

Climatic Change and Dynamics of Northern Hemisphere Storm-tracks: Changes in Transient Eddies Behavior

Yuliya Martynova^{1,2}, Vladimir Krupchatnikov^{1,3}

¹Siberian Regional Hydrometeorological Research Institute

²Institute of Monitoring of Climatic and Ecological Systems Siberian Branch of the Russian Academy of Science

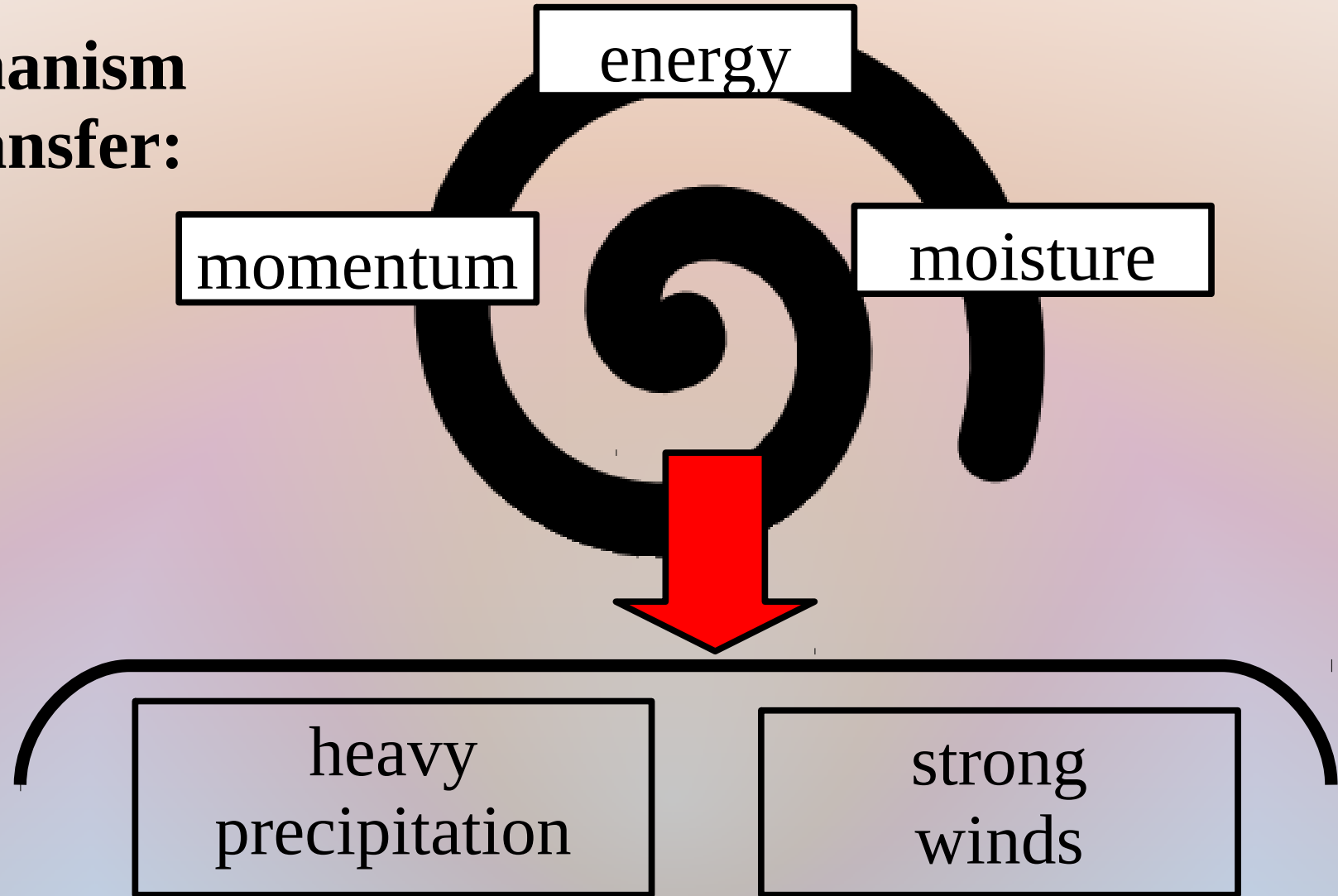
³Novosibirsk State University



07.04.2013 — 12.04.2013, Vienna

Role of Transient Eddies

**Mechanism
of transfer:**



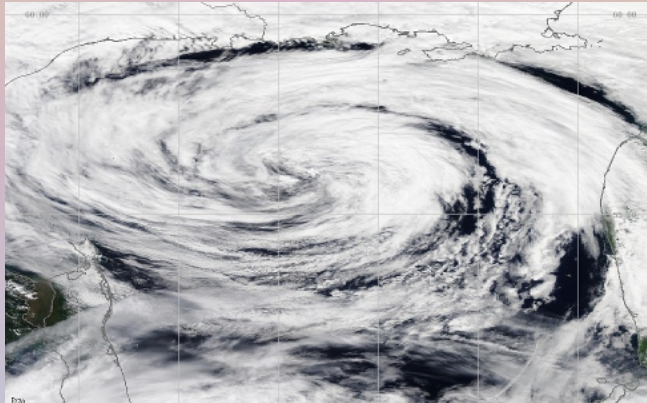
Fact

(Fyfe J.C., 2003)

Reanalysis data

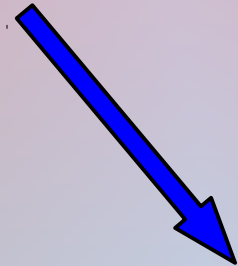
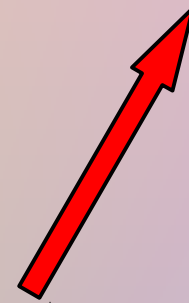
High latitudes

Second half of the 20th century



RATE

FREQUENCY



Study

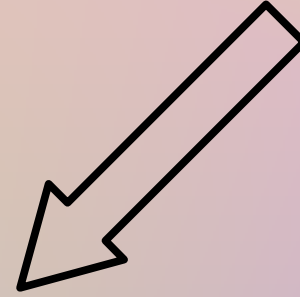
"warming

-and-

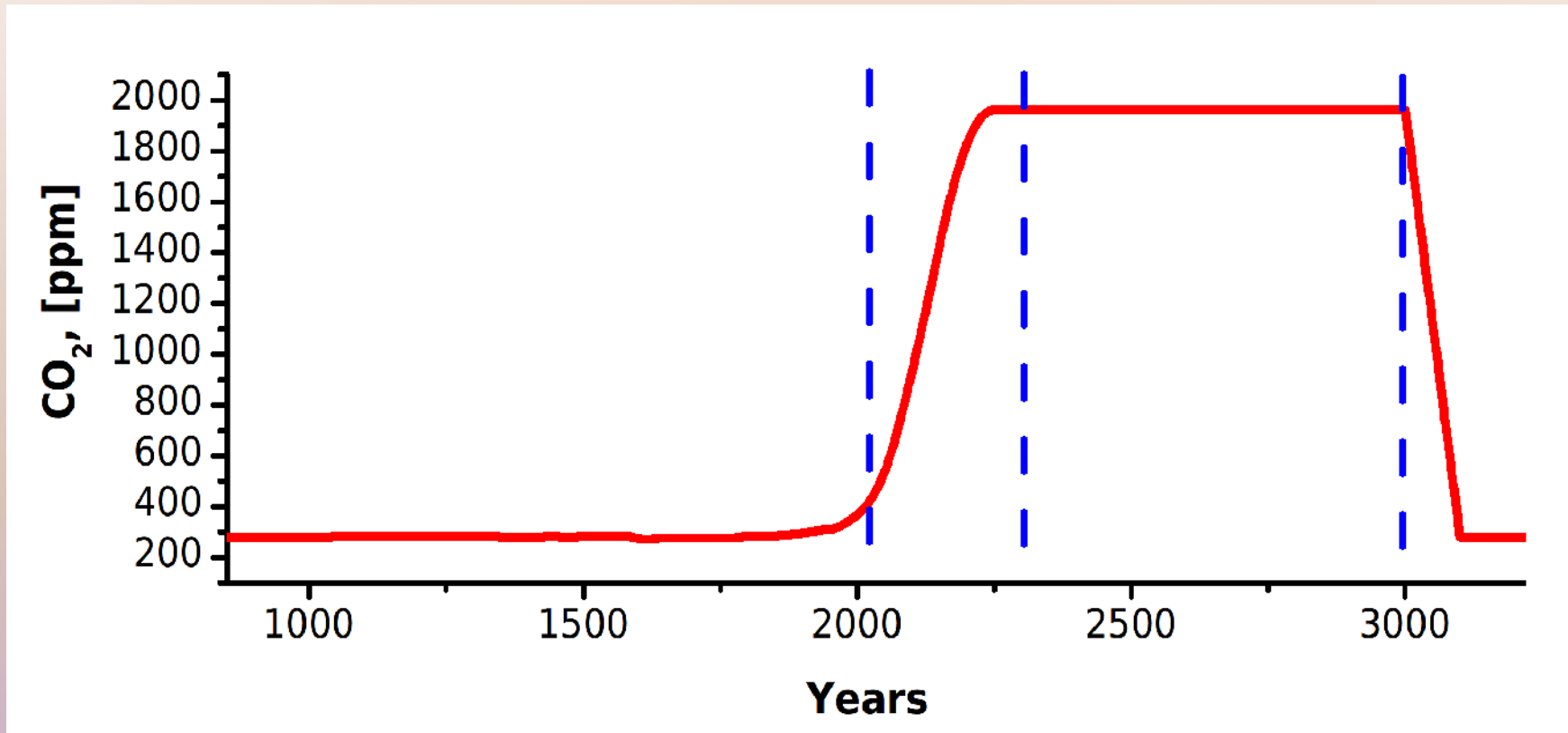
return"



?



Scenario



Time period: 850 - 3000

Scenario: 850 - 2005 «Historical simulations» CMIP5;

XXI - XXIII RCP 8.5 [Meinshausen M. et al., 2011];

XXIV - XXX — CO₂ concentration is fixed on level of 2300;

XXXI - XXXII — during first 100 years CO₂ concentration is lineary decrease to preindustrial value.

Model

“Planet Simulator” – Global large-scale climate system model of intermediate complexity (Fraedrich K. et al., 2005).

Modules:

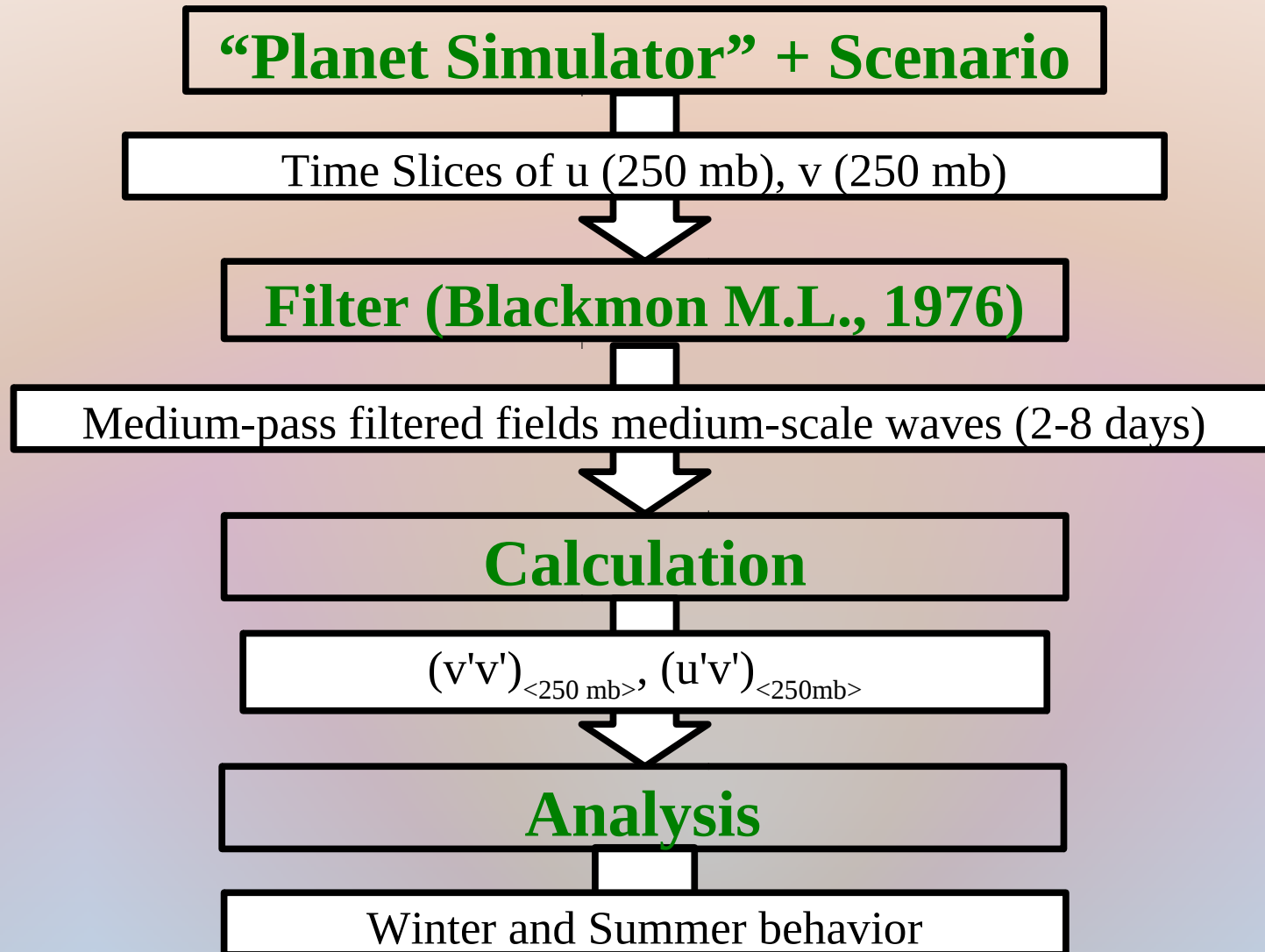
- atmosphere,
- ocean,
- land surface,
- soil,
- sea ice,
- biosphere

Horizontal resolution: 2,5° x 2,5°.

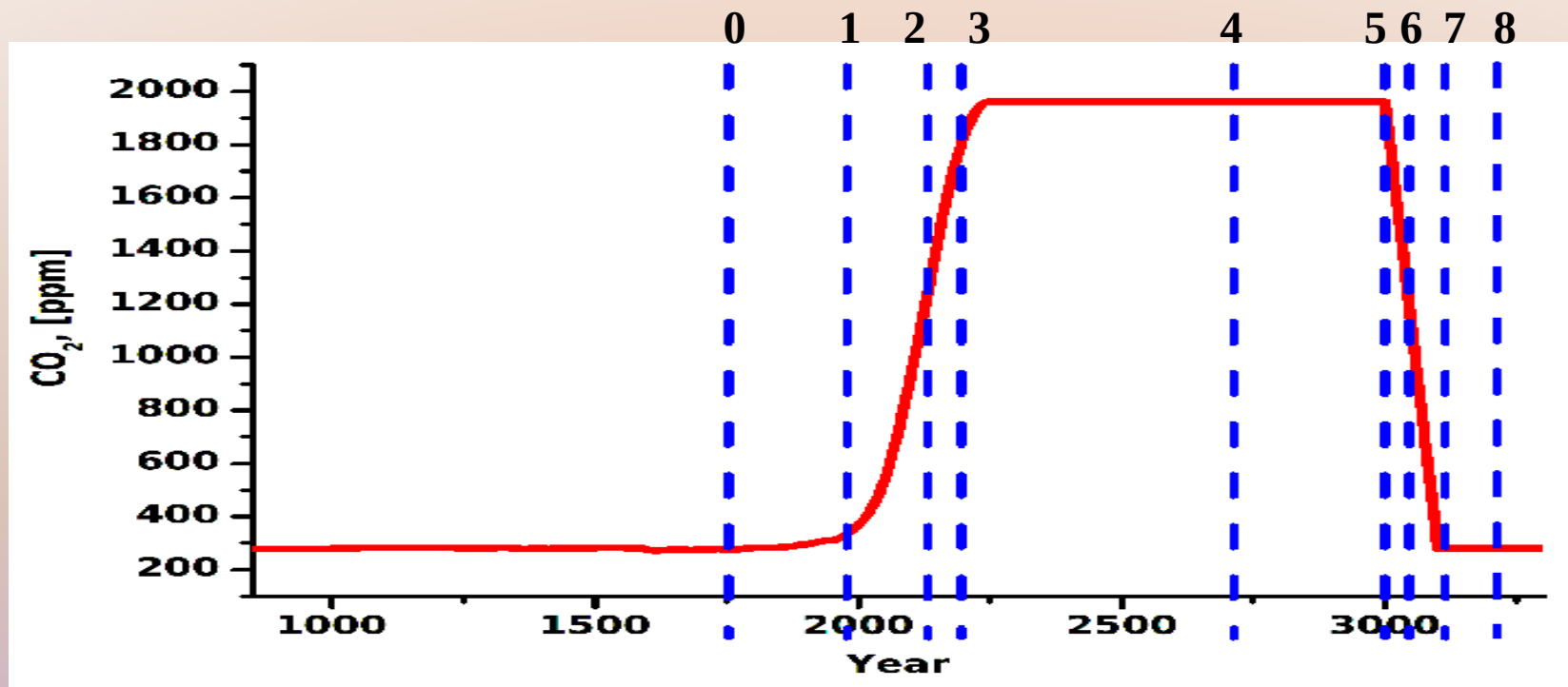
Vertical resolution:

- atmosphere – 10 equidistant σ -levels
- soil – 5 depth levels (0.4, 0.8, 1.6, 3.2, 6.4 [m]).

Processing of the model results



10-years-length data slices

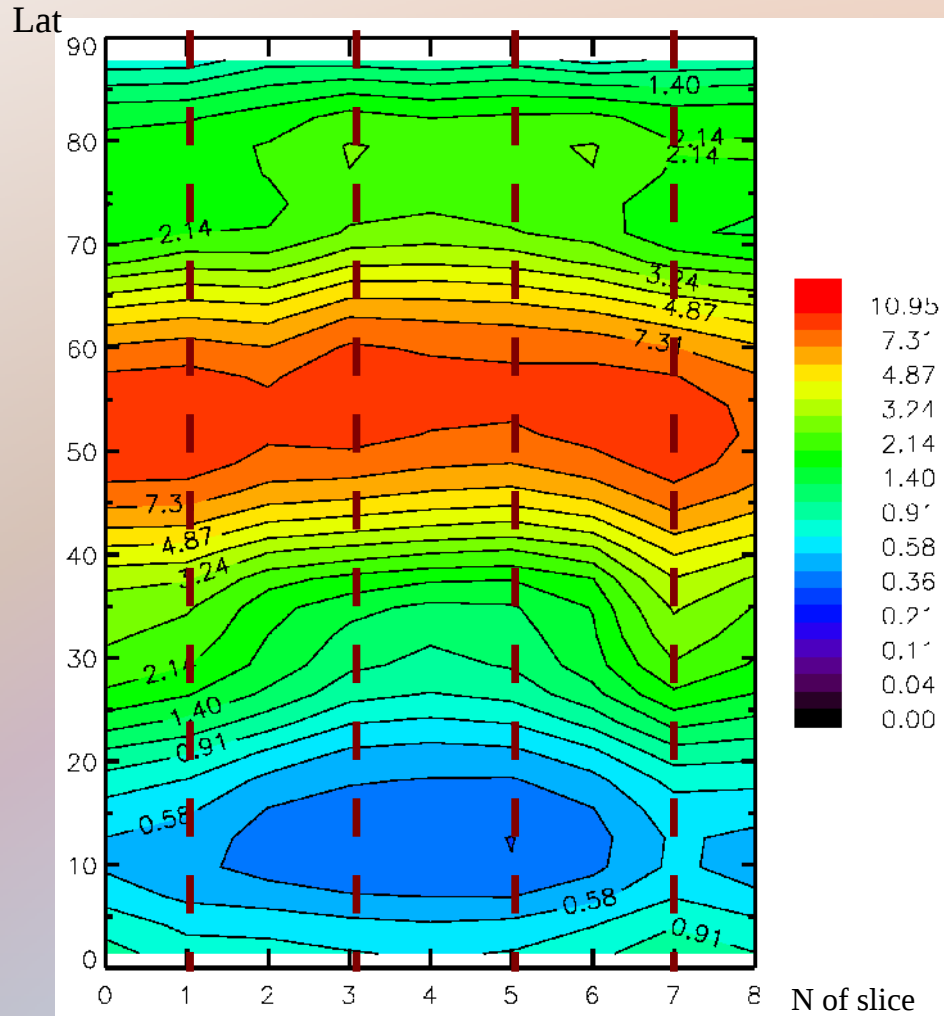


- 1) for equilibrium state of climate system before the CO₂ increase,
- 2) at the beginning of CO₂ concentration increase time period,
- 3) in the middle of this period,
- 4) at the end of this period,
- 5) for equilibrium state of climate system for the highest CO₂ concentration;

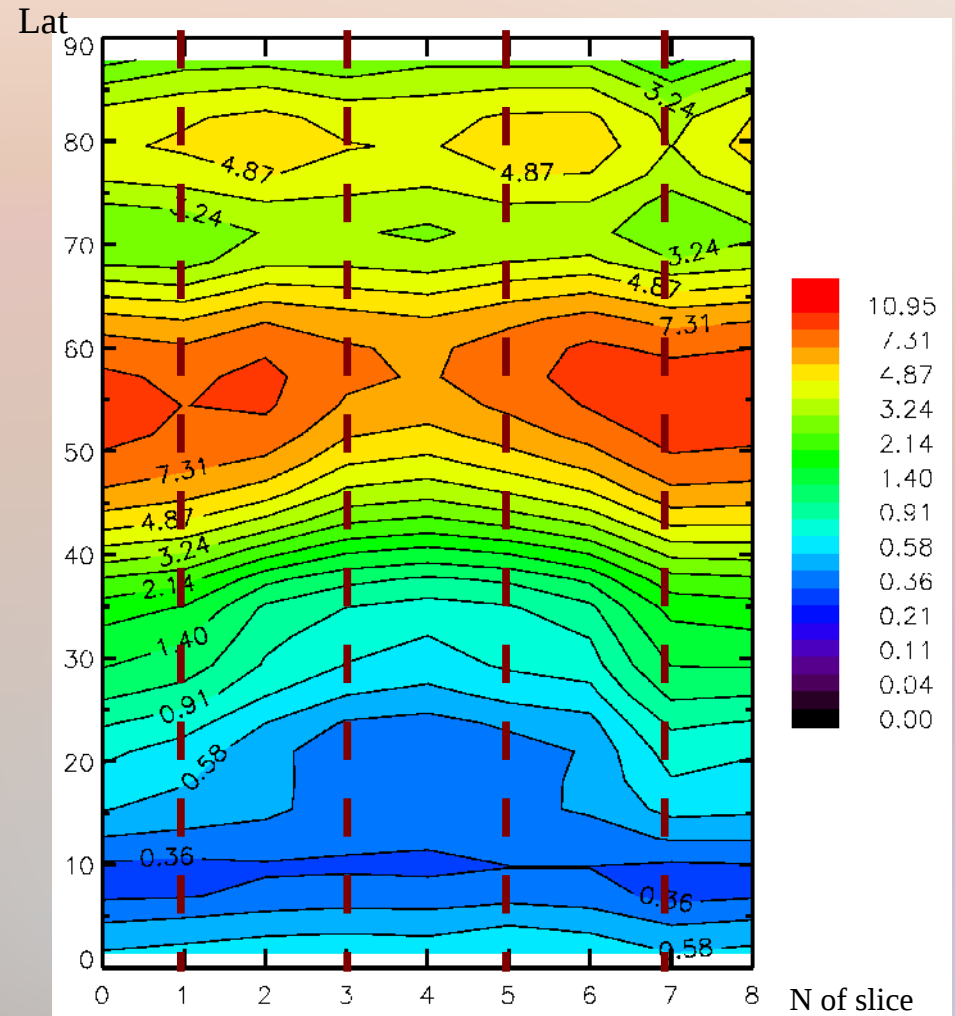
- 6) at the beginning of CO₂ concentration decrease,
- 7) in the middle of this period,
- 8) at the end of this period,
- 9) for equilibrium state of climate system at the end of the simulation.

Storm-track activity

v-variance at 250 mb



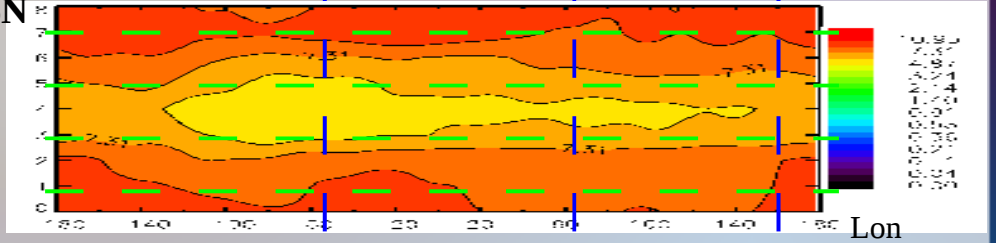
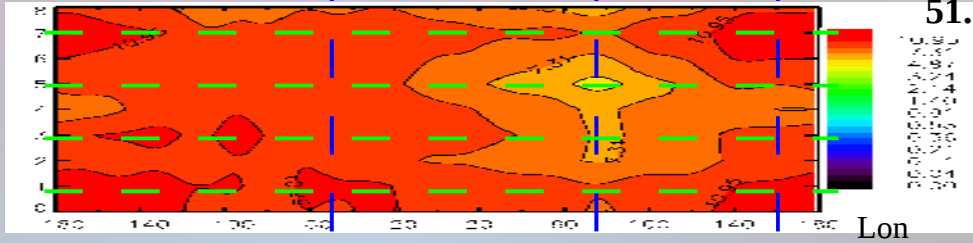
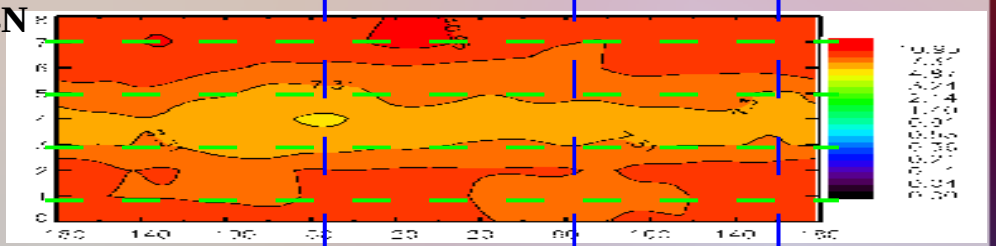
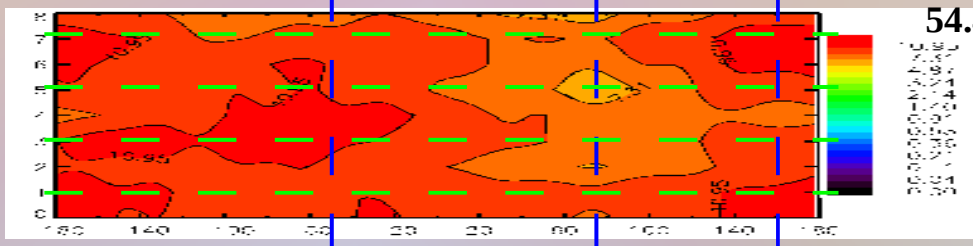
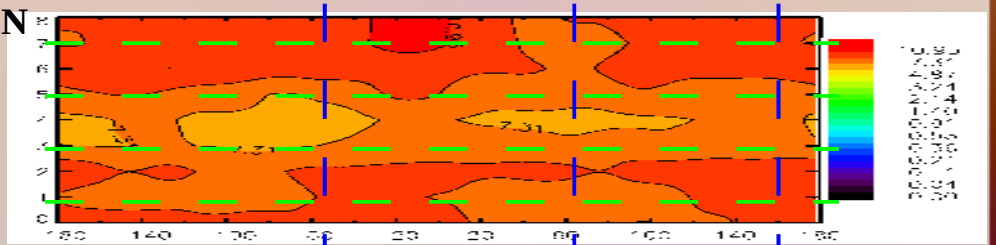
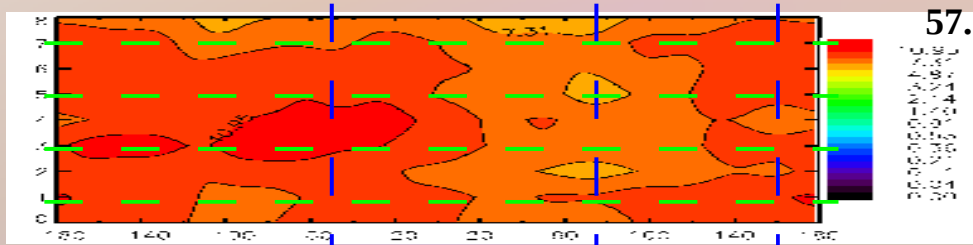
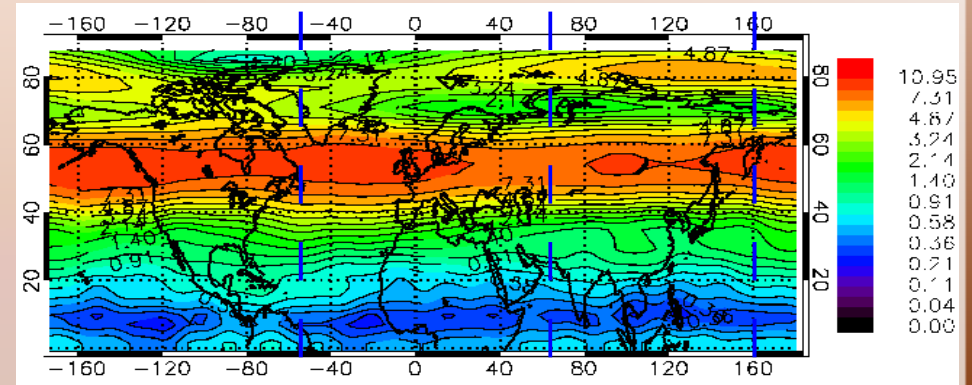
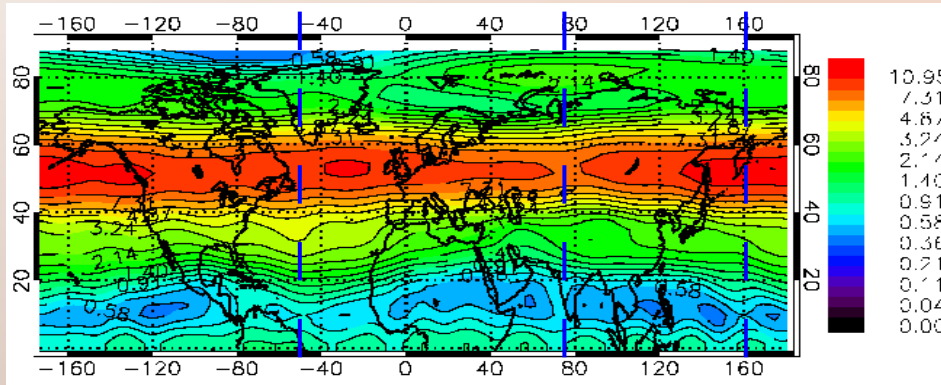
Winter (DJF)



Summer (JJA)

Storm-track activity

v-variance at 250 mb



Winter (DJF)

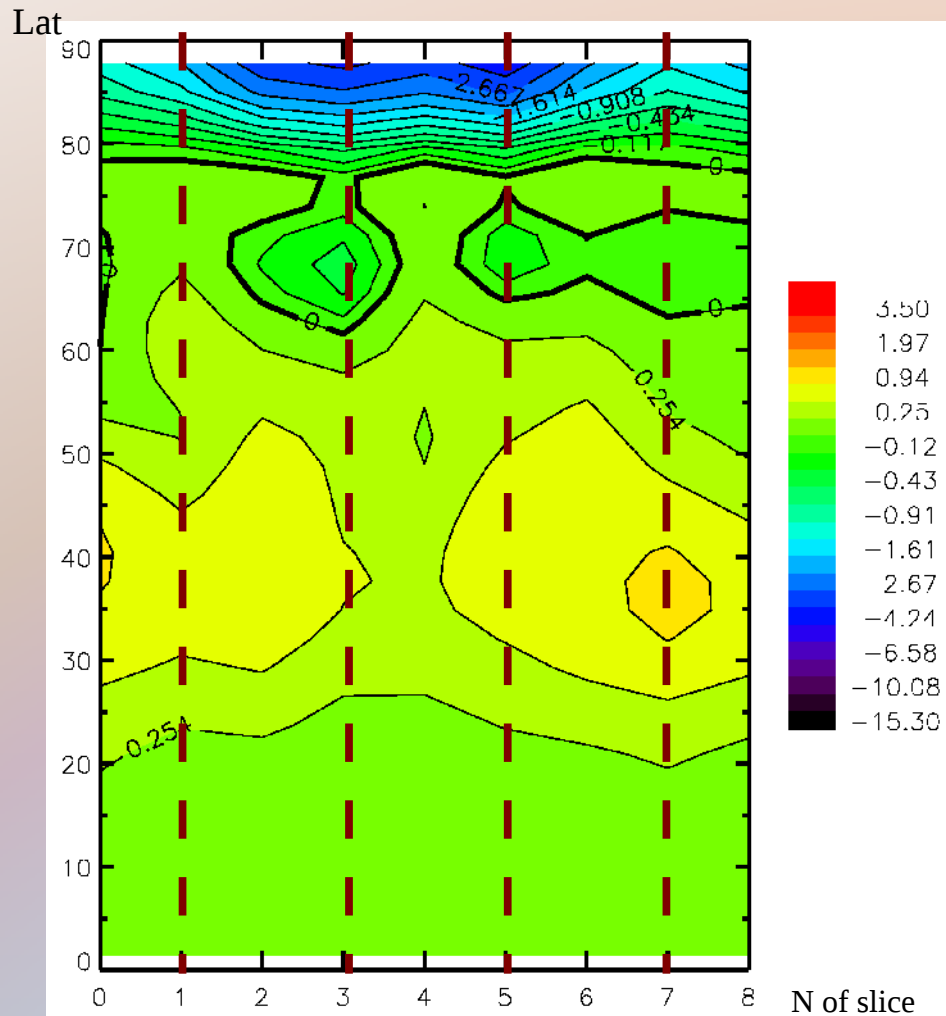
Summer (JJA)

N of slice

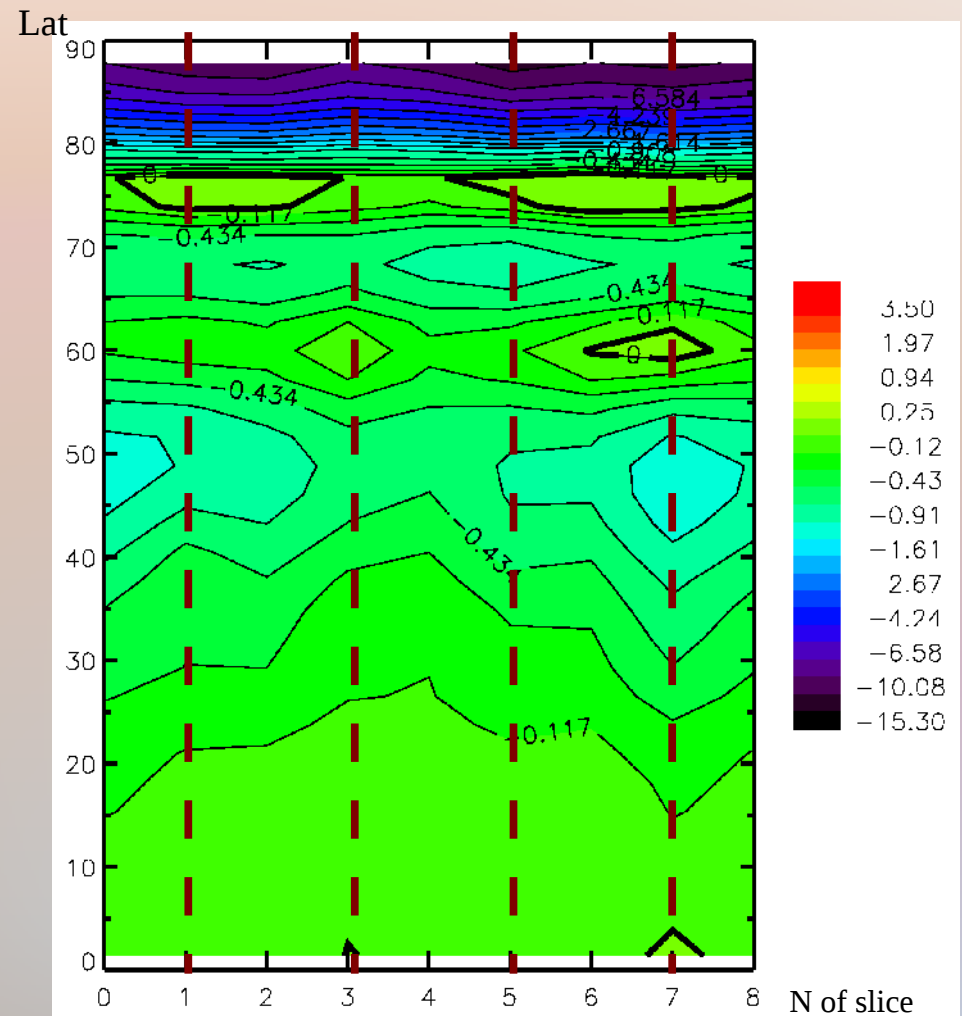
Lon

Lon

Eddy momentum flux ($u'v'$) at 250 mb



Winter (DJF)



Summer (JJA)

Conclusion

1. Variation of CO₂ concentration affects storm-track behavior?

YES

2. Storm-track behavior changes back to preindustrial state?

winter – NO; summer – YES
(in our case)

**Thank you
for your attention!**