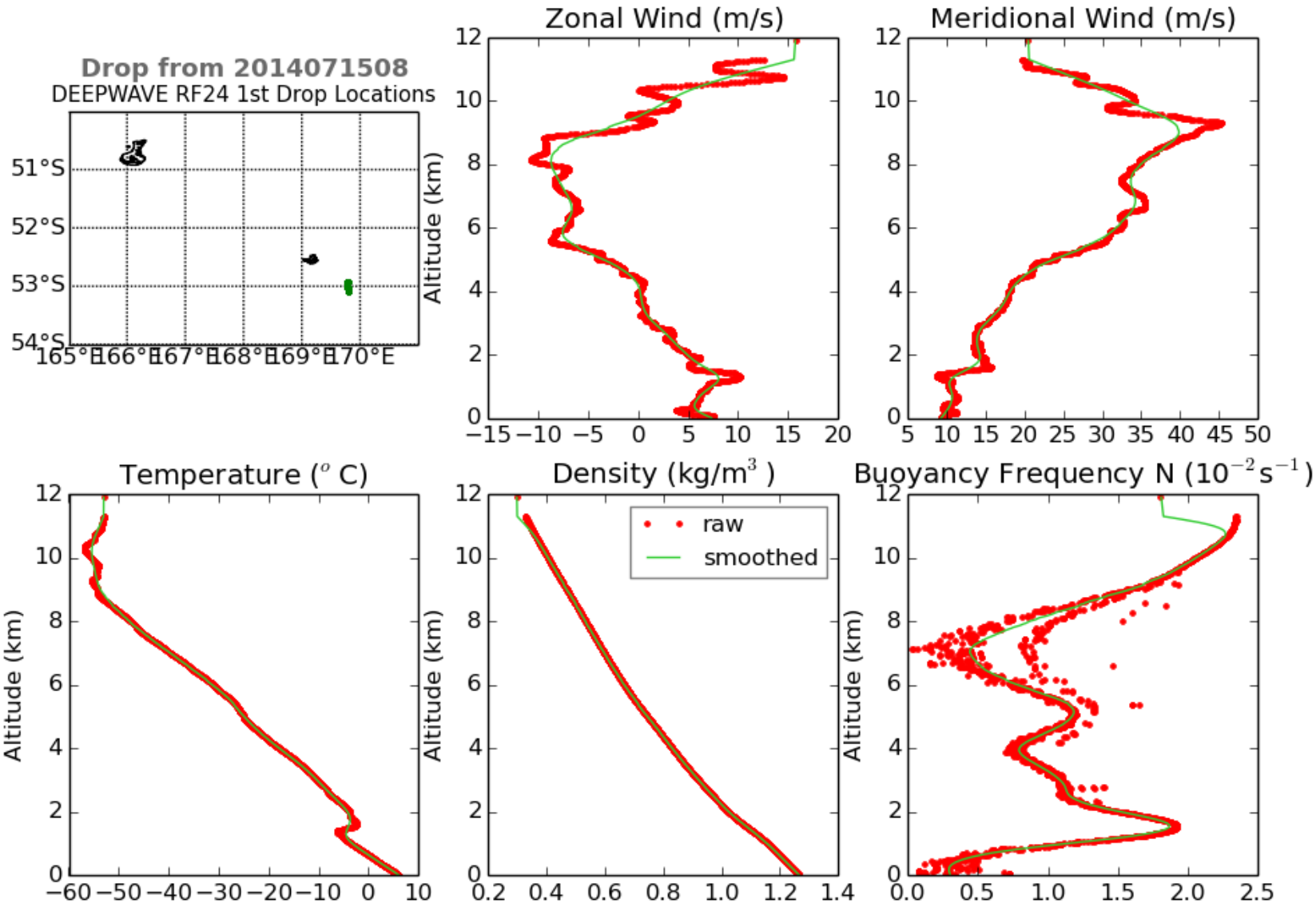
# MW excited by AI on RF23: Comparison between observation and simulation

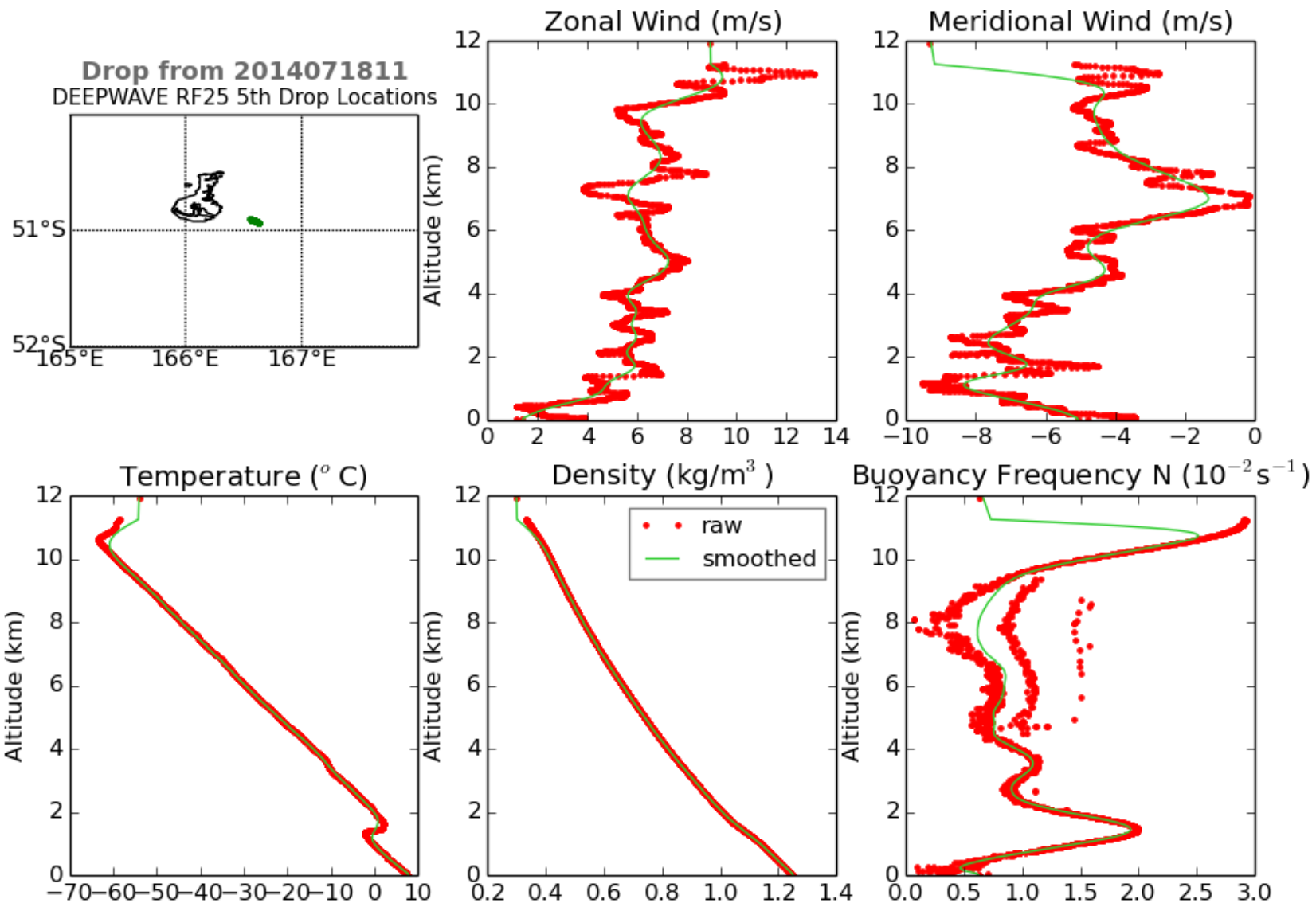
J. Ma, D. Broutman, S. D. Eckermann

1. **DEEPWAVE Dropsonde Data**
2. DEEPWAVE ECMWF Data
3. DEEPWAVE NAVGEM Data
4. Combined Background Data
5. DEEPWAVE FR Simulation
6. DEEPWAVE Airglow Image


Drop from 2014071411
DEEPWAVE RF23 5th Drop Locations
50°S
51°S
52°S
163°E164°E165°E166°E167°E
Zonal Wind (m/s)
Meridional Wind (m/s)
Altitude (km)
Temperature (° C)
Density (kg/m3 )
Buoyancy Frequency N (10−2s−1)
raw
smoothed


Drop from 2014071408
DEEPWAVE RF23 3rd Drop Locations
54°S
55°S
56°S
157°E
158°E
159°E
160°E
Zonal Wind (m/s)
Meridional Wind (m/s)
Altitude (km)
Temperature ($^o$ C)
Density (kg/m$^3$ )
Buoyancy Frequency N ($10^{-2}$s$^{-1}$)
raw
smoothed


Drop from 2014071508
DEEPWAVE RF24 1st Drop Locations
51°S
52°S
53°S
54°S
165°E
166°E
167°E
168°E
169°E
170°E
Altitude (km)
Zonal Wind (m/s)
Meridional Wind (m/s)
Temperature (° C)
Density (kg/m3 )
Buoyancy Frequency N (10−2s−1)
raw
smoothed


Drop from 2014071811
DEEPWAVE RF25 5th Drop Locations
51°S
52°S
165°E
166°E
167°E
Zonal Wind (m/s)
Meridional Wind (m/s)
Altitude (km)
Temperature ($^o$ C)
Density (kg/m$^3$ )
Buoyancy Frequency N ($10^{-2}$s$^{-1}$)
raw
smoothed

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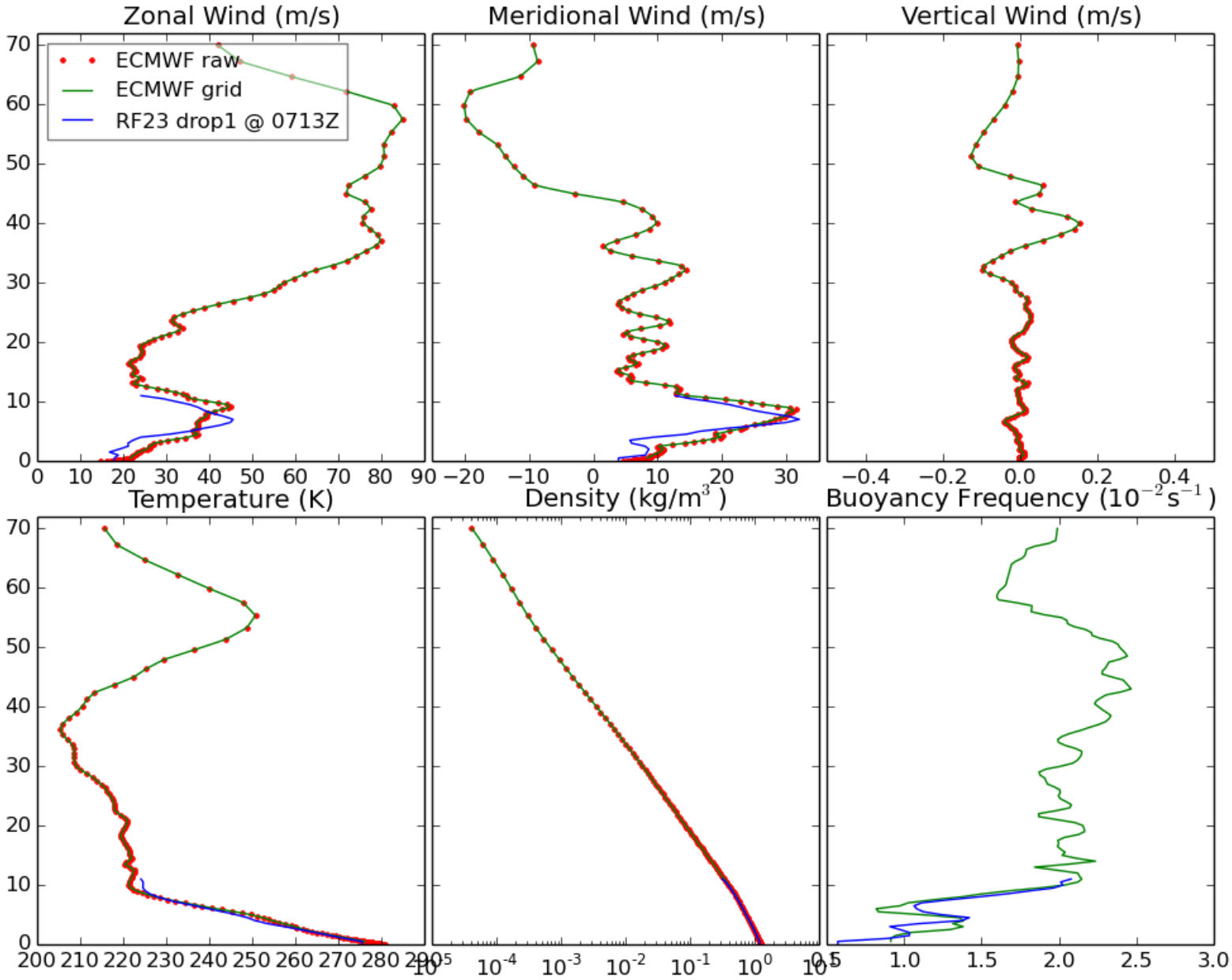
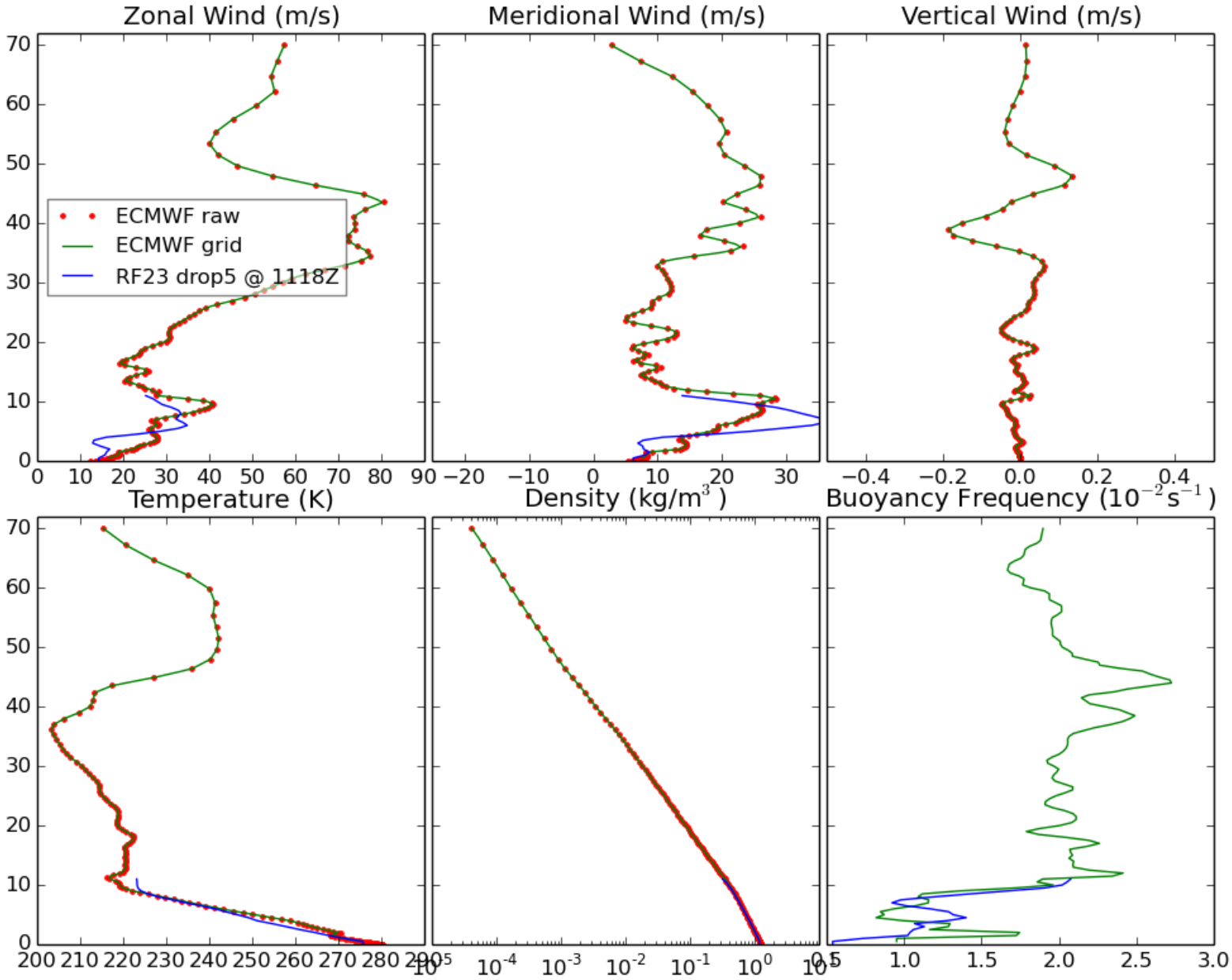
# ECMWF Analysis on 2014071406 over Auckland Island



# ECMWF Analysis on 2014071412 over Auckland Island



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3. **DEEPWAVE NAVGEM Data**
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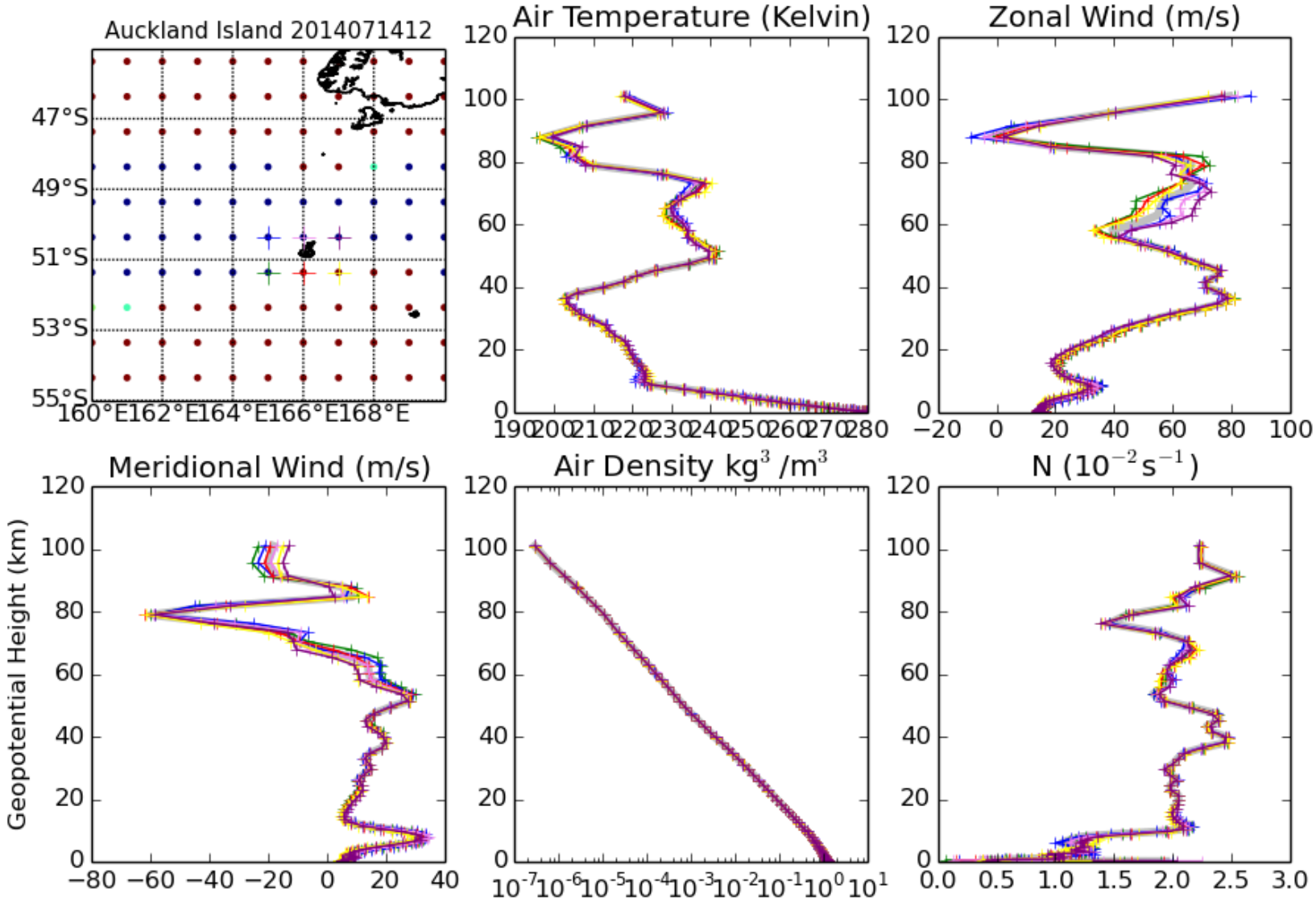
5. DEEPWAVE FR Simulation
6. DEEPWAVE Airglow Image


Auckland Island 2014071412
47°S
49°S
51°S
53°S
55°S
160°E162°E164°E166°E168°E
Air Temperature (Kelvin)
Zonal Wind (m/s)
Meridional Wind (m/s)
Air Density kg$^3$ /m$^3$
N ($10^{-2}$s$^{-1}$)
Geopotential Height (km)

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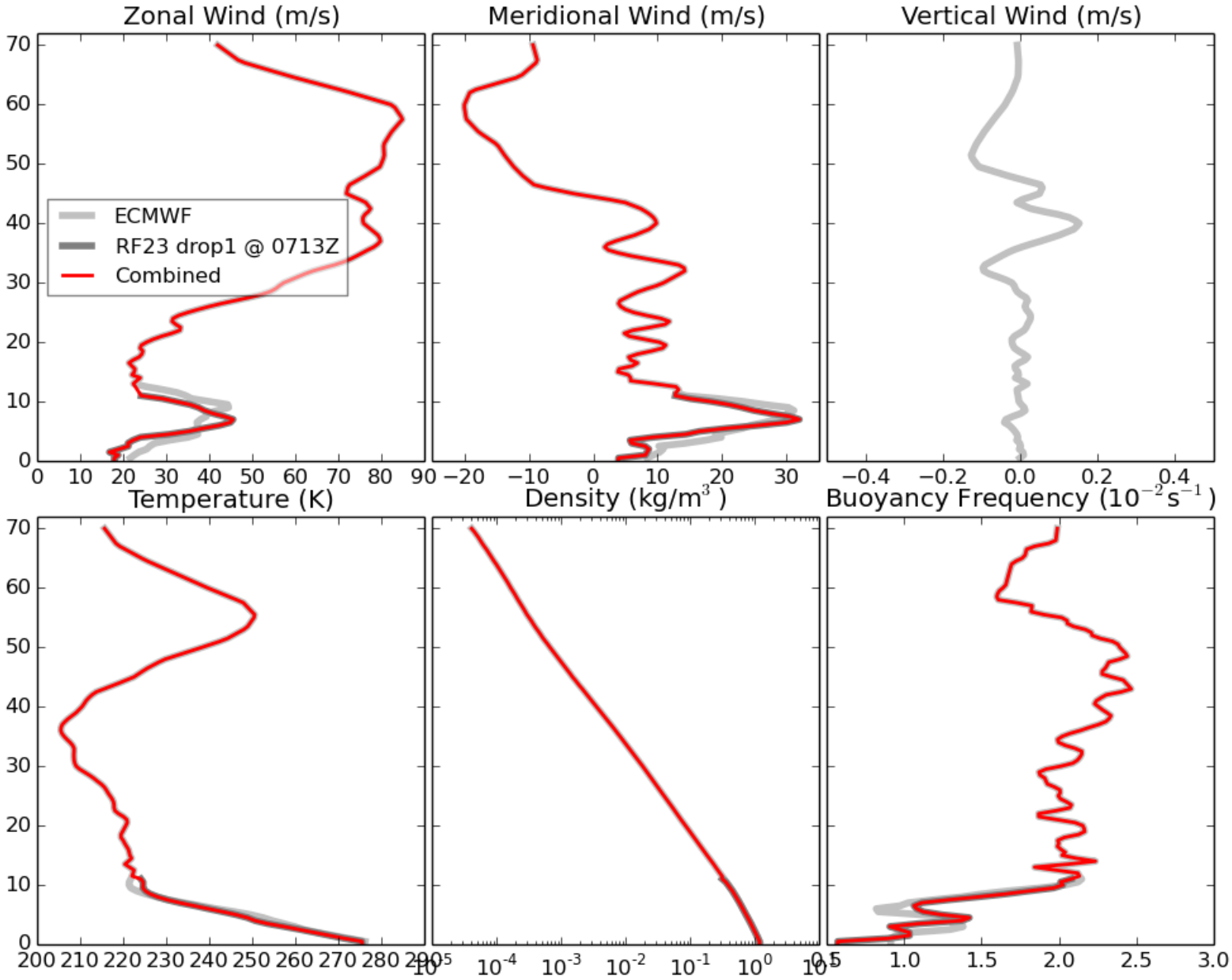
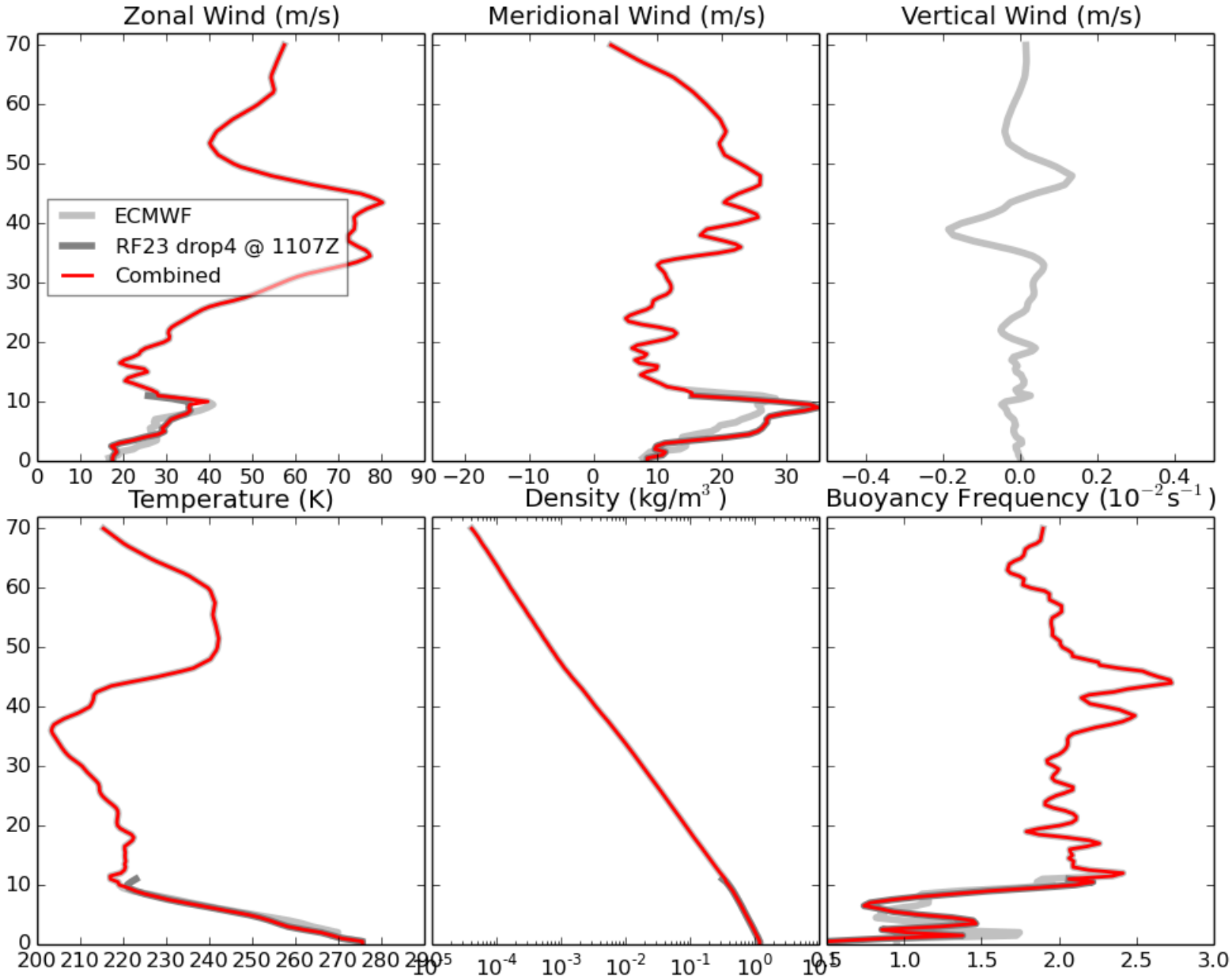
4. **Combined Background Data**
5. DEEPWAVE FR Simulation
6. DEEPWAVE Airglow Image

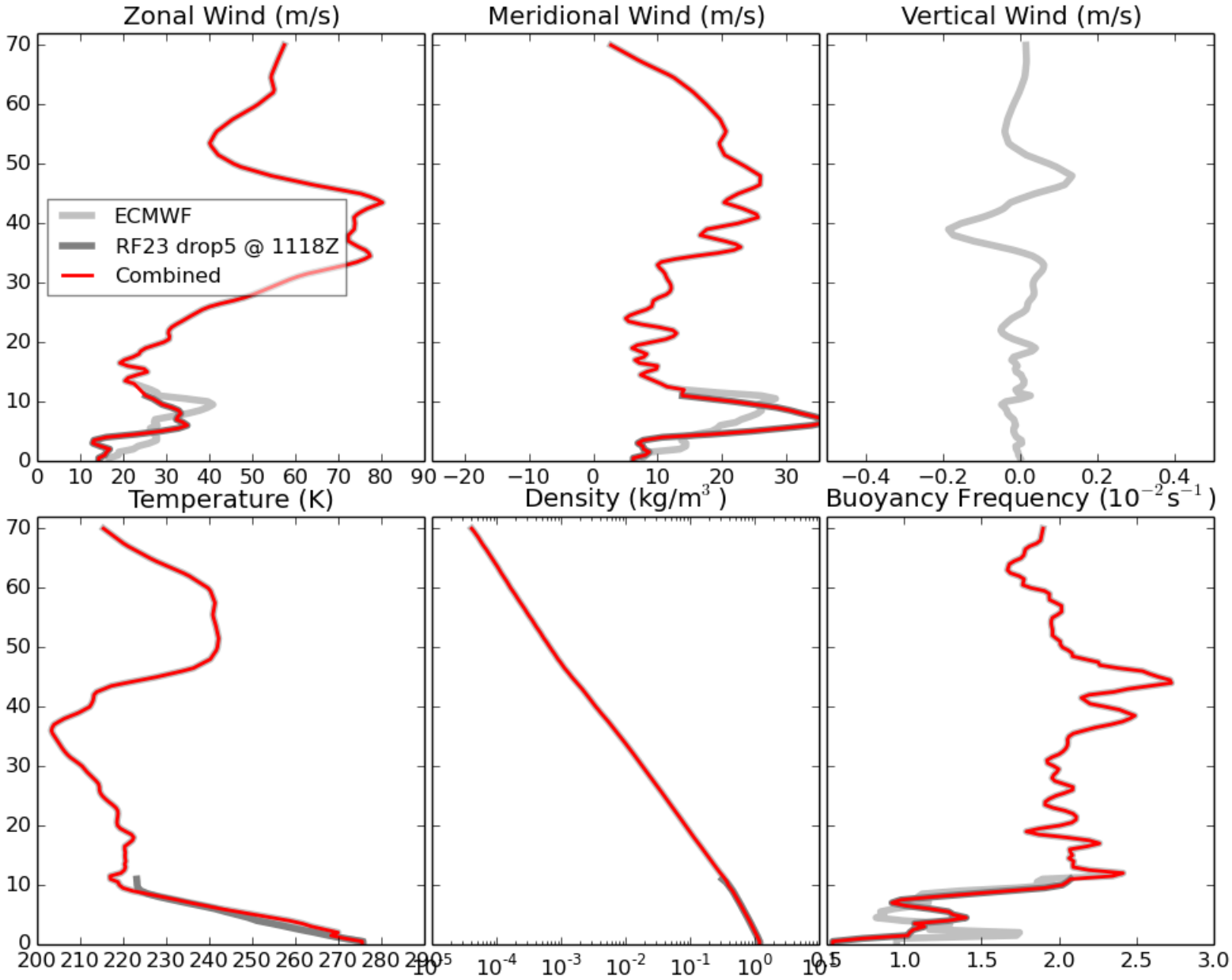
# ECMWF Analysis on 2014071406 over Auckland Island



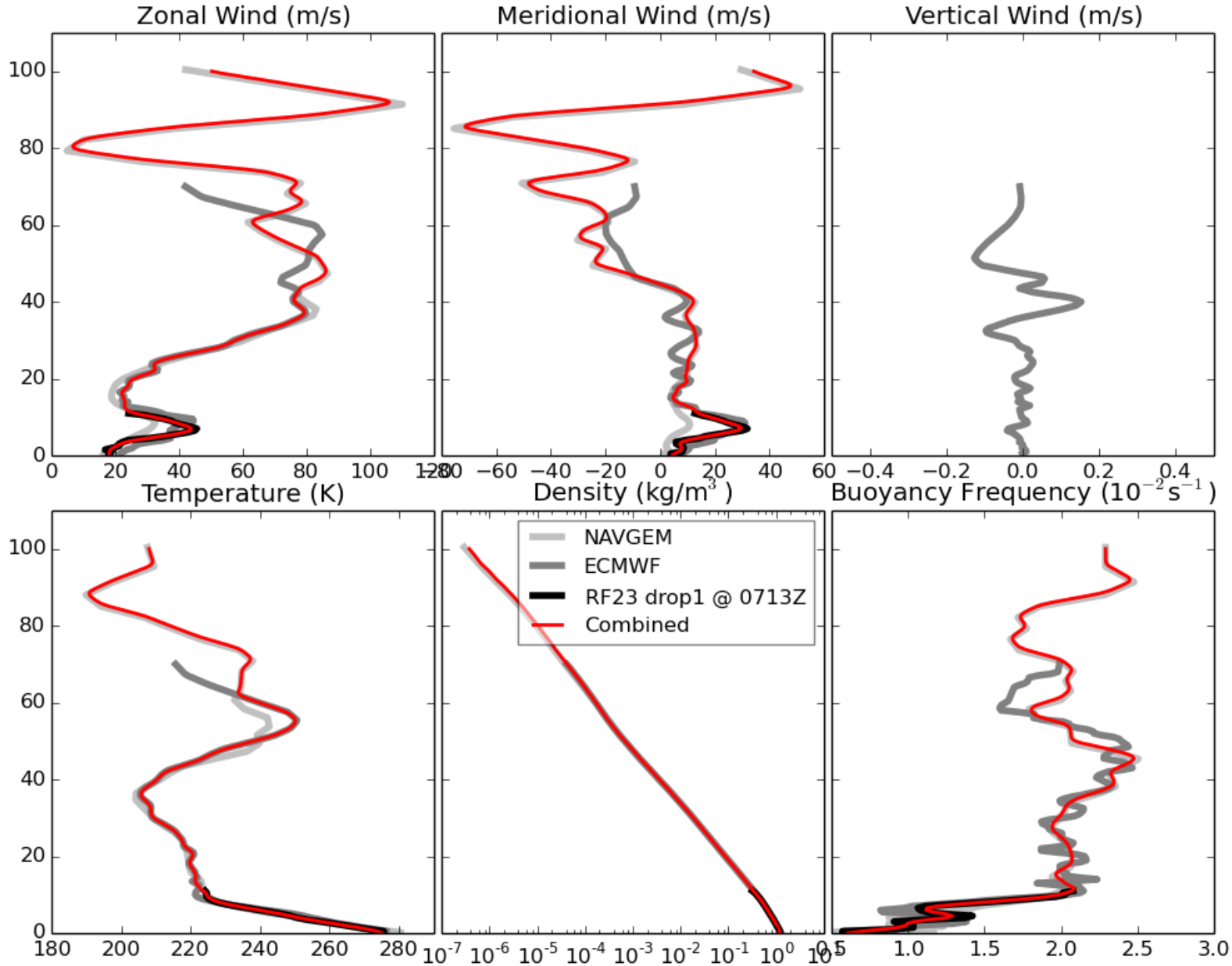
# ECMWF Analysis on 2014071412 over Auckland Island



# ECMWF Analysis on 2014071412 over Auckland Island



# Combined Background Profile on 2014071406 over Auckland Island



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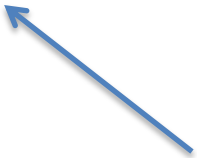
# Fourier–Ray (FR) Method

Start with a standard Fourier integral representation for mountain waves, with (*k,l*) = horiz. wavenos.:

$$\eta(x,y,z) = \iint_{-\infty}^{\infty} \hat{\eta}(k,l,z)\, e^{i(kx+ly)}\, dk\, dl$$

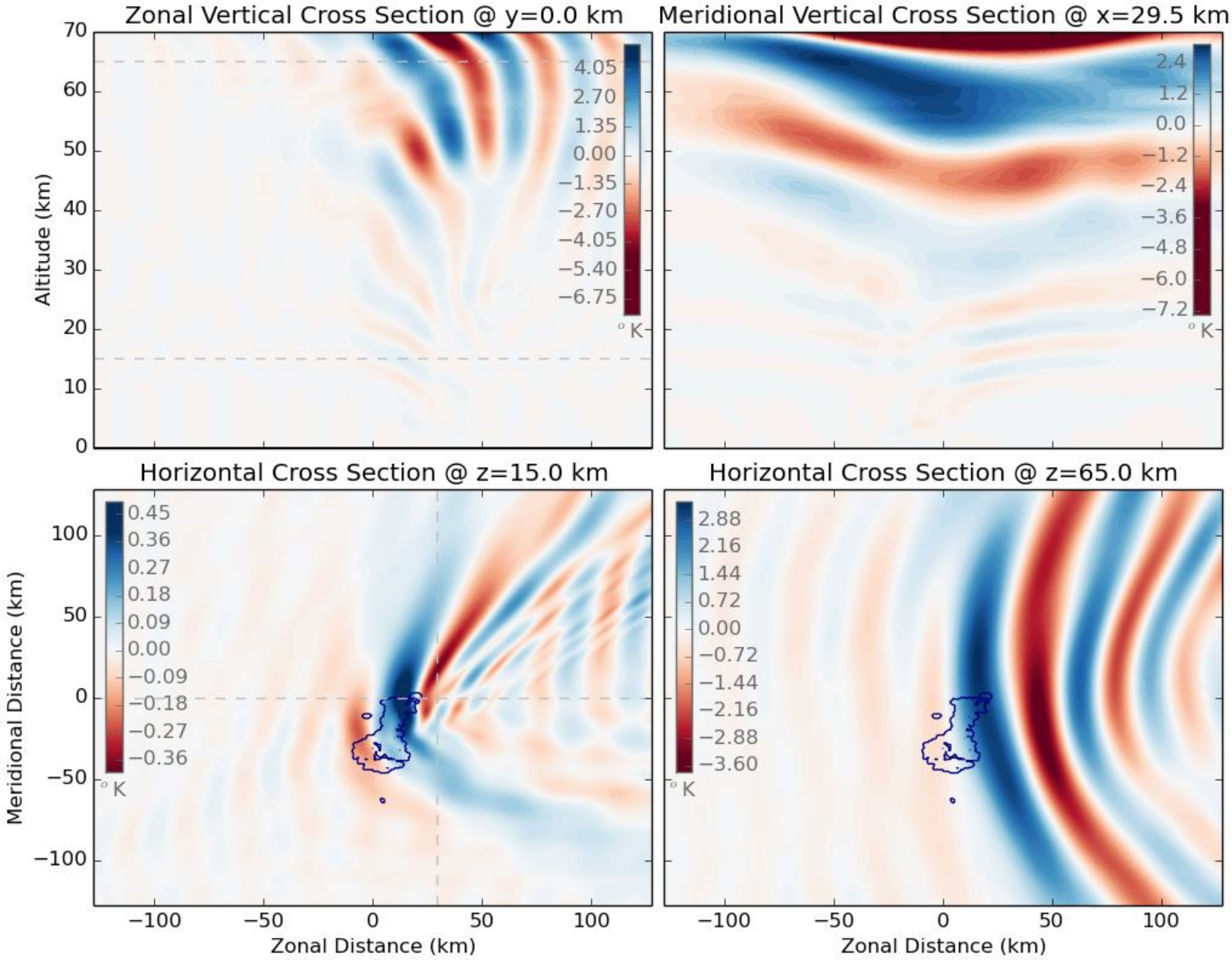


**FR: use the ray approximation for the vertical eigenfunctions.**

**This is different from using the ray approximation for the spatial solution η(x,y,z).**

# FR: Temperature Perturbation on 16384x16384 Grids

## FR Analysis on 2014071406 with ECMWF/Dropsonde Profile



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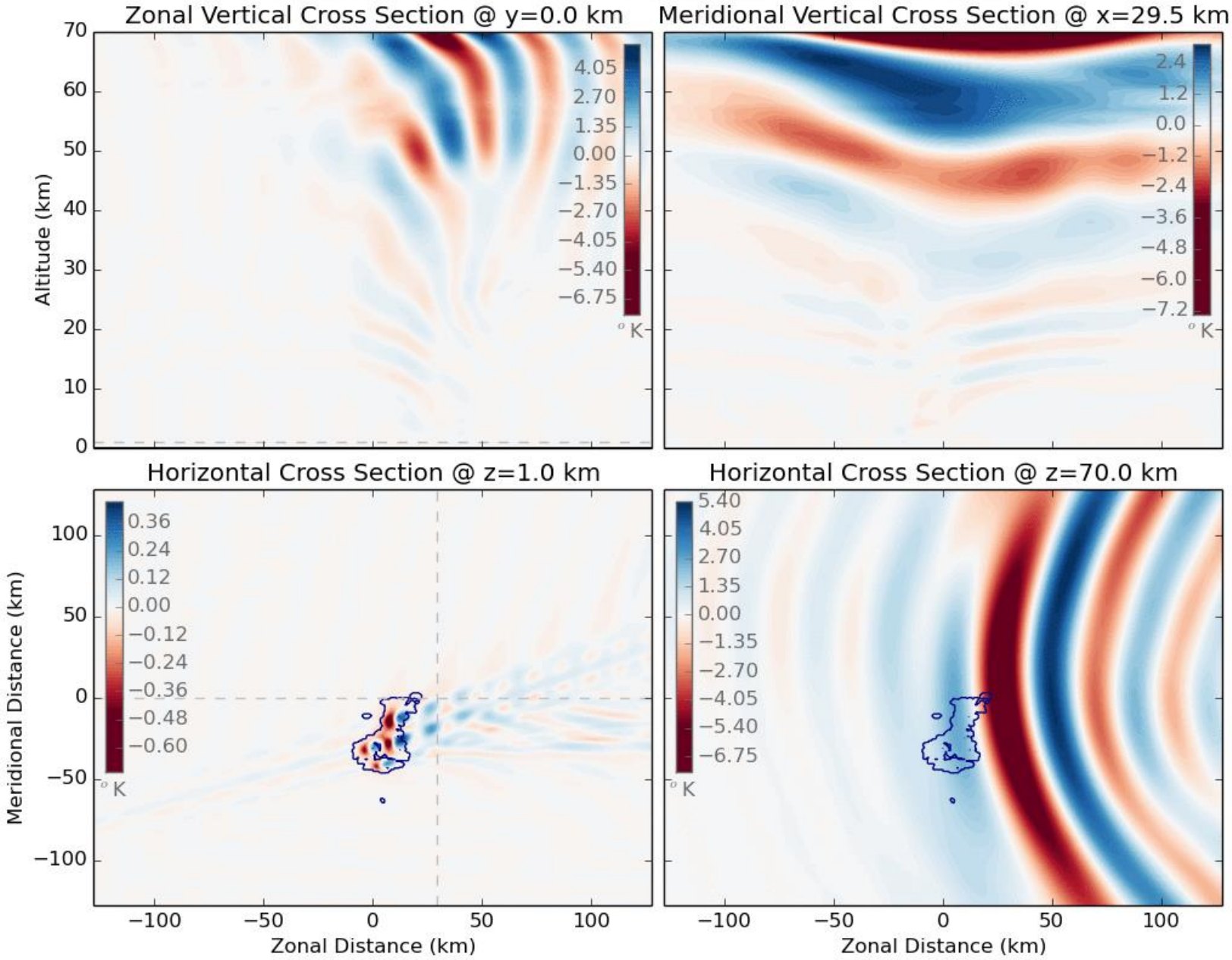

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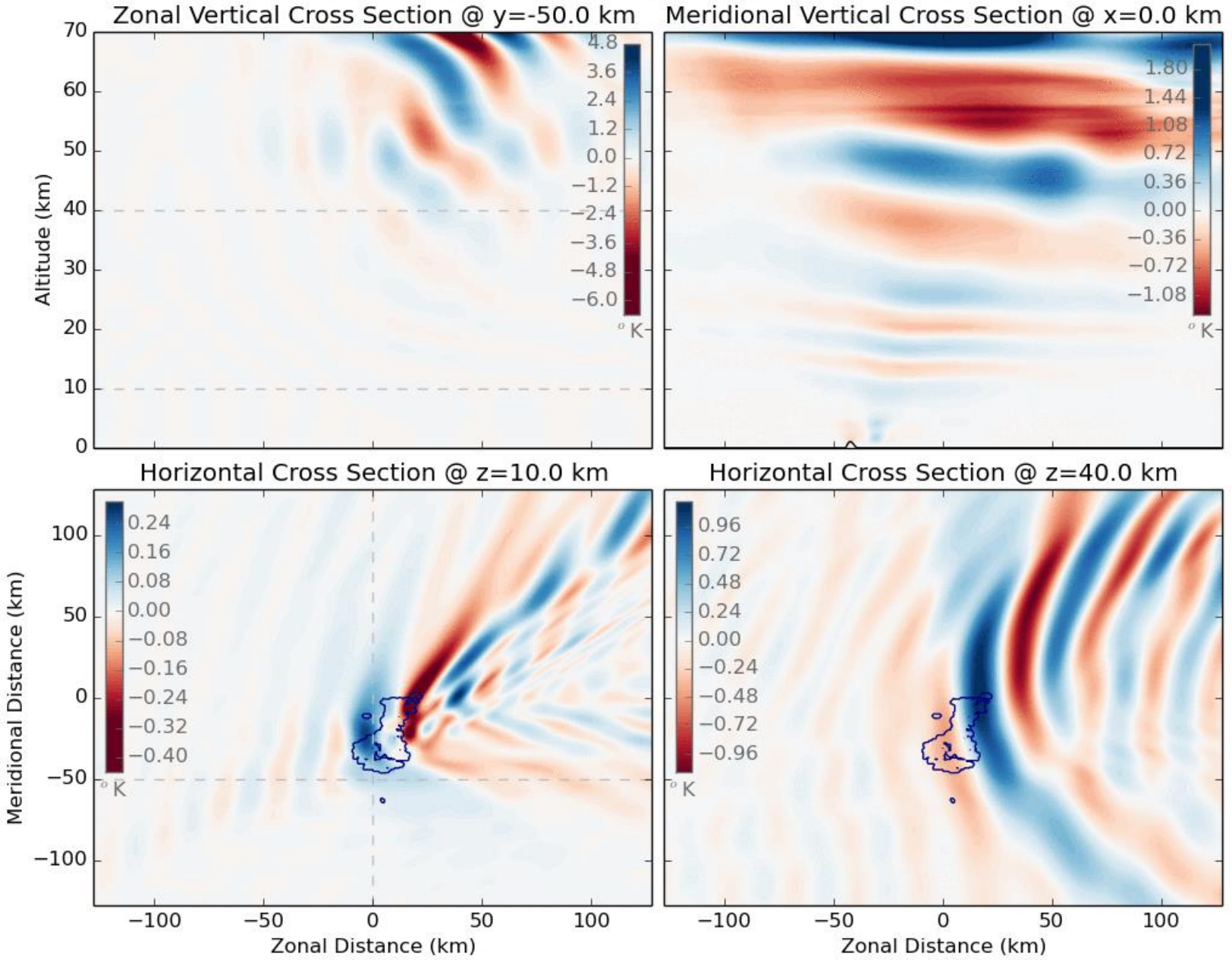

# FR: Temperature Perturbation on 16384x16384 Grids

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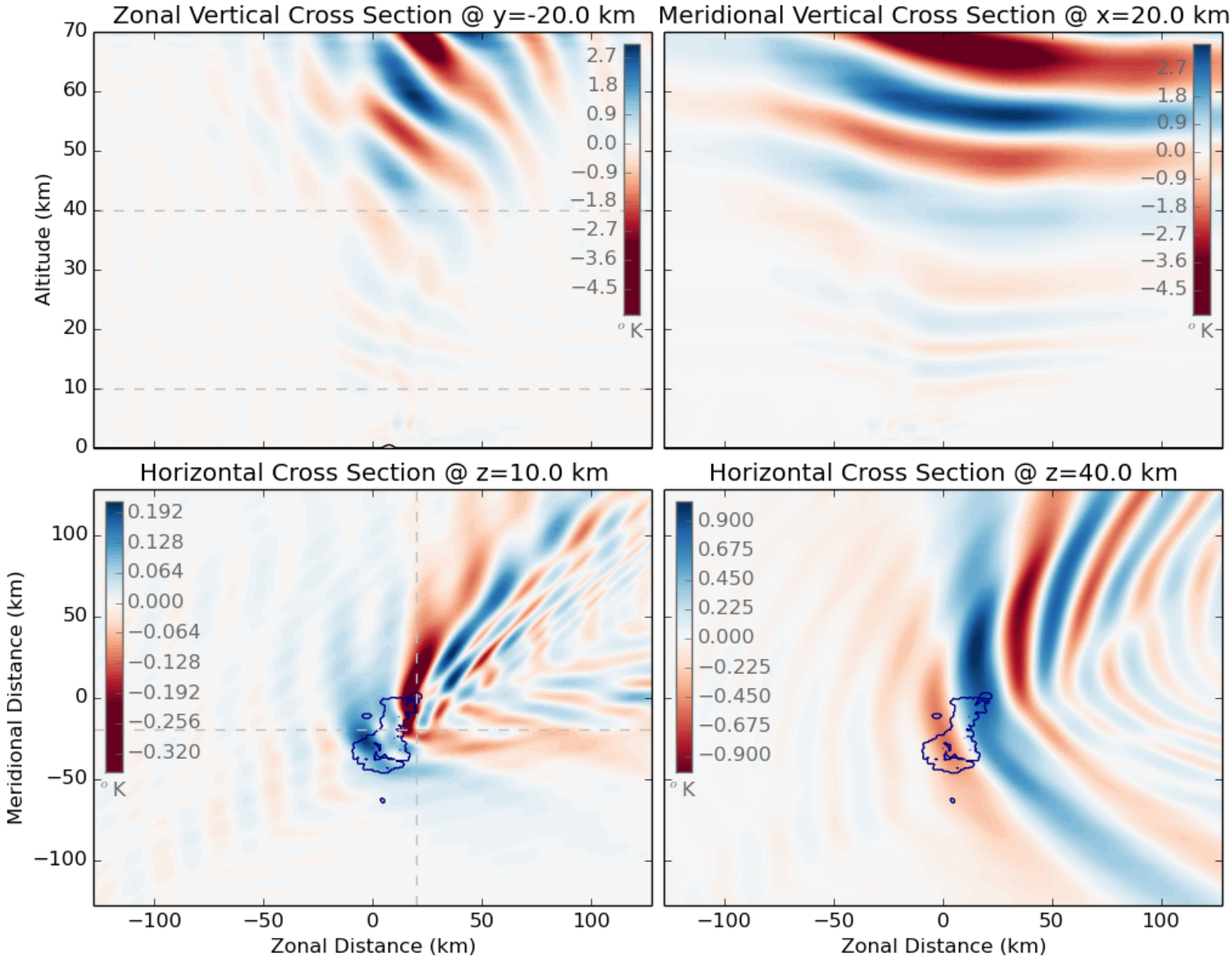
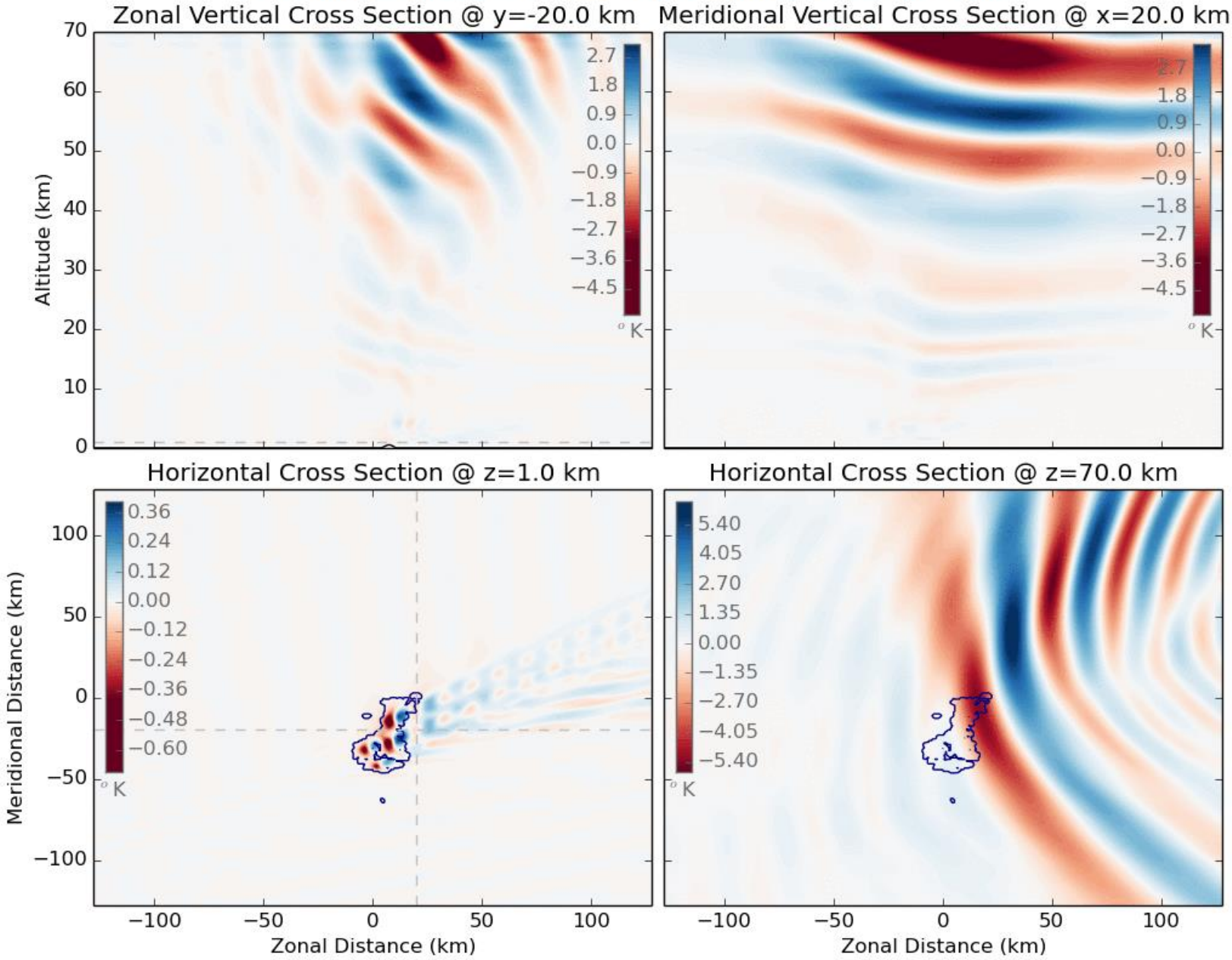


# FR: Temperature Perturbation on 16384x16384 Grids

## FR Analysis on 2014071412 with ECMWF/Dropsonde Profile



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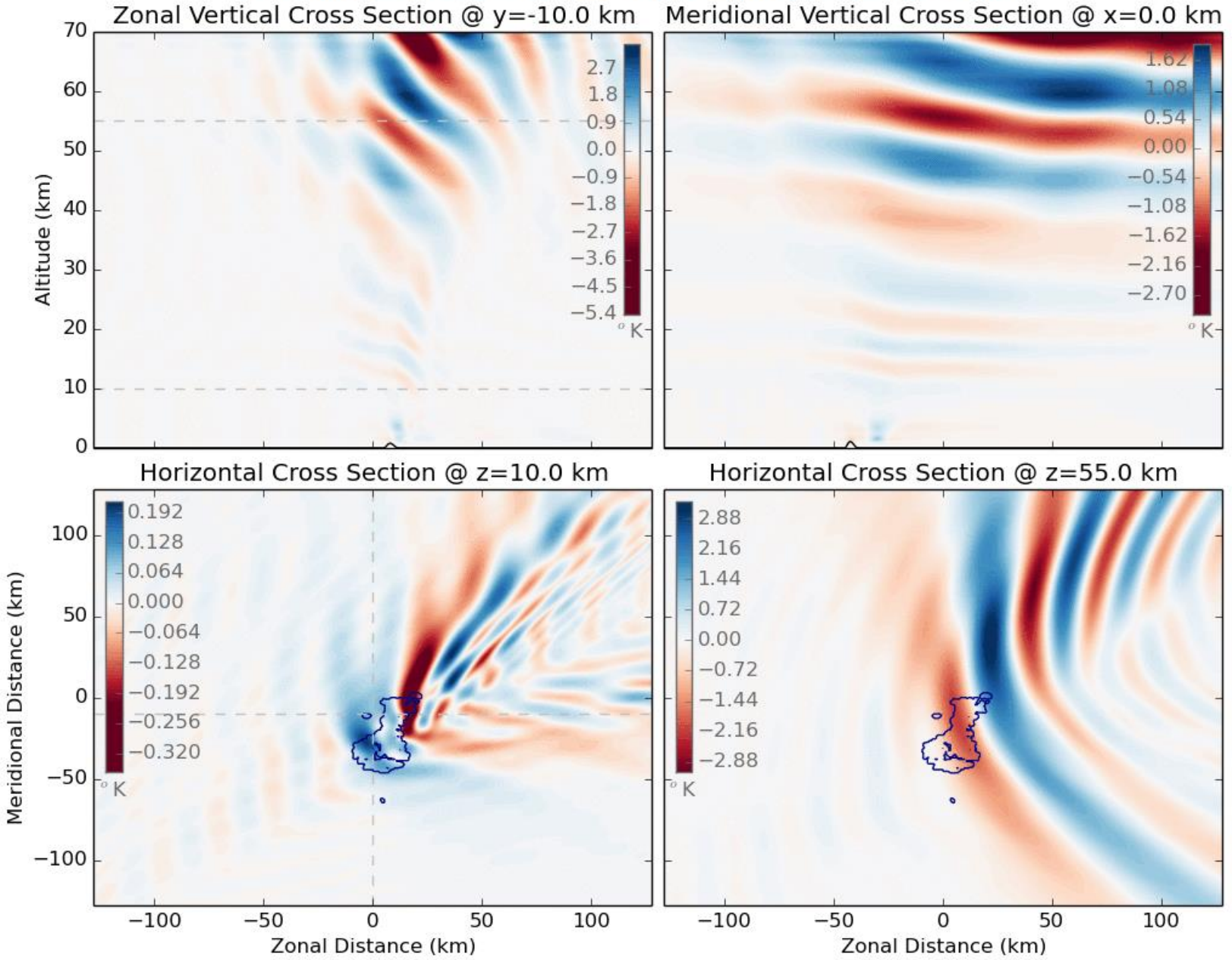
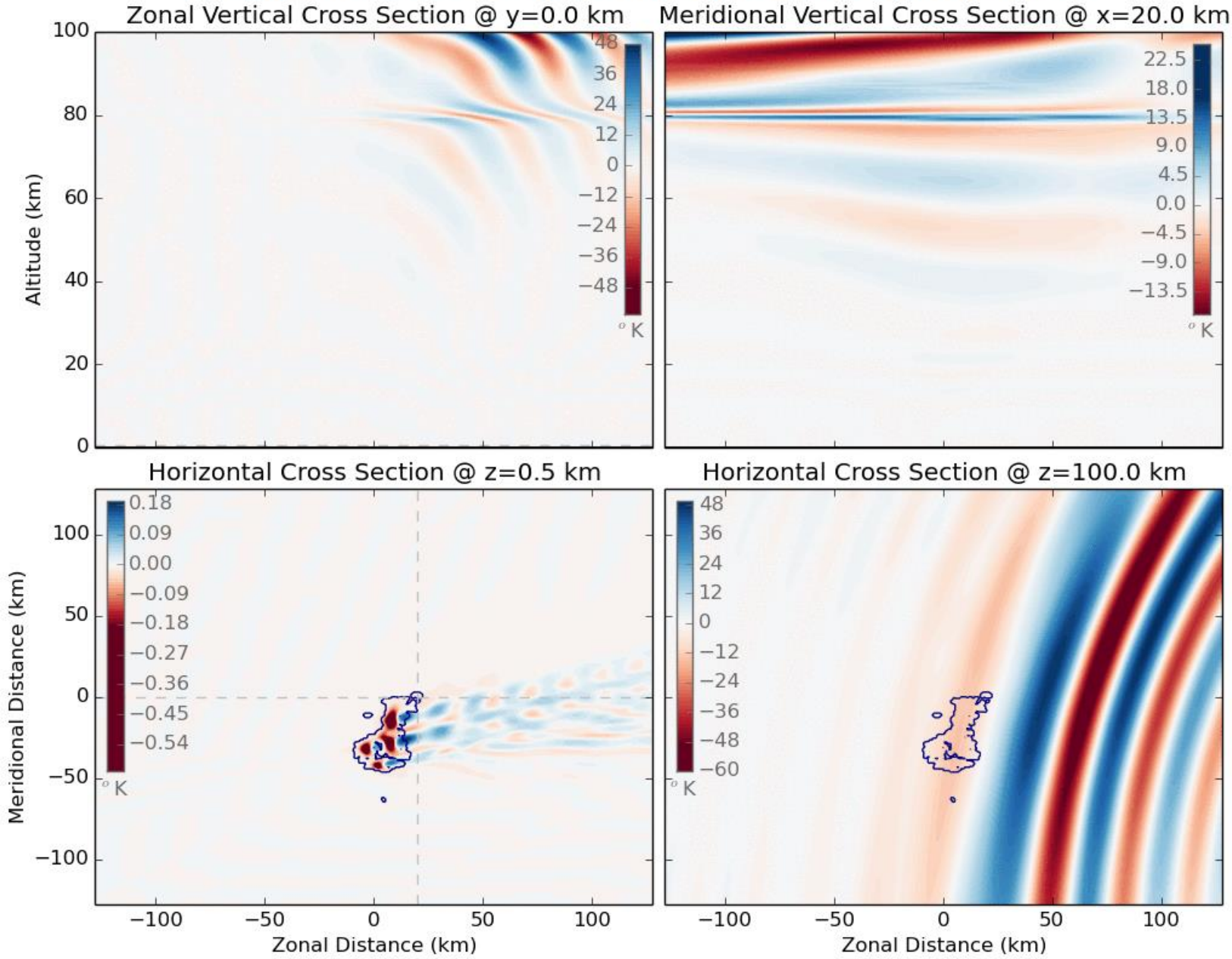


# FR: Temperature Perturbation on 16384x16384 Grids

## FR Analysis on 2014071406 with NAVGEM/ECMWF/Dropsonde Profile



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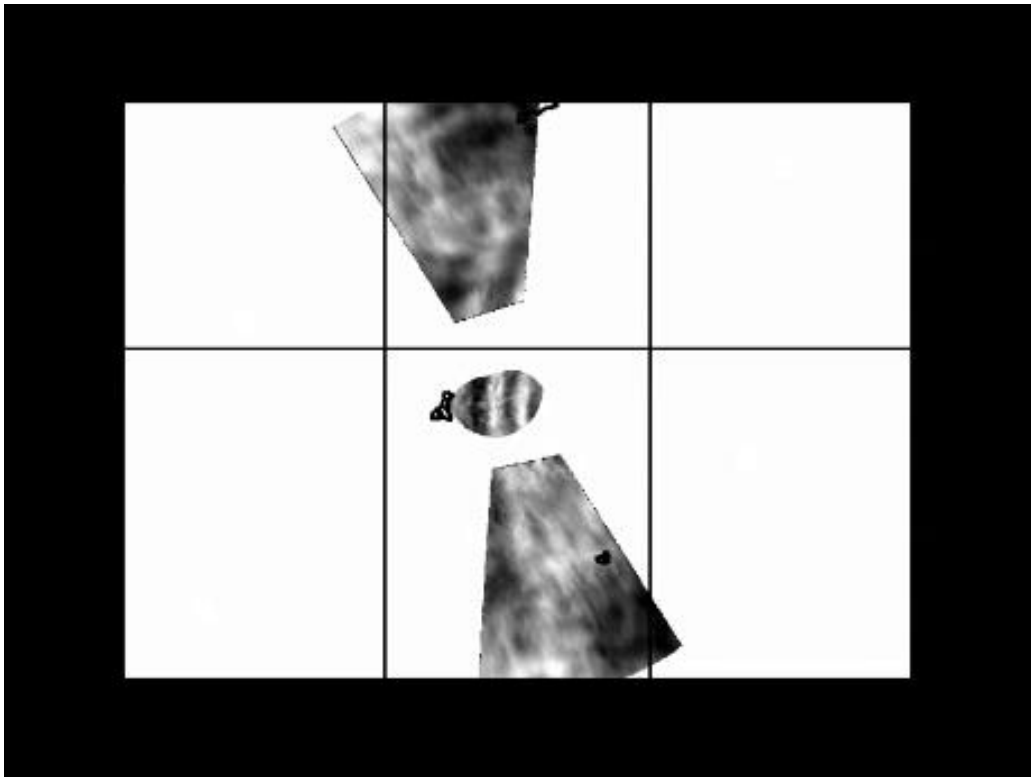
OH Airglow: Vibrationally and rotationally excited OH radicals emit red and infra-red in a narrow layer (6-10 km FWHM) centered at ~ 86-87 km.



# FR: Temperature Perturbation on 16384x16384 Grids

## FR Analysis on 2014071406 with NAVGEM/ECMWF/Dropsonde Profile