Modeling Studies on Blowing Snow Processes Associated with Extreme Arctic Weather

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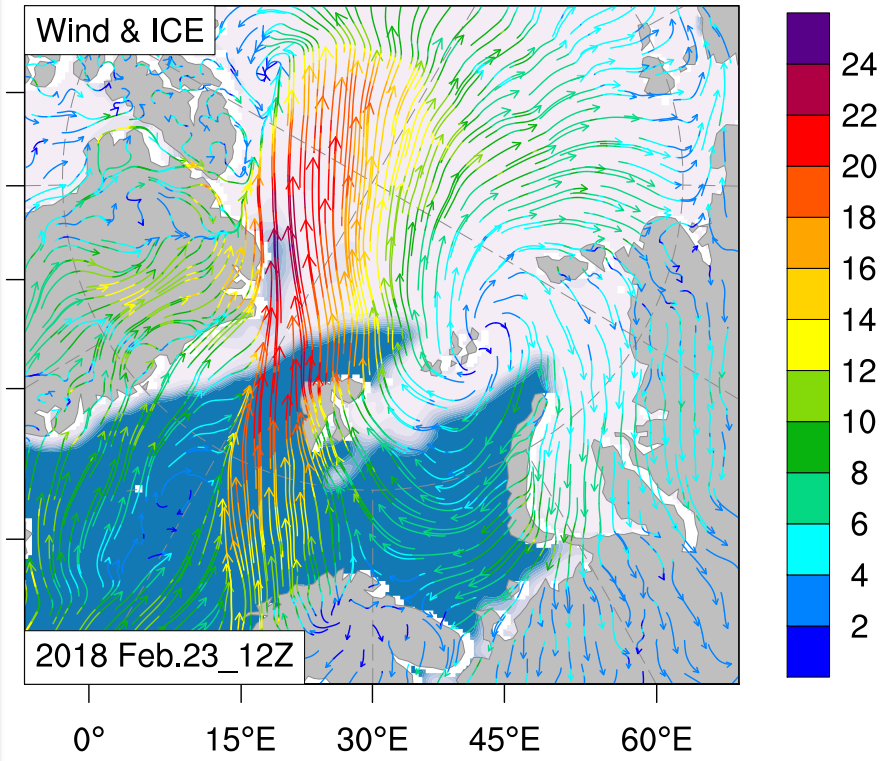
Simulation setup with snow/ice enhanced WRF-ice model

Grid settings	dx=dy=20 km nx=204，ny=194，nz=49 top=10 hPa
Forcing Data	ERA5 reanalysis
Simulation period	2018.02.23-26
Cloud scheme	Morrison 2-moment scheme
PBL scheme	MYNN-2.5 + blowing snow
Radiation scheme	RRTMG long/short-wave
Surface scheme	Noah Surface + blowing snow sea-ice ice-sheet/shelf

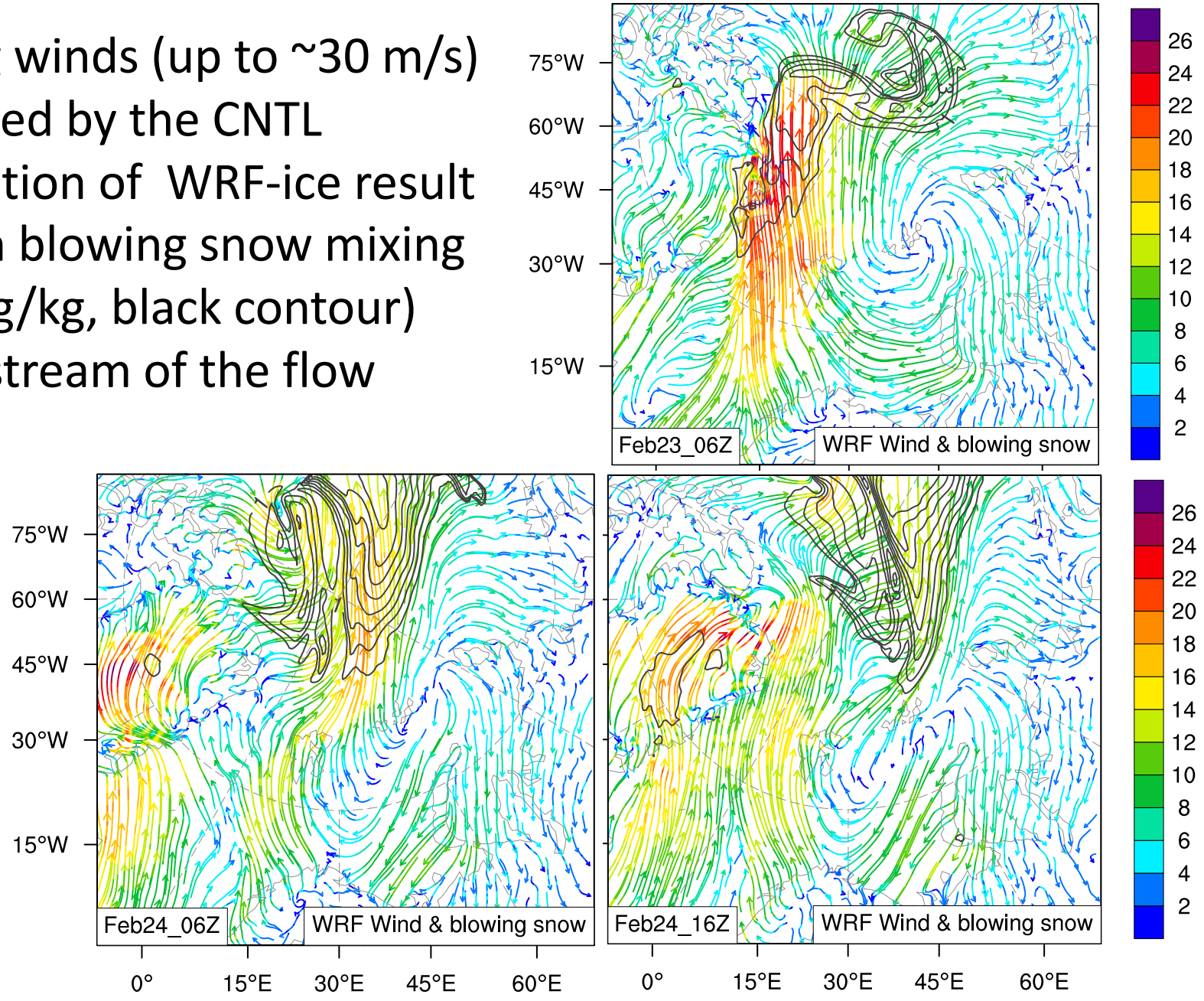
Grid configuration



Two Simulation Experiments:
CNTL-- Turn on blowing snow
Blow-off –Turn off blowing snow

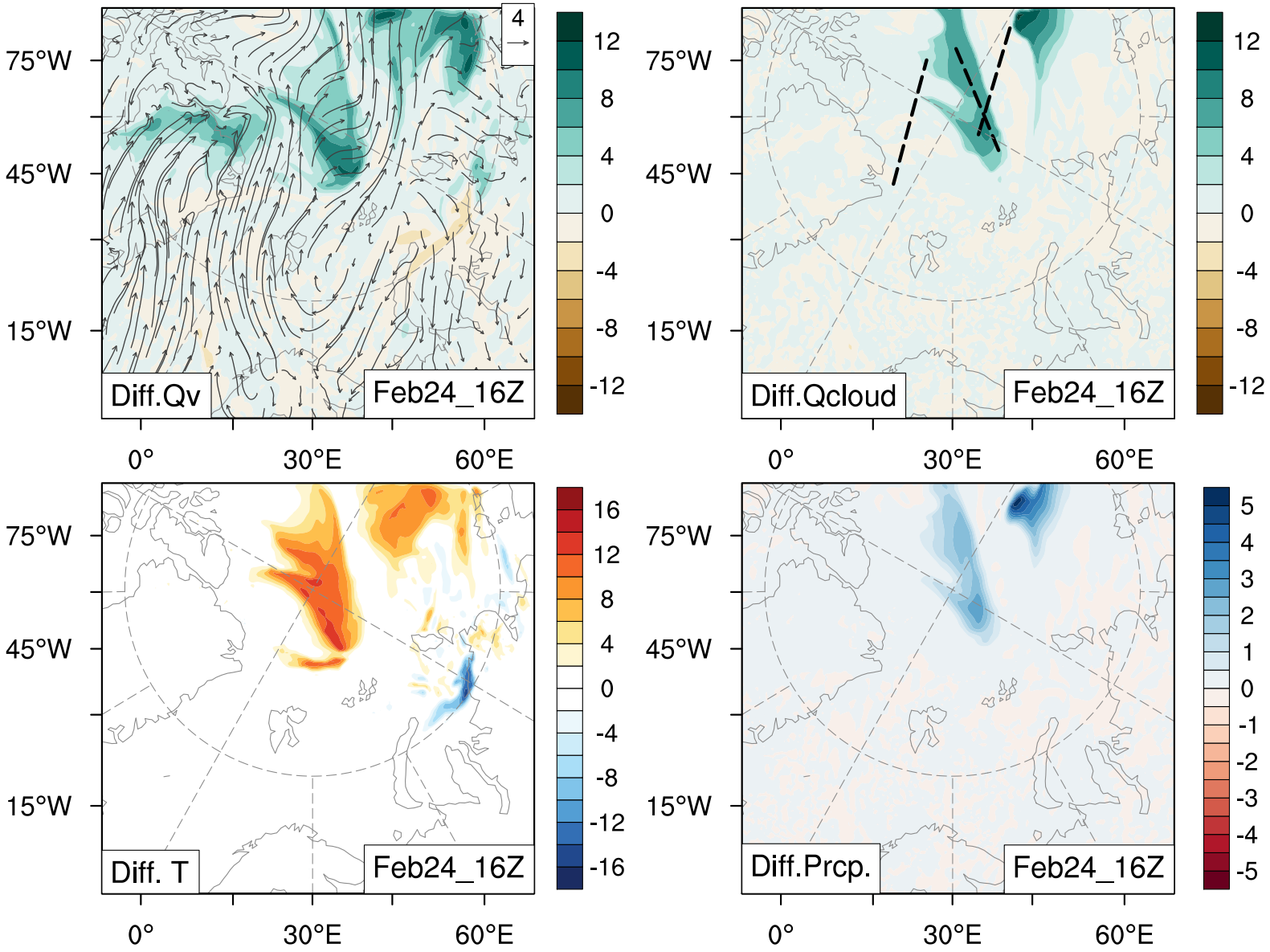
Surface winds & blowing snow in CNTL

Strong winds (up to ~30 m/s) captured by the CNTL simulation of WRF-ice result in high blowing snow mixing ratio (g/kg, black contour) downstream of the flow



Differences between CNTL and Blowing-off

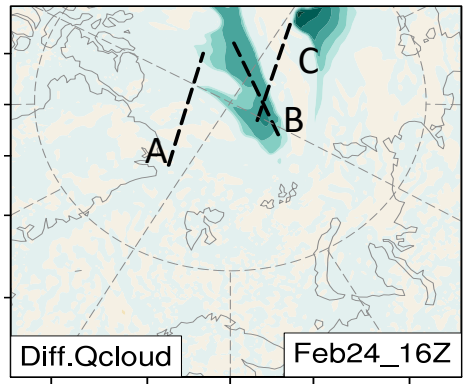
There are increased water vapor (Qv, g/kg), cloud (Qcloud, g/kg), surface temperature (ºC), and precipitation (mm/hour) over the blowing snow impacted areas.

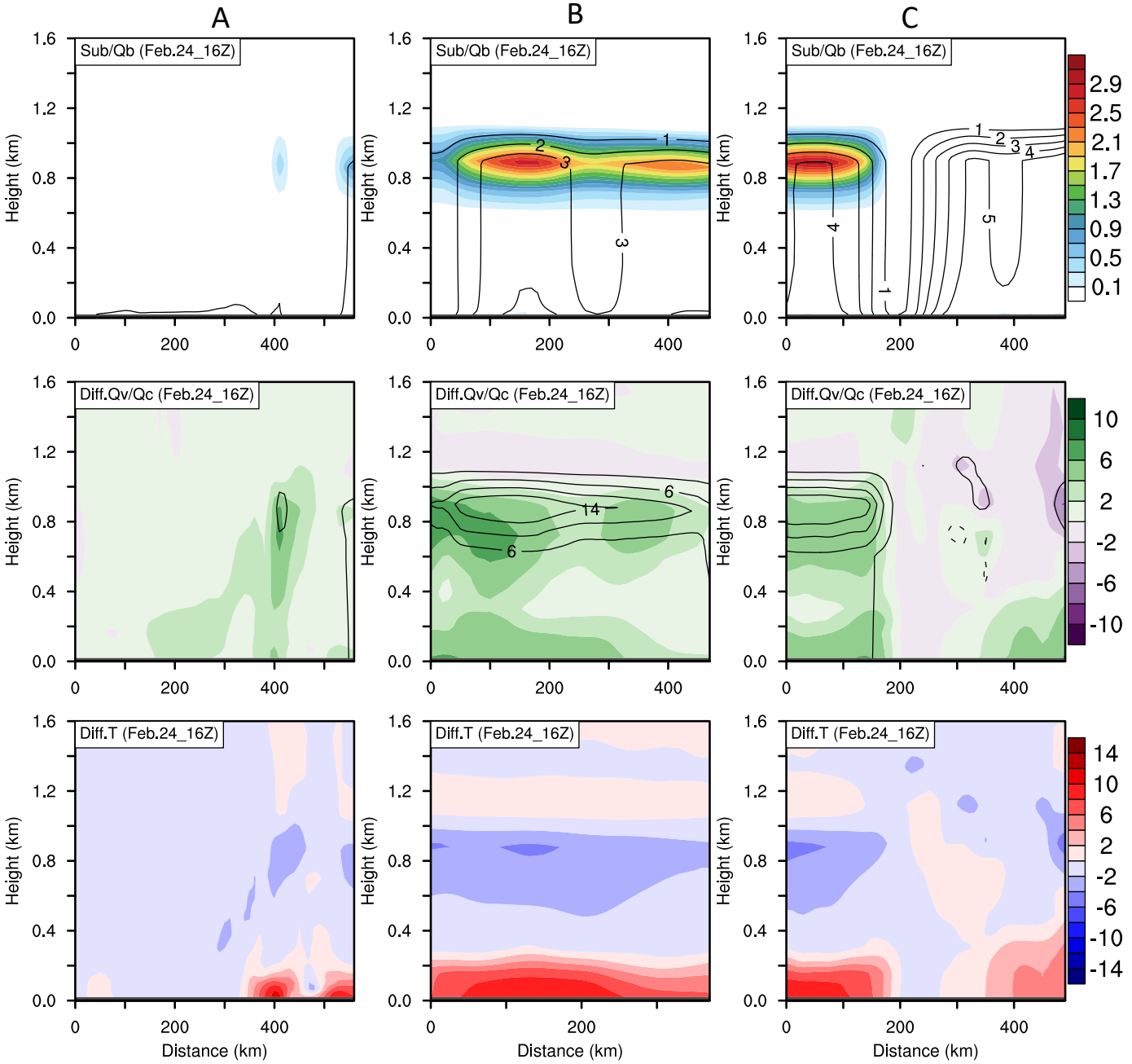


Cross section profiles of blowing snow in CNTL, and differences of air humidity and temperature between CNTL & Blow-off

Blowing snow sublimation and associated moistening and cooling effects reduce stability, increase cloud cover, and warm up the surface.

Location of cross sections





Summary

- Extreme wind-induced blowing snow effects over the Arctic have been studied with a snow/ice enhanced WRF-ice model.
- Preliminary analysis of the modeling results indicates that the blowing snow effects within WRF-ice include moistening and cooling the air via snow sublimation, which helps to reduce lower atmosphere stability, increase cloud cover and precipitation.
- Blowing snow also contributes to a warmer surface via increased cloud forcing radiation and reduced latent heat flux.