

# GW momentum flux during disturbed and undisturbed polar vortex conditions

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# Introduction and outline

Trondheim Meteor Radar

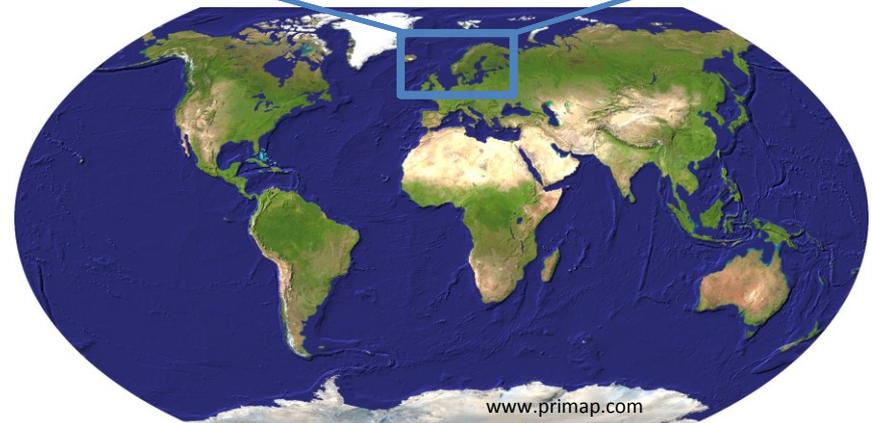
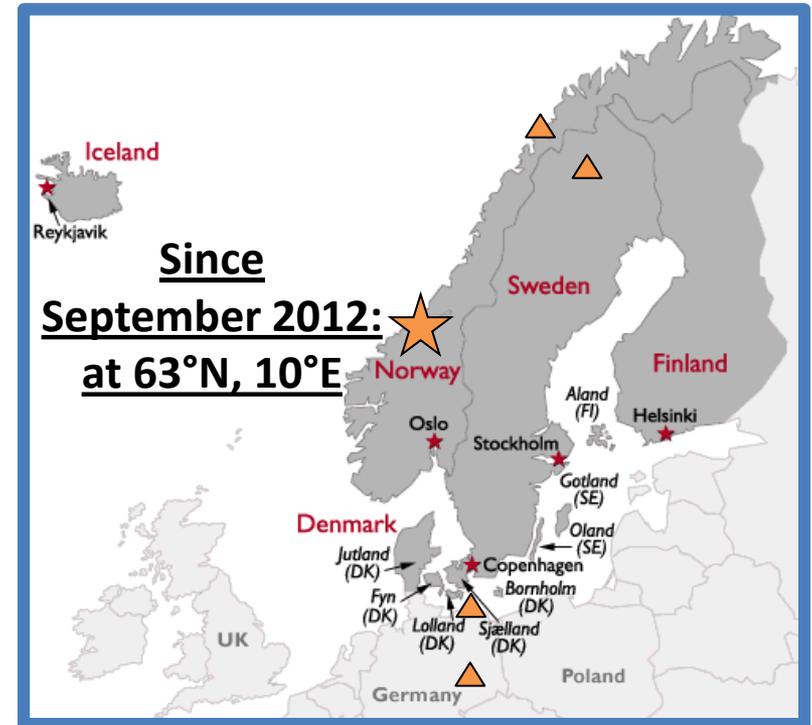
## Part 1

2013 major Sudden Stratospheric Warming

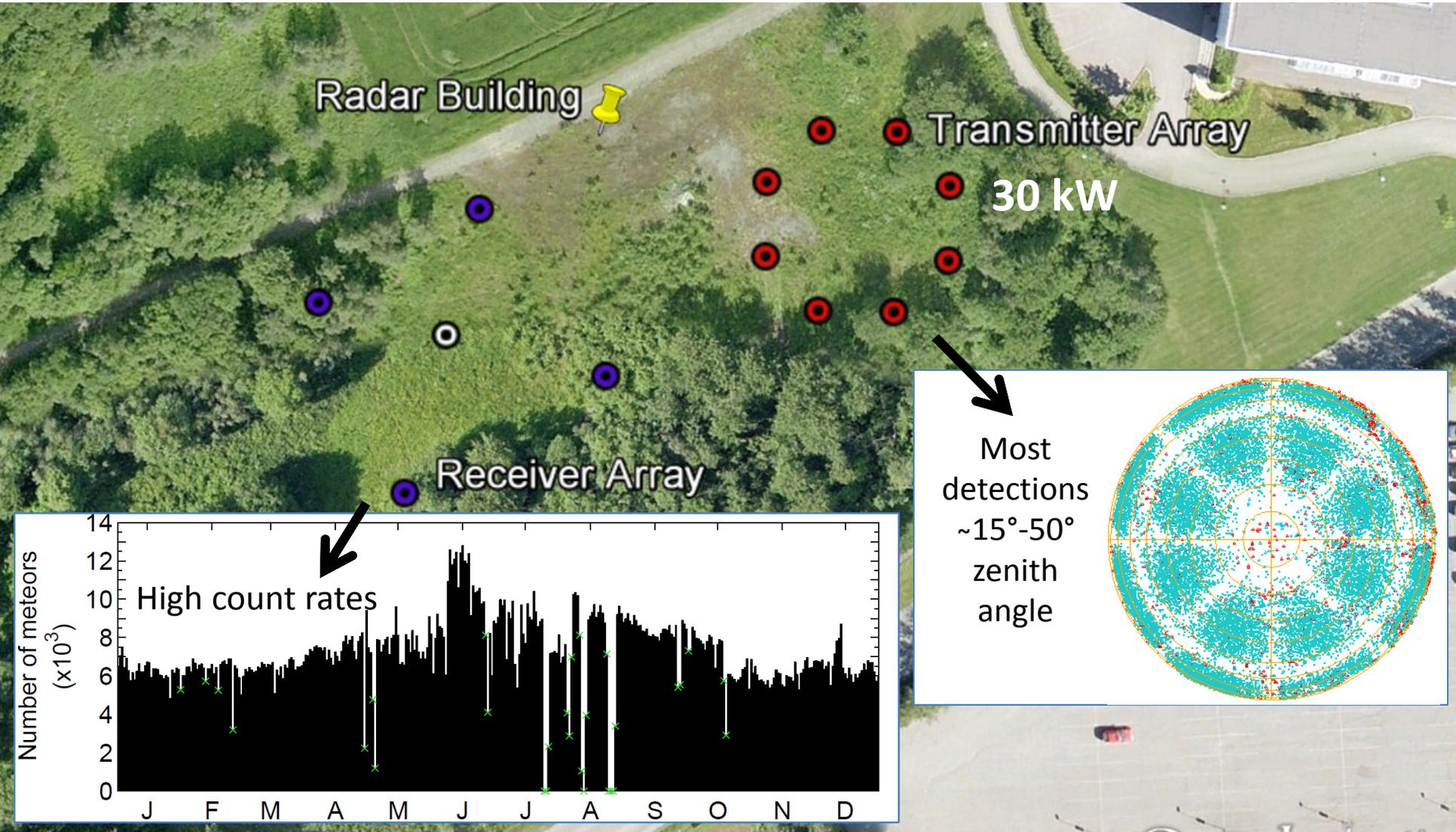
## Part 2

Comparison:

GW momentum flux during disturbed/undisturbed winter



# Trondheim meteor radar: Optimized to measure GW momentum flux

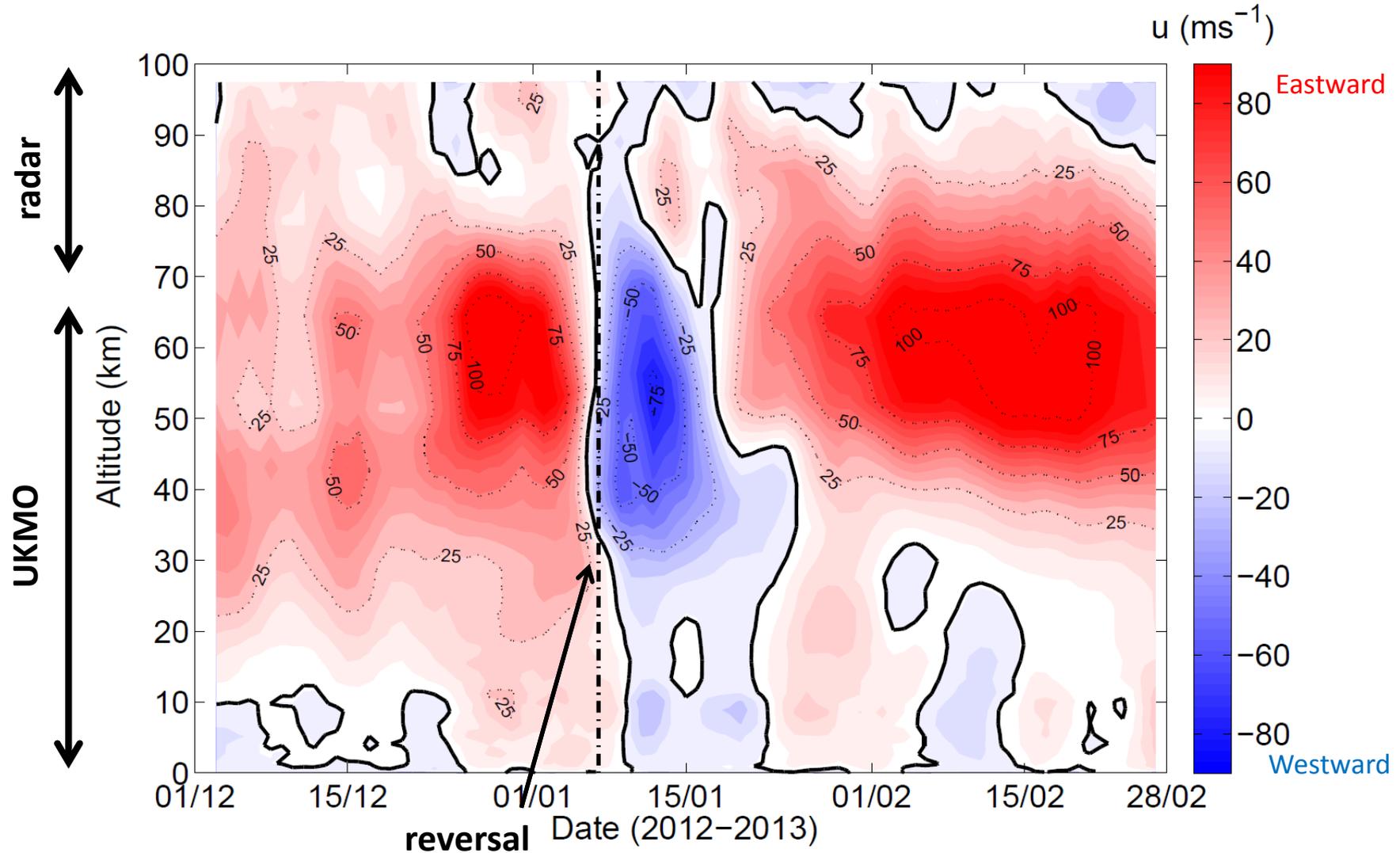


# Part 1

2013 major Sudden Stratospheric Warming

# Part 1: SSW over Trondheim

## Zonal wind



# Part I: SSW over Trondheim

## GW momentum flux

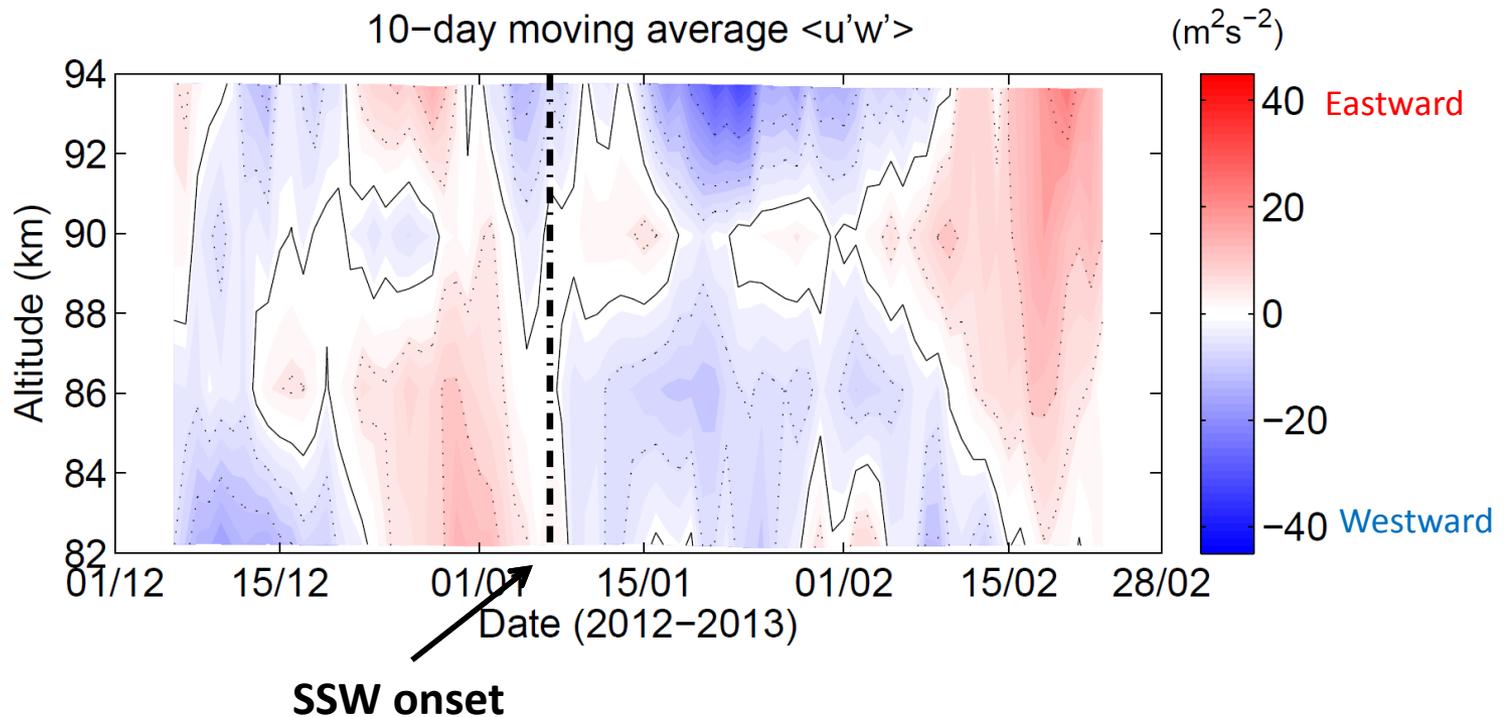
Determine:

- Fine temporal and vertical resolution horizontal background wind
- Individual meteor's background wind ( $v_m$ )
  - Interpolate background wind to meteor's time and altitude of detection
- Individual meteor's perturbation velocity  $v_m' = v_{\text{rad}} - v_{m,\text{los}}$
- Use Hocking (2005) technique to determine  $u'w'$  from  $v_m'$ 
  - 4 km bins between 80-96 km

# Part 1: SSW over Trondheim

## GW momentum flux

Vertical flux of zonal momentum →  
Net GW wave direction and strength

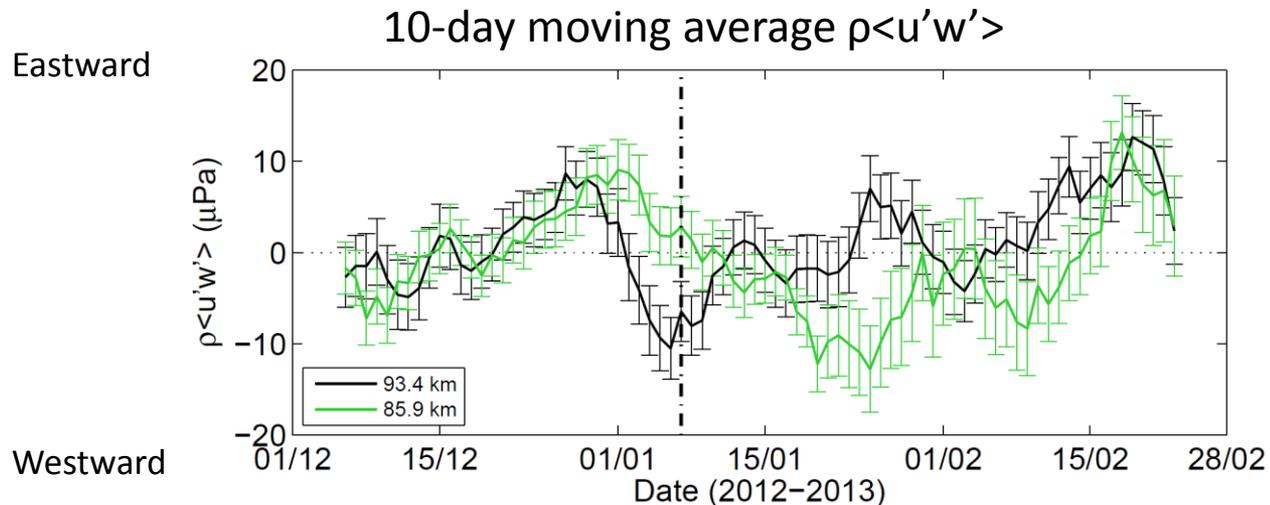


# Part 1: SSW over Trondheim

## GW forcing

$\langle u'w' \rangle$  shows **presence** of GWs, **not** GW forcing

$$\rightarrow \text{Use: } F(z) = -\frac{1}{\rho(z)} \frac{\partial \rho \langle u'w' \rangle}{\partial z}$$



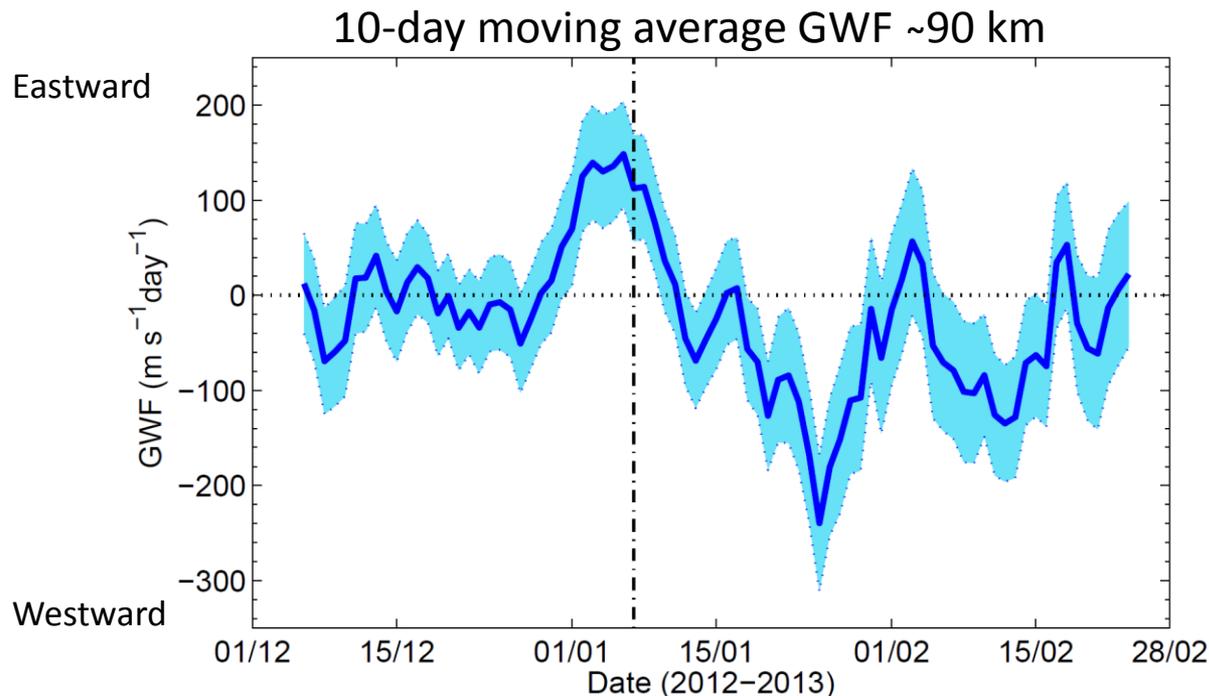
de Wit *et al.* (2014),  
submitted to GRL

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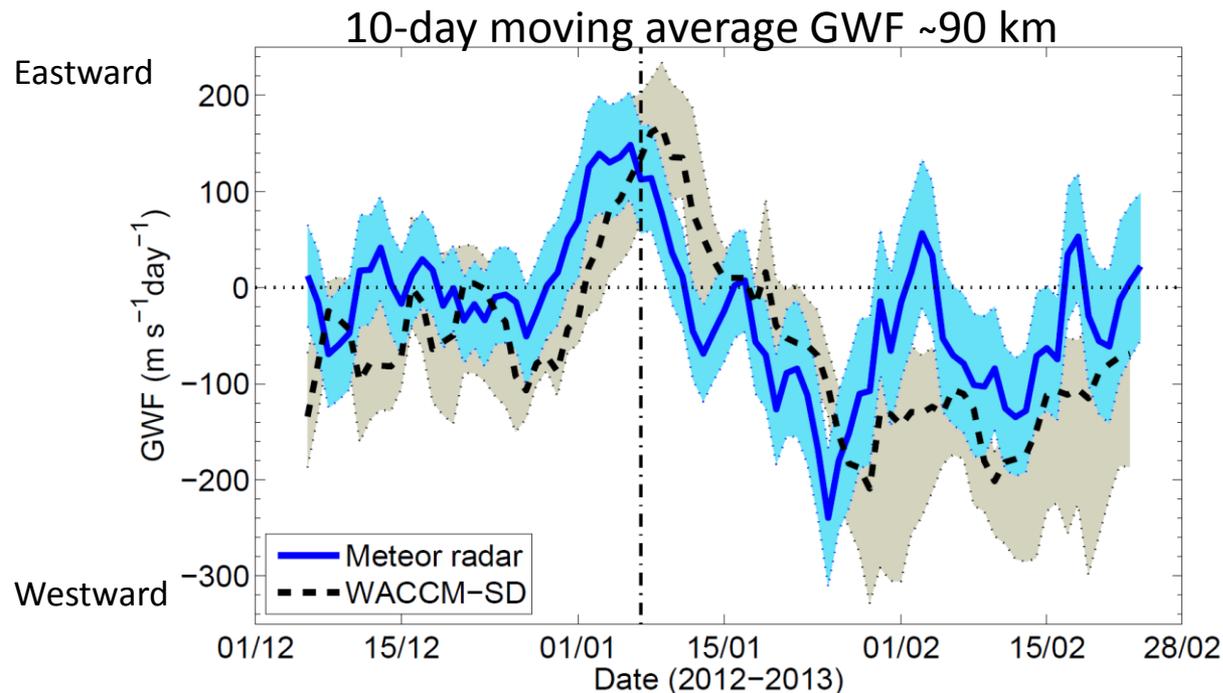
# Part 1: SSW over Trondheim

## GW forcing

Compare to WACCM-SD:

→  $\sim 4^\circ$  area centered around Trondheim

→ Average GW forcing from  $\sim 80$ - $100$  km



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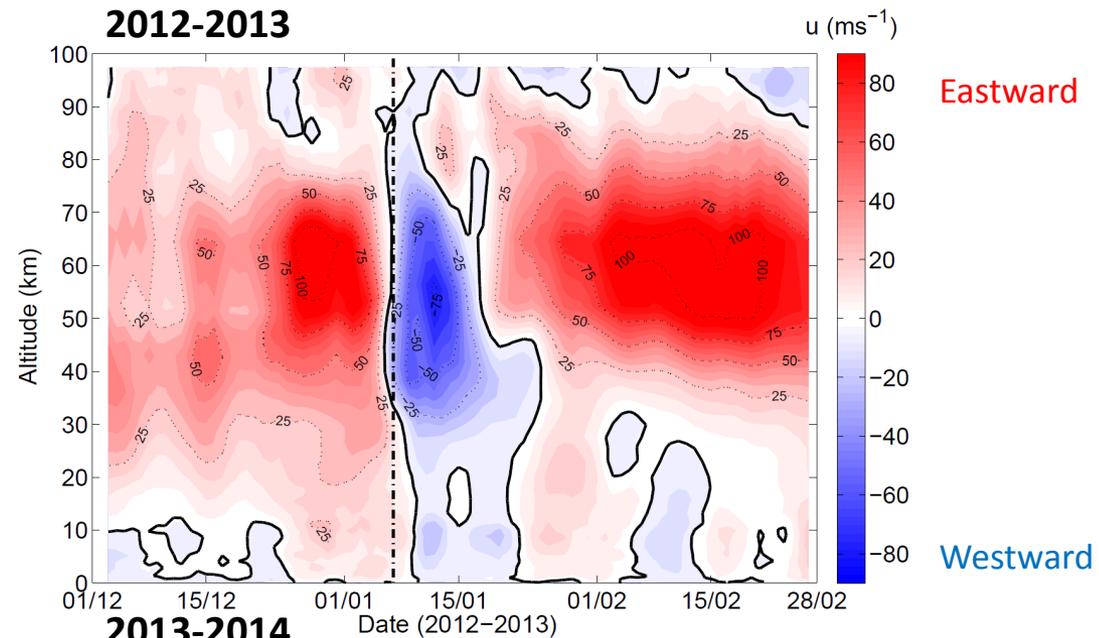
# Part 2

Comparison between disturbed and undisturbed winter  
INITIAL RESULTS

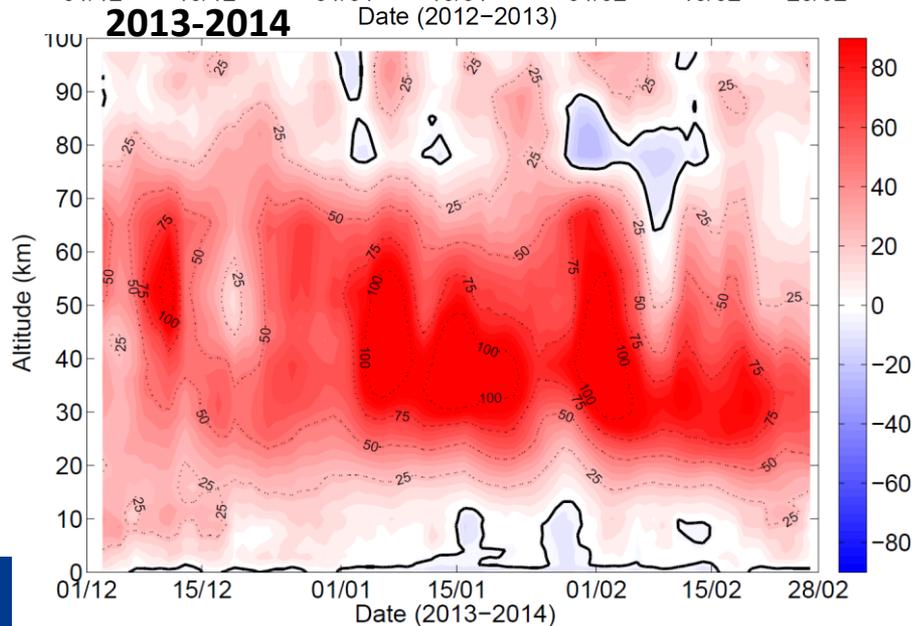
# Part 2: Comparison disturbed/undisturbed

## Zonal wind

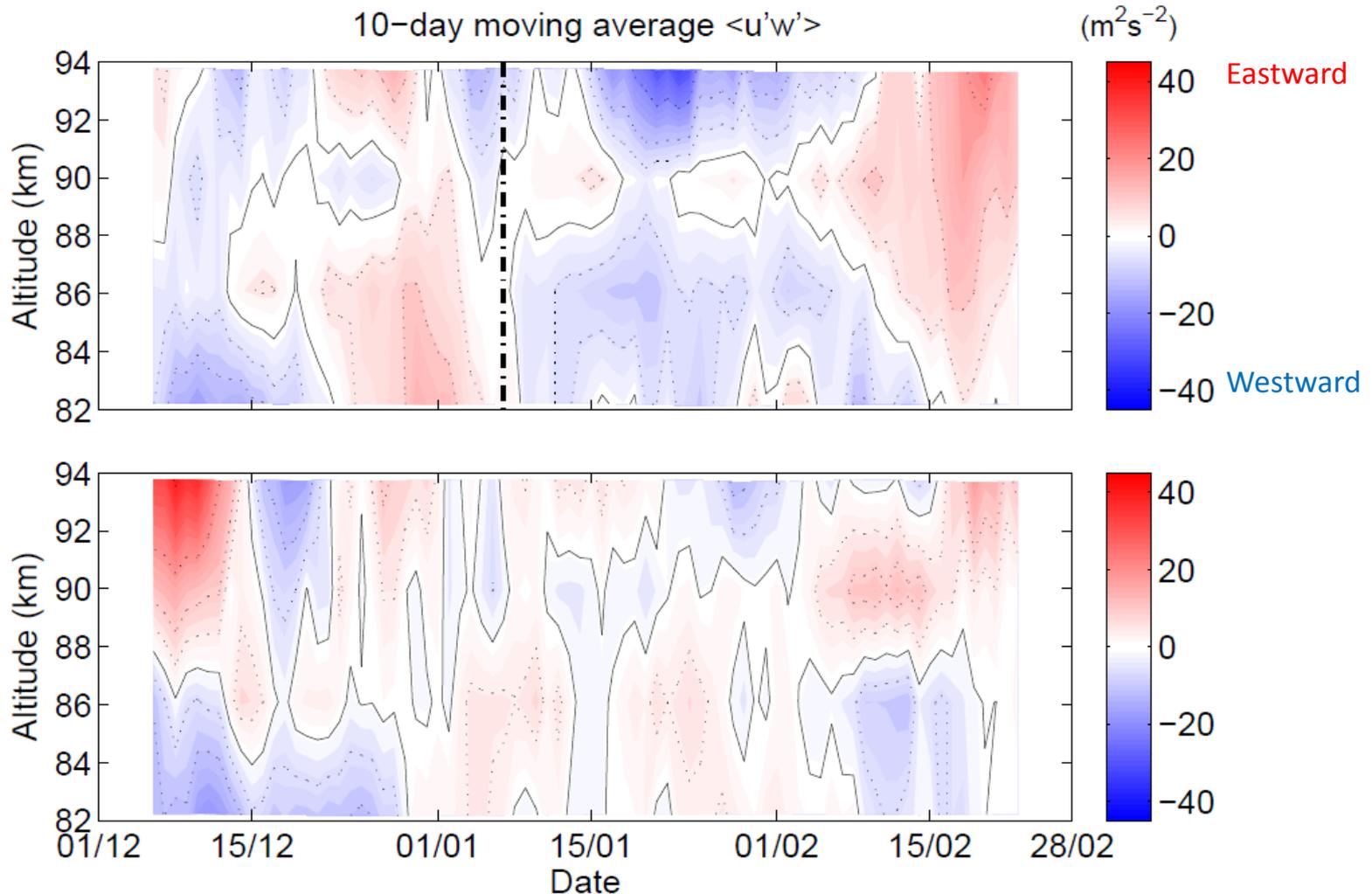
disturbed



undisturbed



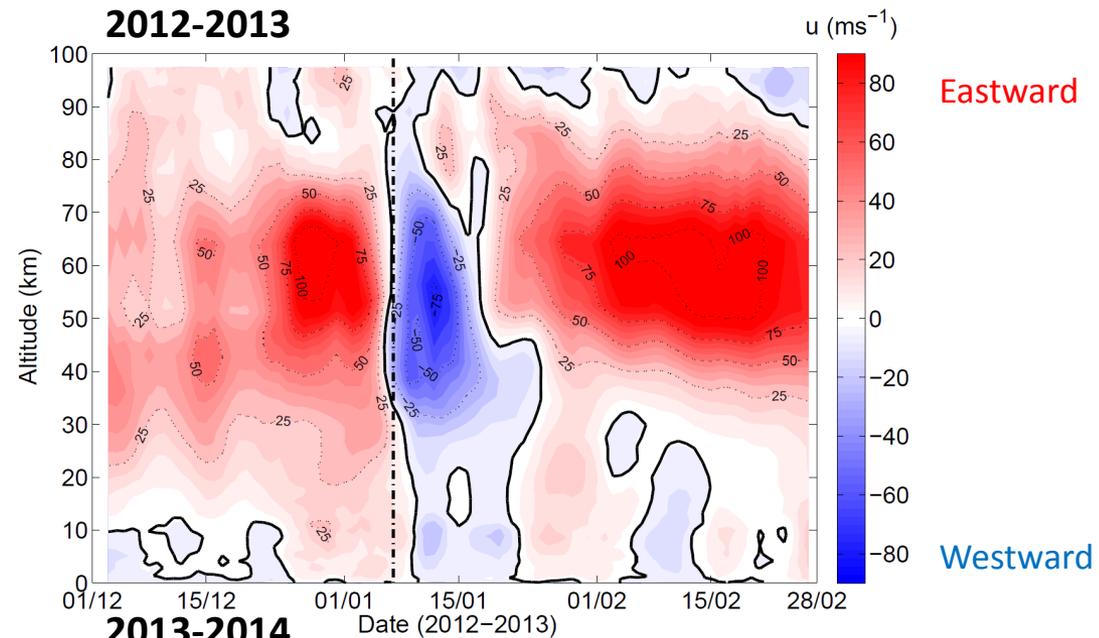
# Part 2: Comparison disturbed/undisturbed GW momentum flux



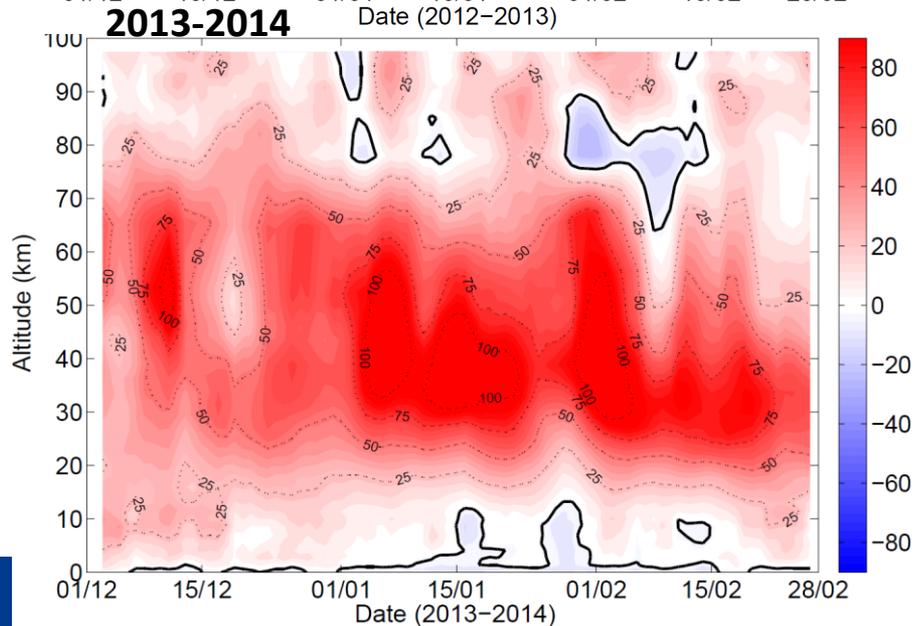
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## Zonal wind

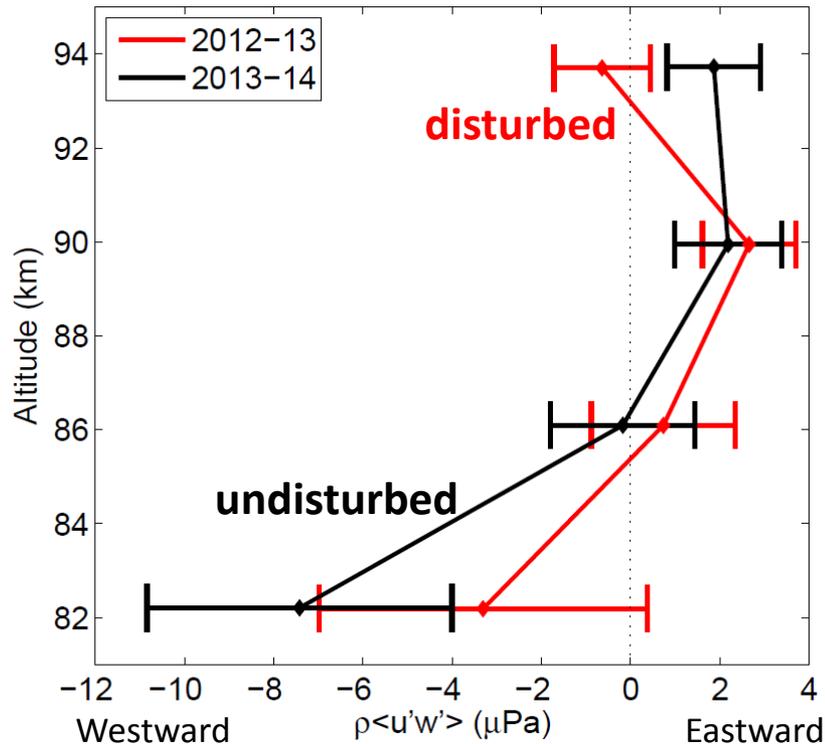
disturbed



undisturbed



# Part 2: Comparison disturbed/undisturbed GW momentum flux budget



- Density weighted momentum flux not significantly different
  - Net GW forcing similar despite stratospheric differences
- Cancellation of SSW effect due to post-SSW behavior?

# Summary

- 0-100 km view of wintertime zonal winds
- GW forcing: eastward during SSW, strongly westward post-SSW
  - Good agreement with WACCM-SD simulations
- Measured GW momentum flux during a disturbed and an undisturbed winter
- During undisturbed conditions: no strong westward GW momentum flux post-SSW
  - However: net effect of disturbed winter small on total GW momentum flux budget
- Future work:
  - Quantify differences between disturbed and undisturbed winters
  - Compare GW forcing to WACCM-SD for undisturbed winter