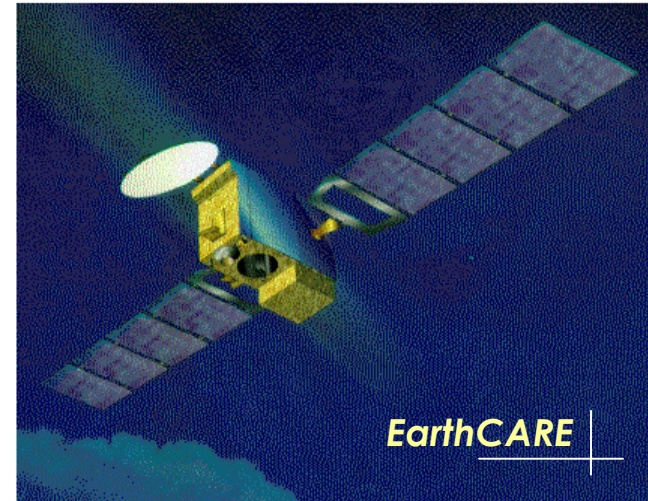


MOC2 Meeting
University of Toronto
December 2002



Realistic detailed

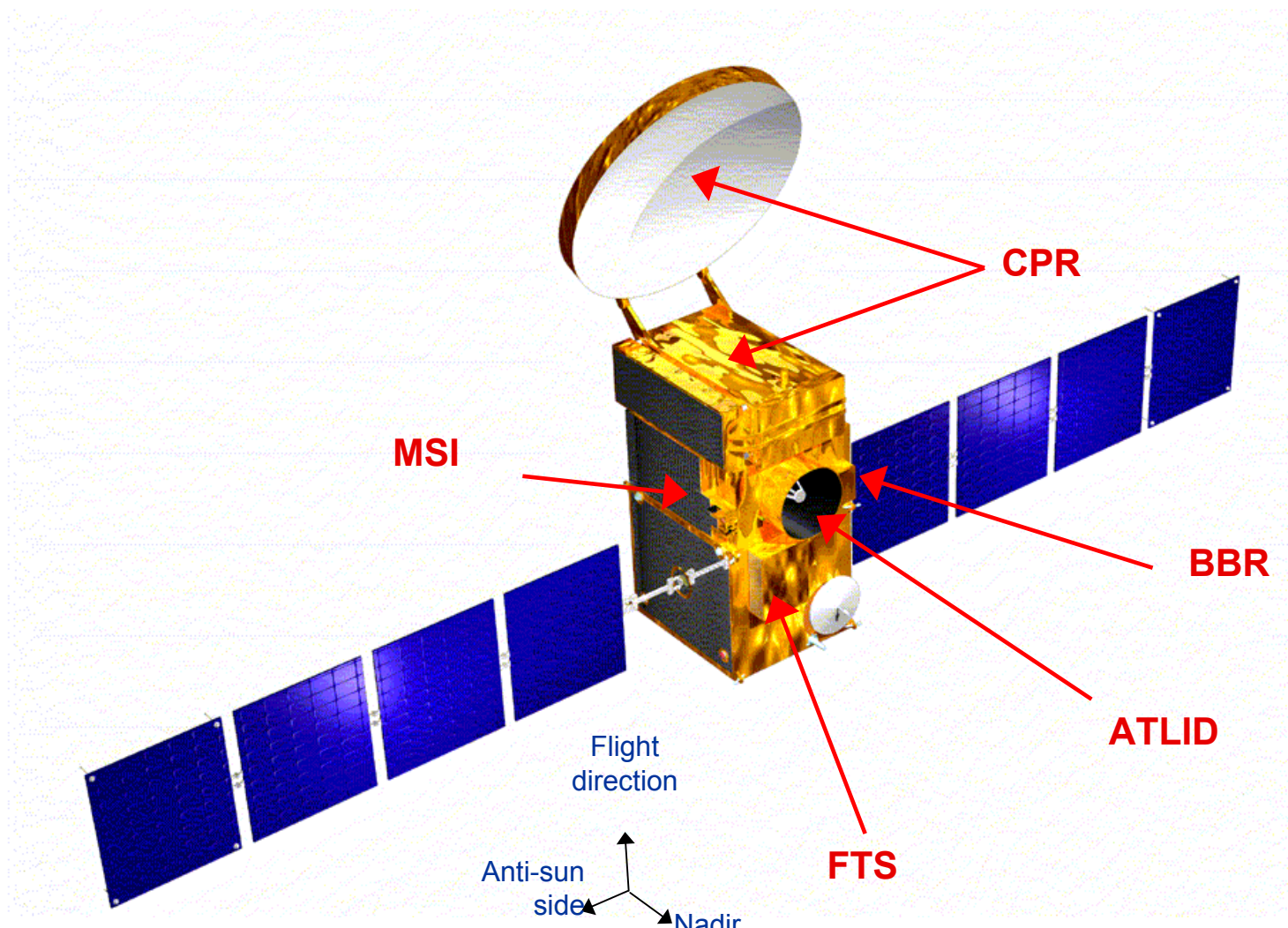
model generated cloud scenes

for EarthCARE

Wanda Szyrmer, Jean-Pierre Blanchet *, Alain Beaulne

Department of Earth and Atmospheric Sciences
University of Quebec in Montreal (UQÀM), Montreal, Canada

* On Sabbatical at the Institute of Geophysics
University of Fribourg, Switzerland



MSI

CPR

BBR

ATLID

FTS

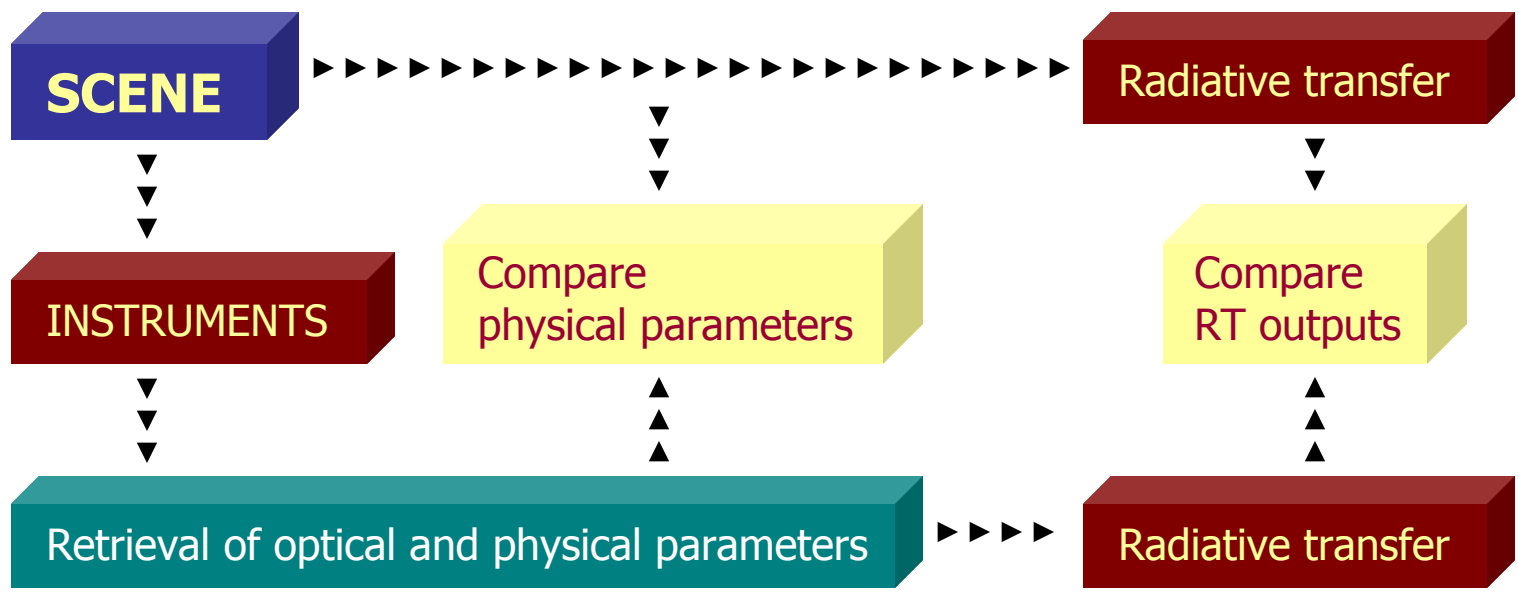
Flight
direction

Anti-sun
side

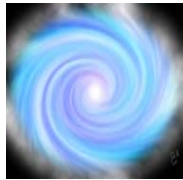
Nadir

EarthCARE simulator

End-to-end simulation procedure



Developped by *Wanda Szyrmer*



Dynamical core

Based on the Cooperative Center for Research in Mesometeorology
Mesoscale Compressible Community model (MC2)

Numerous modifications: turbulence, radiation, boundary periodicity ...

Use the **fully elastic nonhydrostatic 3D Euler equations** for atmospheric flow

- operation at all meteorological scales (microns to kilometers) (Szyrmer 1998)

Semi-implicit numerical scheme

- resolves high frequency modes without any approximations

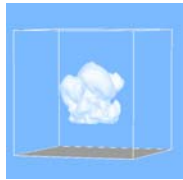
Semi-langrangian advection algorithm

- no sillage (all waves displaced at same speed)

improved stability, longer time steps, no approximations to Euler equations

Caya and Laprise (1999)

Developped by *Wanda Szyrmer*



Microphysics

Droplet microphysics as in *Brenguier and Grabowski (1993)*

Drizzle size distribution as in *Wood (2002)*, normalized inverse exponential spectrum

Explicit cloud droplet spectra evolution ($r < 19\mu\text{m}$)

- initiation from nuclei, explicit spectral evolution by condensation (BG)
-

Water transfer to drizzle category ($r > 19\mu\text{m}$)

- by condensation, autoconversion and accretion (Khairoutdinov and Kogan, 2000)
-

Bulk microphysics for drizzle

- drizzle water content and concentration (KK)
-

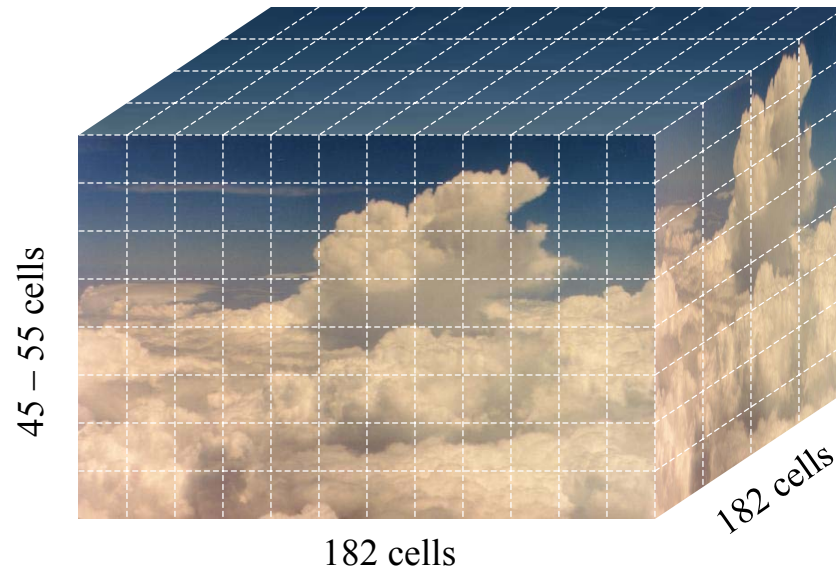
CRM simulation (SGI): 2-sec time step, 180-sec a day

- Department system (SGI)

- RQCHP (Quebec High Performance Computing Network) (Yves Léger and Jacques Richer)

Scene characteristics

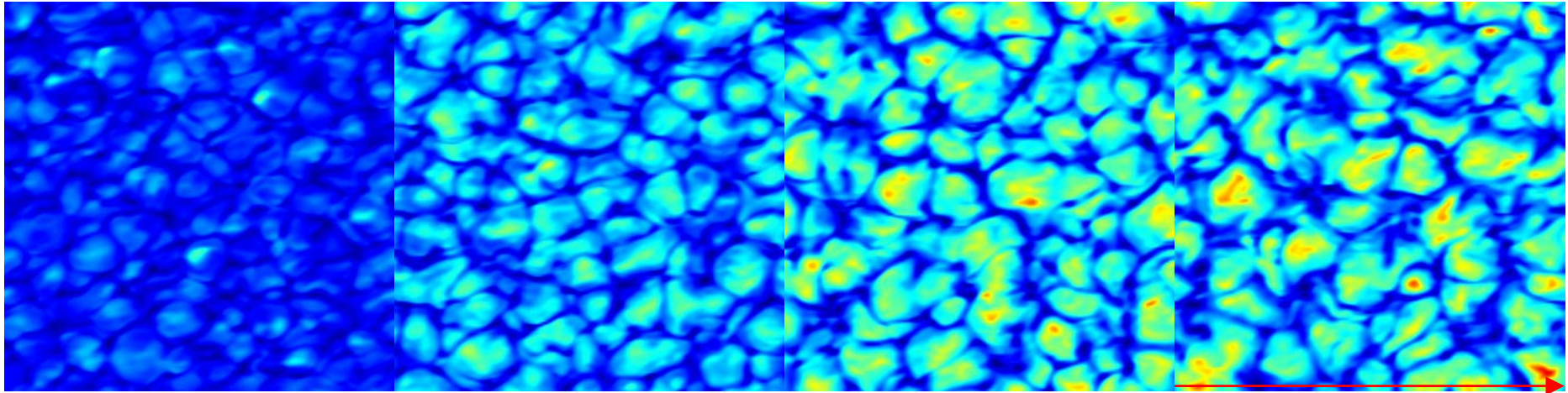
Cloud scene



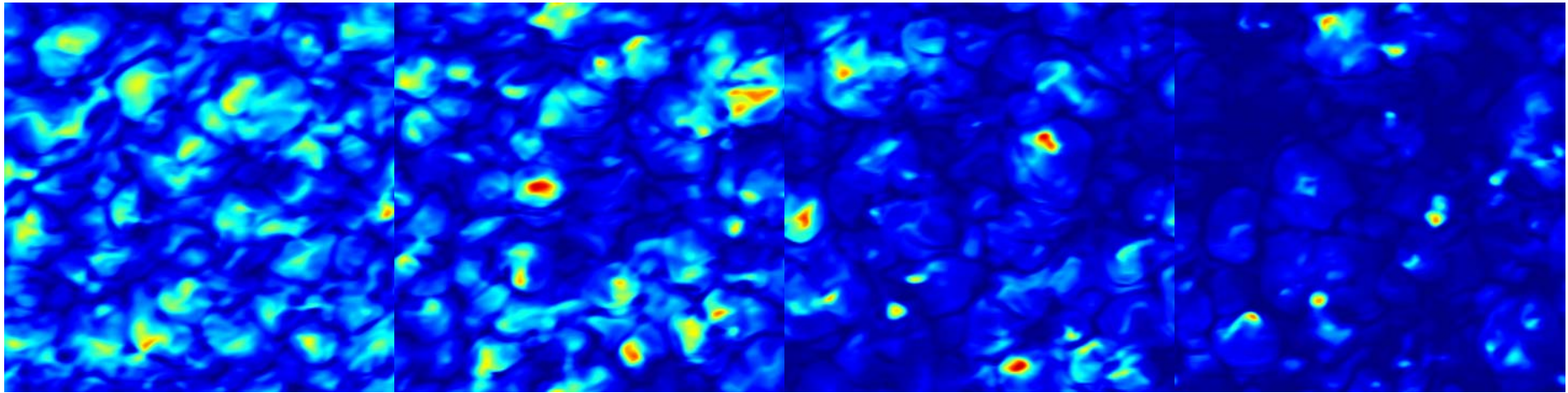
Grid characteristics

# of cells	1.5 million +
dimension	10.010 km x 10.010 km x ~1.100 km
horizontal grid spacing	55 m
vertical grid spacing	25 m

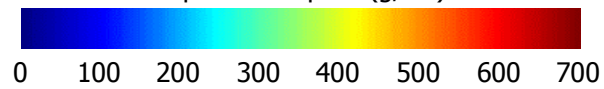
ASTEX1

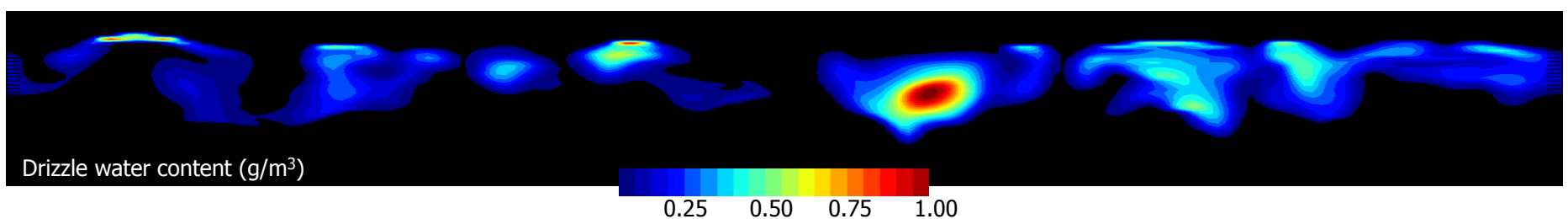
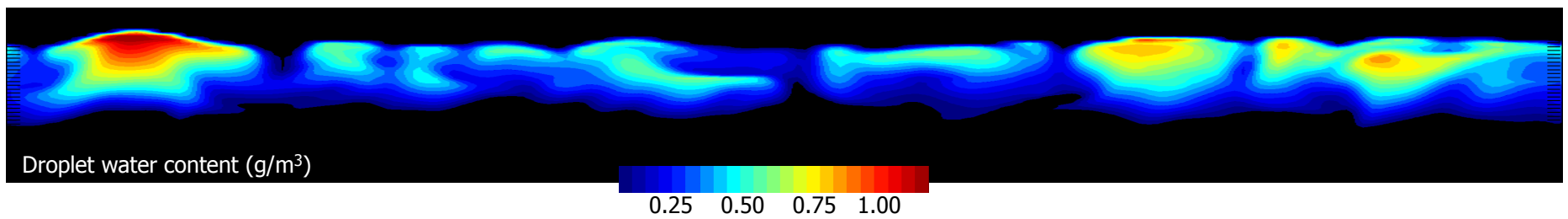
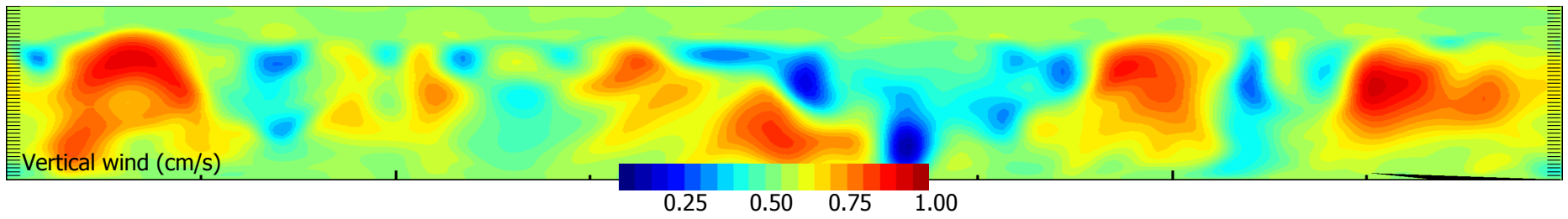
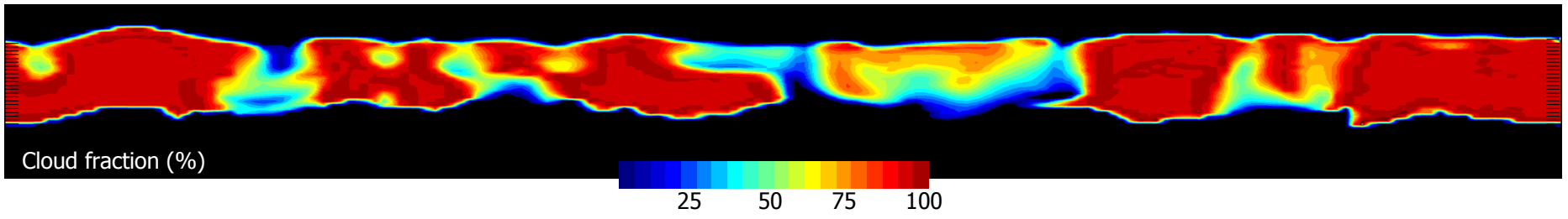


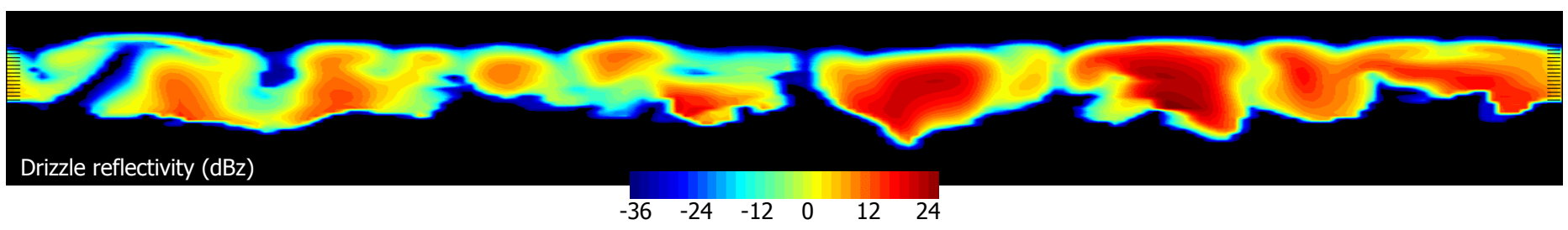
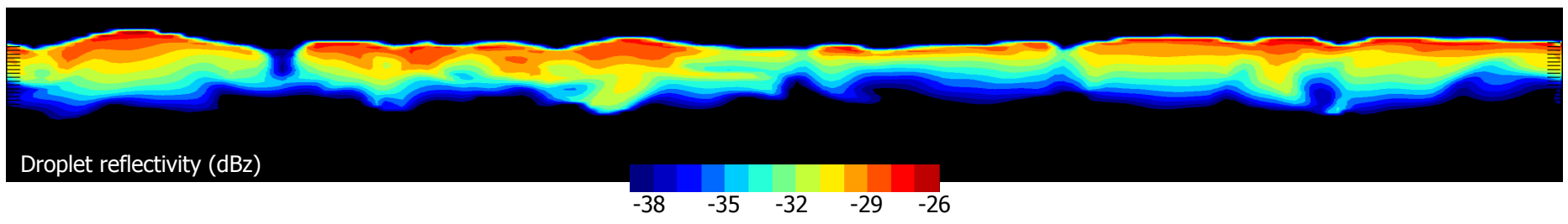
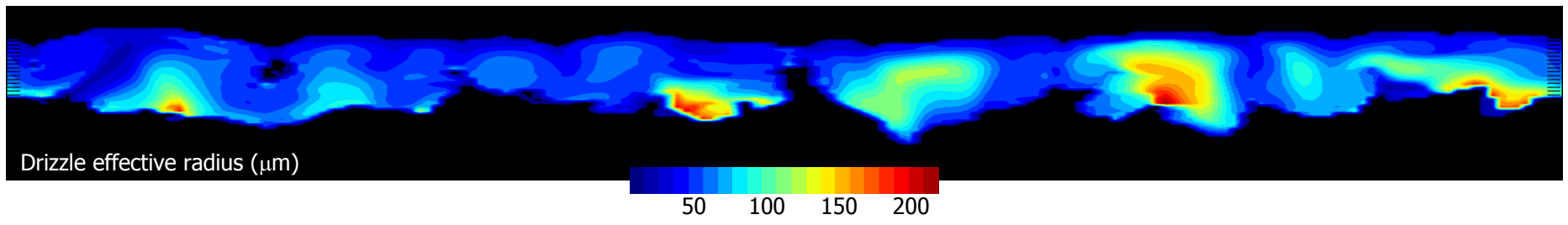
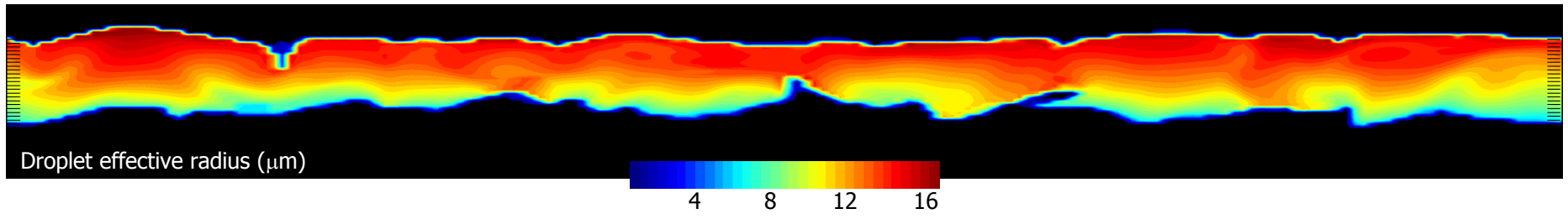
ASTEX2



liquid water path (g/m^2)

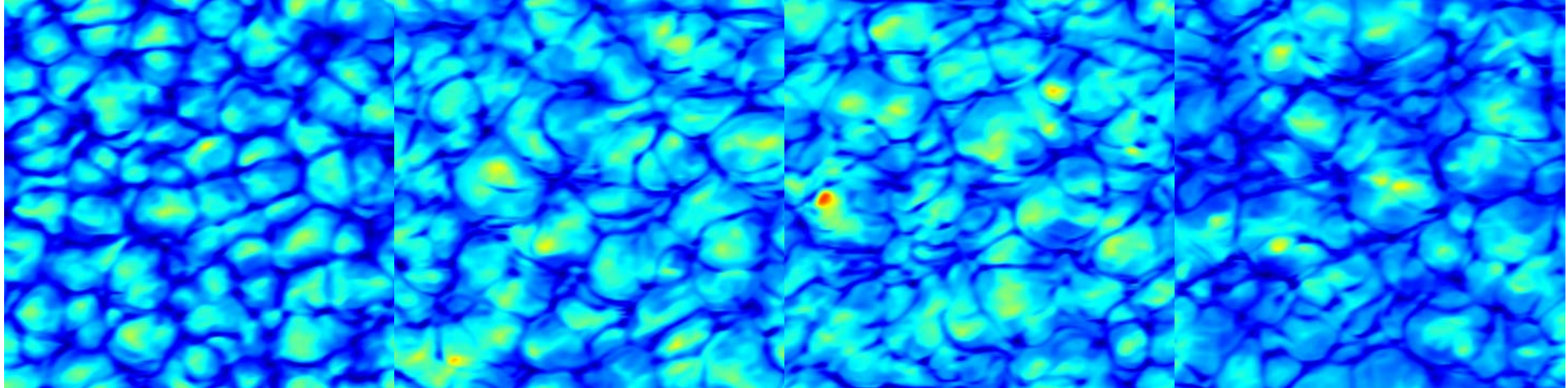
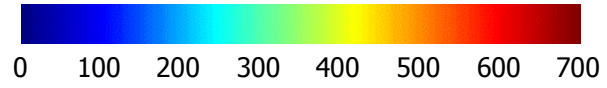






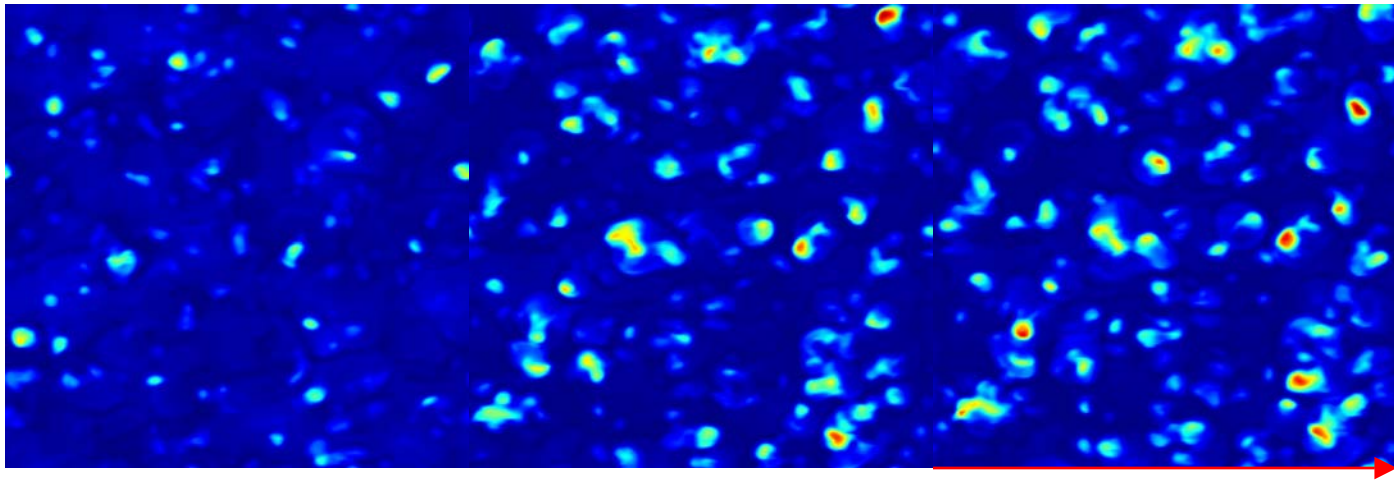
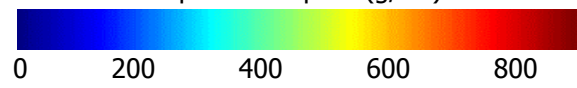
ASTEX3

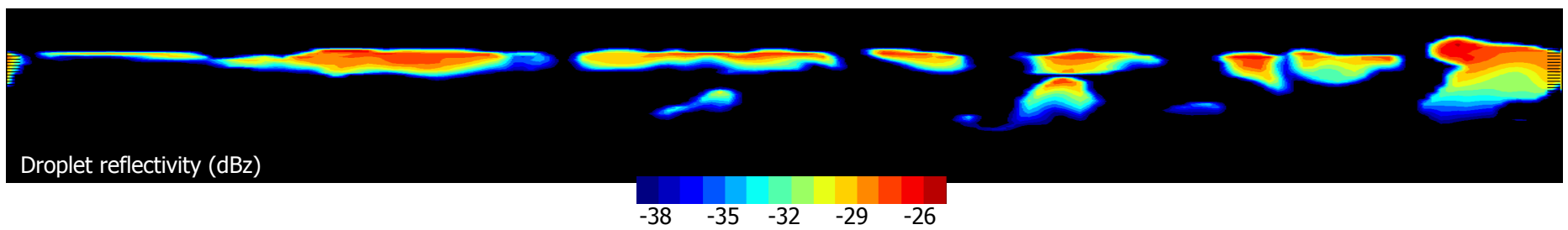
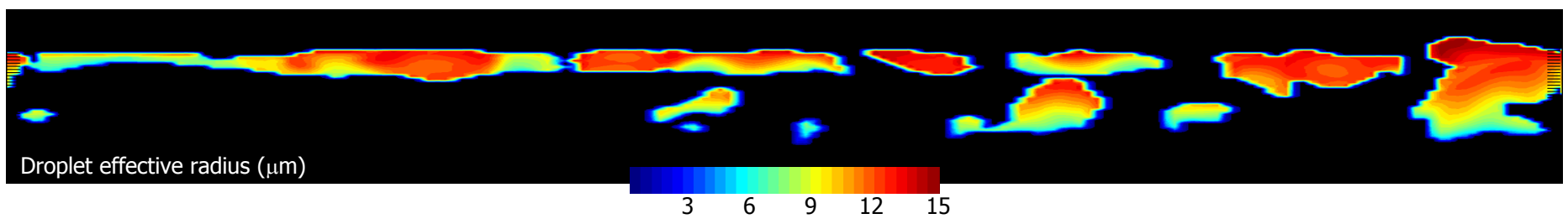
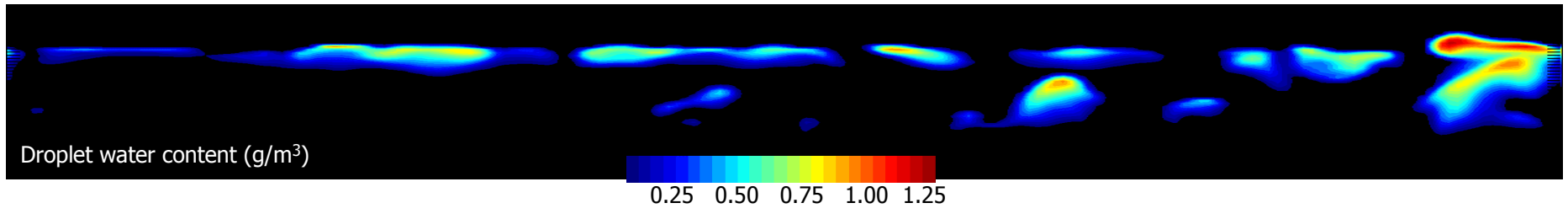
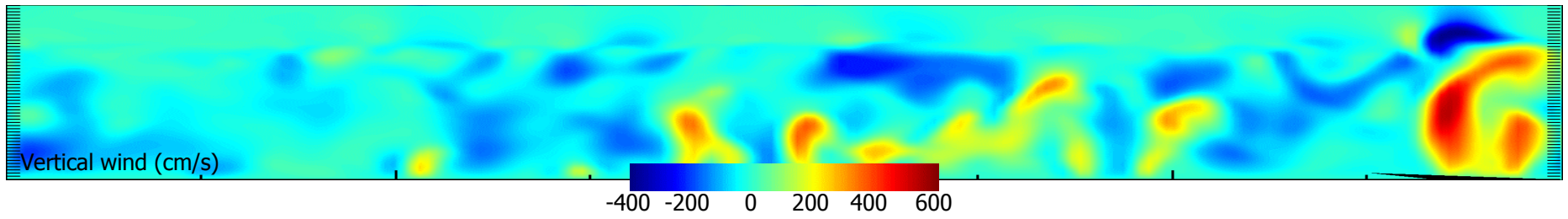
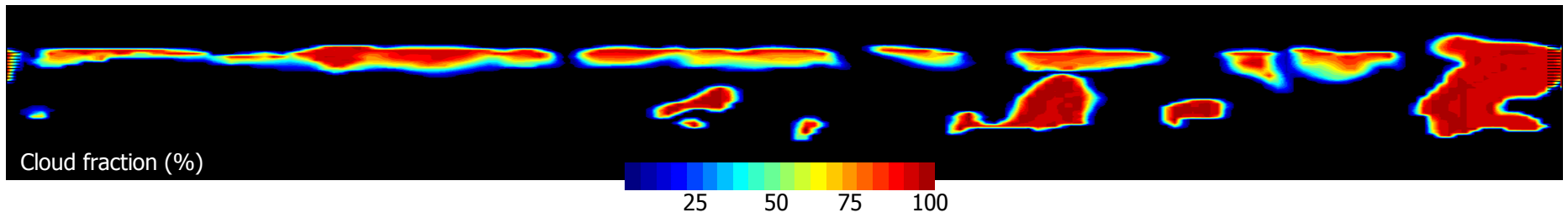
liquid water path (g/m²)



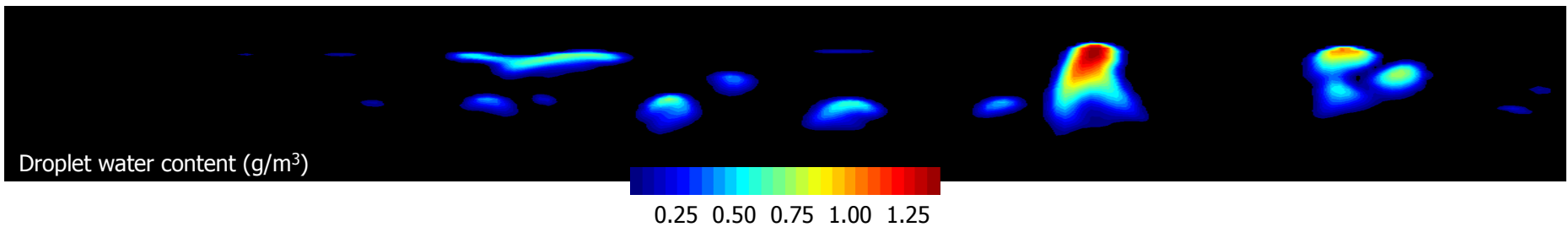
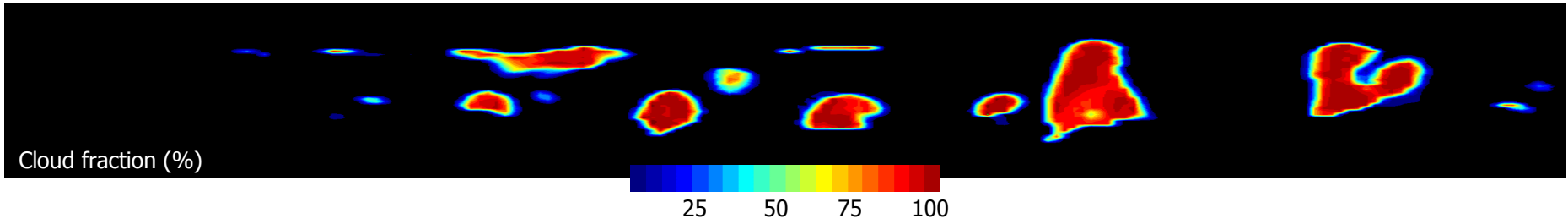
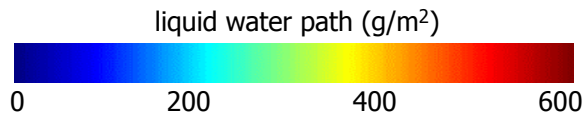
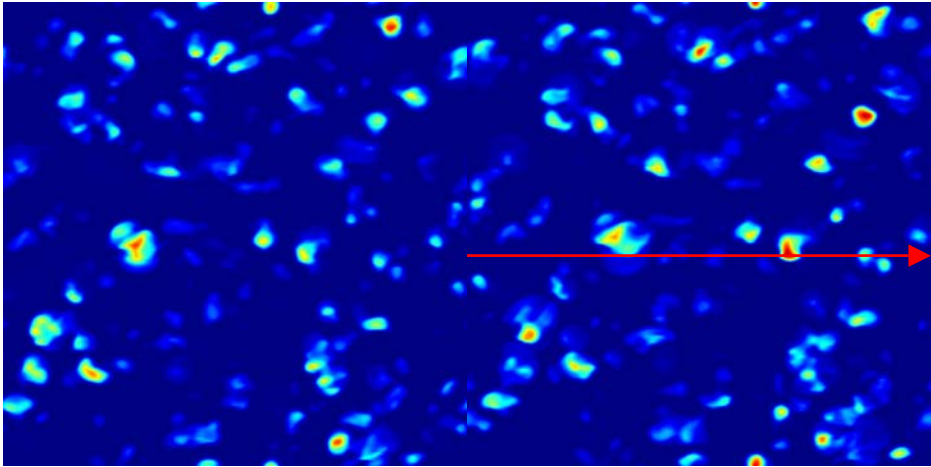
ASTEX4

liquid water path (g/m²)

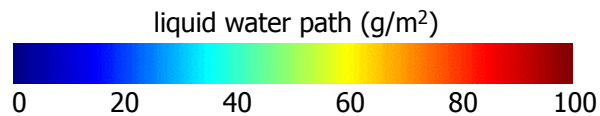
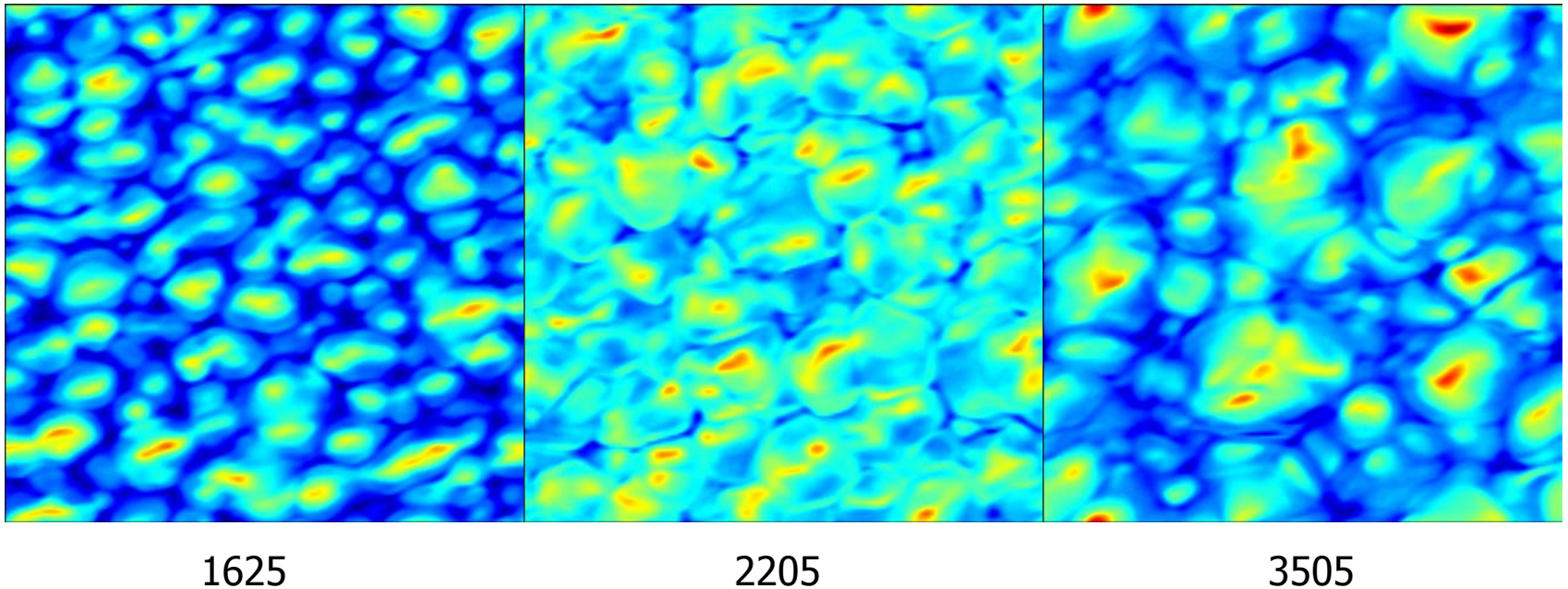


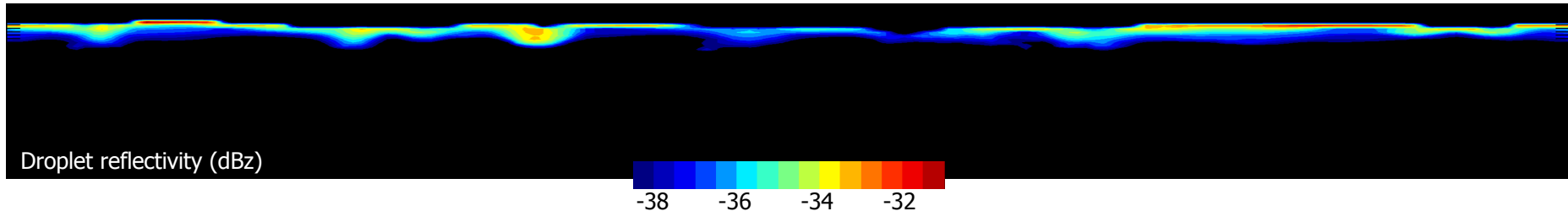
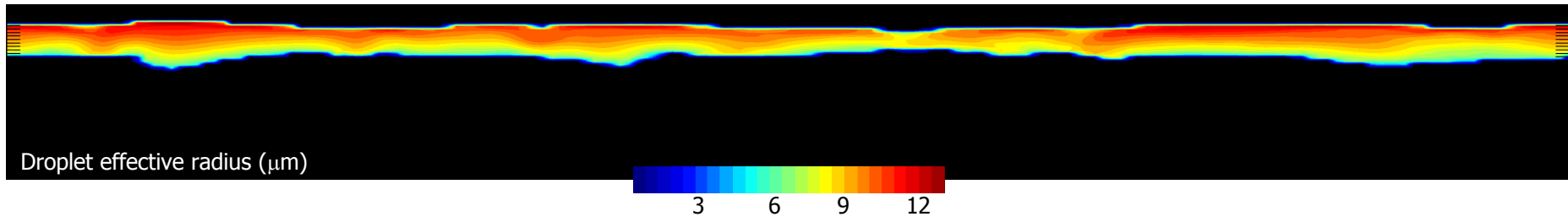
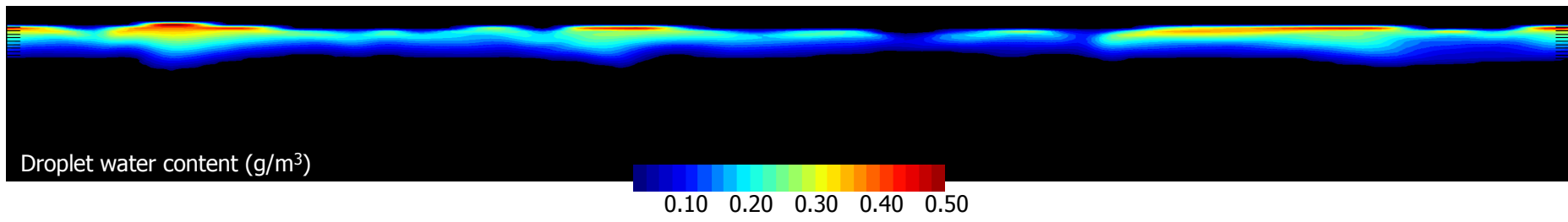
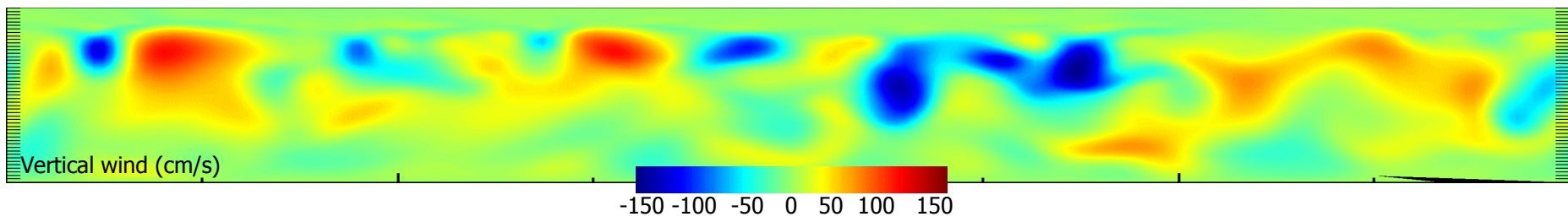
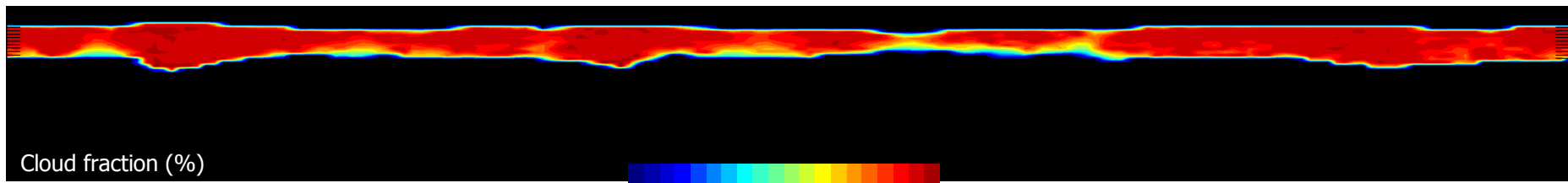


ASTEX5

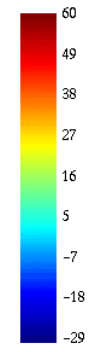
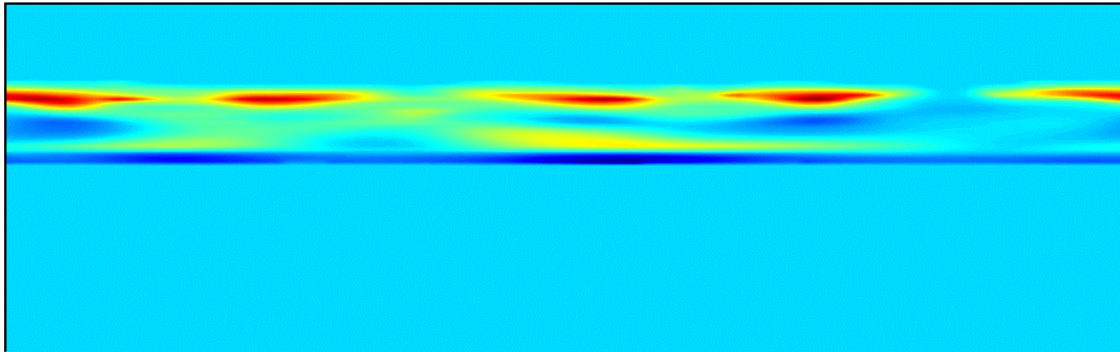


Arctic stratocumulus (summer)

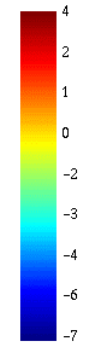
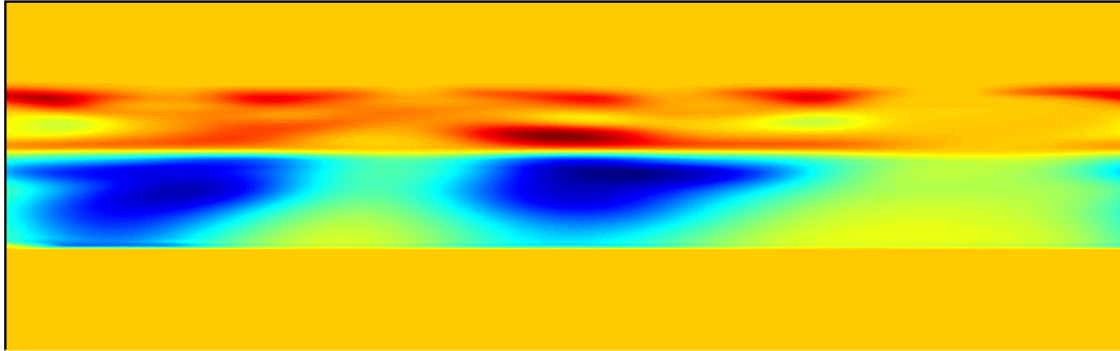




P4
Level: 5 mb - Stamp: PROCC04 - Interval: 0 * 1.0e-05 (?)

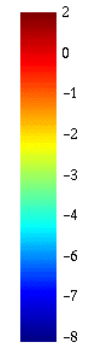
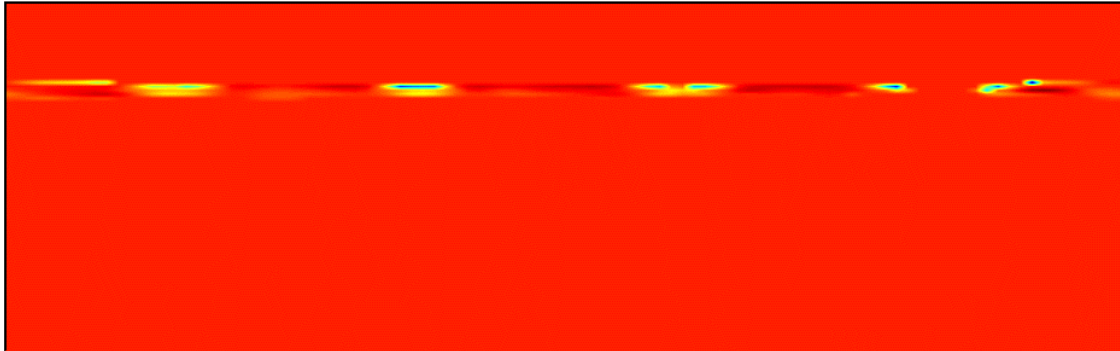


P5
Level: 5 mb - Stamp: PROCC05 - Interval: 0 * 1.0e-05 (?)



950 hour fcast valid 17:29Z April 15 2131

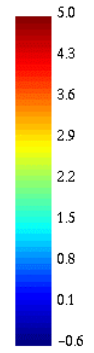
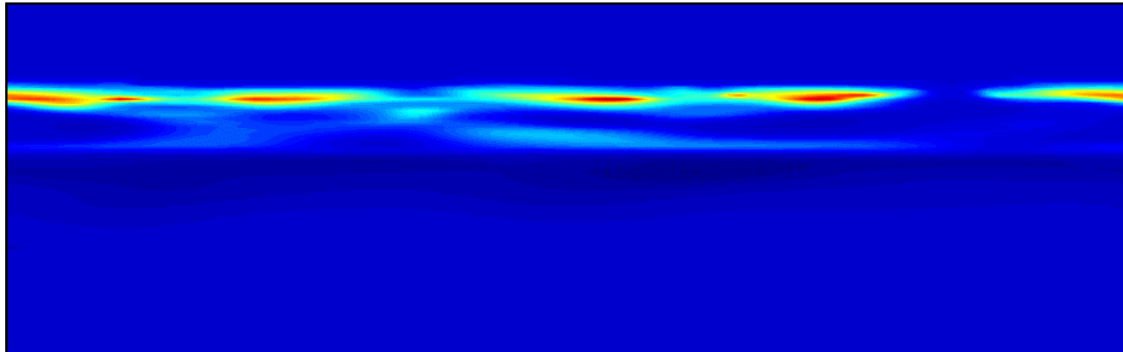
P6
Level: 5 mb - Stamp: PROCC06 - Interval: 0 * 1.0e-03 (?)



950 hour fcast valid 17:29Z April 15 2131

20

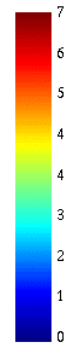
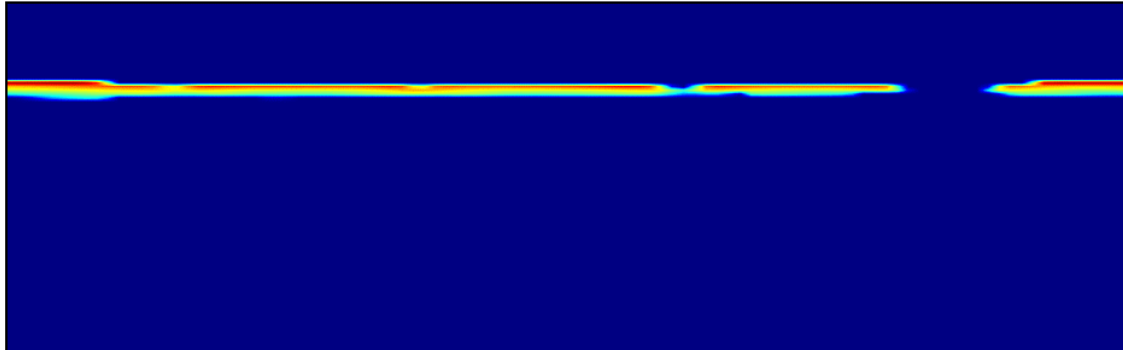
Level: 5 mb - Stamp: HARRI20 - Interval: 0.1 * 1.0e+01 (?)



950 hour fest valid 17:29Z April 15 2131

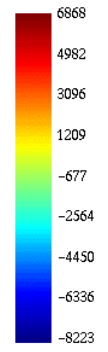
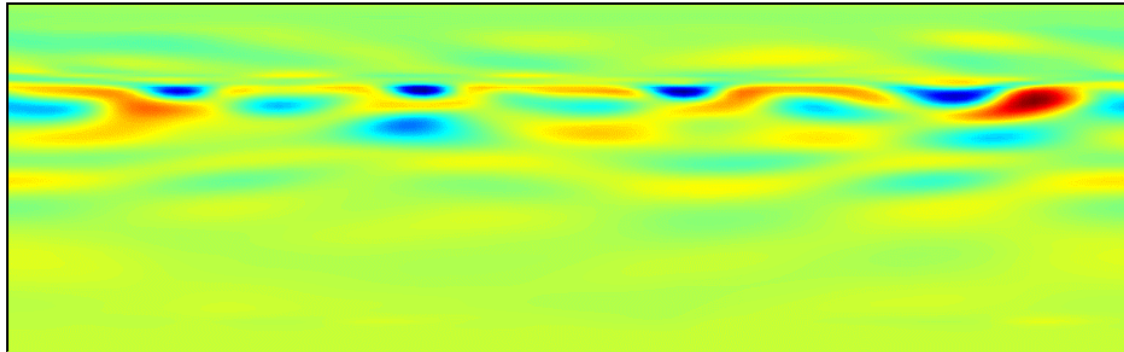
9P

Level: 5 mb - Stamp: CONTA19 - Interval: 0 * 1.0e+04 (?)



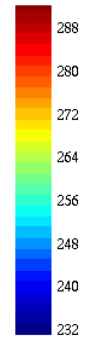
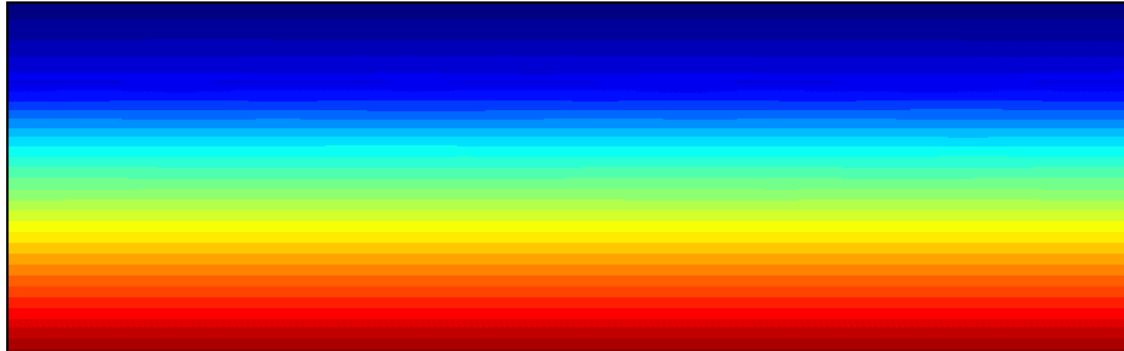
950 hour fest valid 17:29Z April 15 2131

WZ Vertical wind
Level: 5 mb - Stamp: VENT W - Interval: 0 * 1.0e-02 m/s



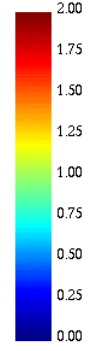
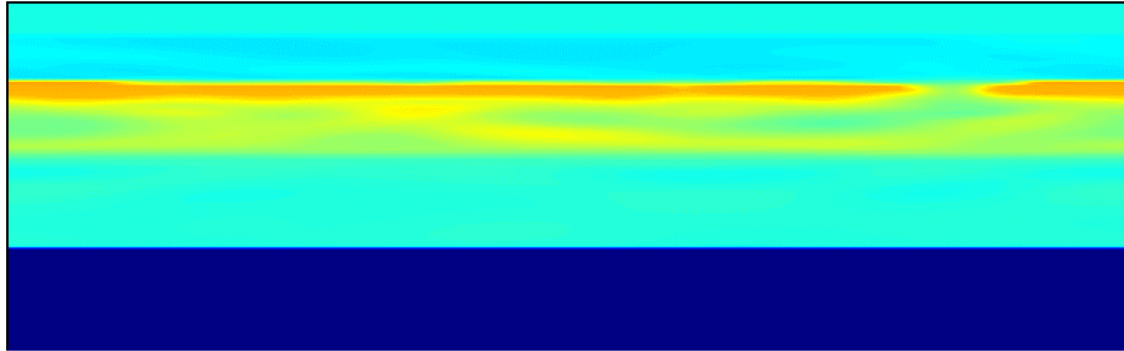
950 hour fest valid 17.29Z April 15 2131

TT (Air Temperature)
Level: 5 mb - Stamp: TEMPERA - Interval: 2 * 1.0e+00 deg C



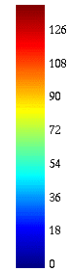
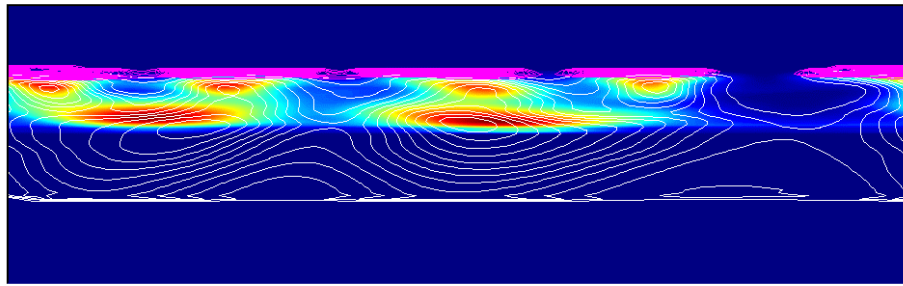
950 hour fest valid 17.29Z April 15 2131

SI
Level: 5 mb - Stamp: ICE SAT - Interval: 0.01 * 1.0e+02 (%)

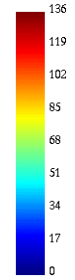
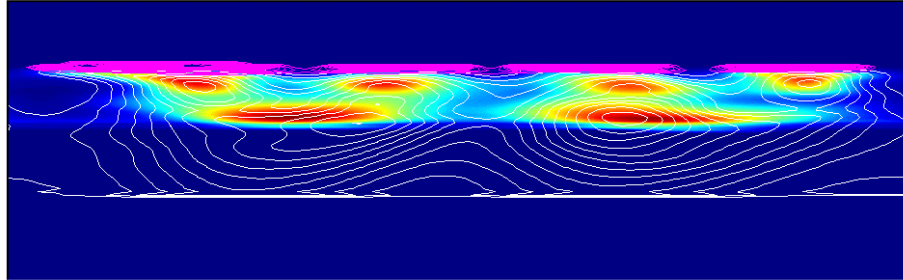


950 hour fest valid 17.29Z April 15 2131

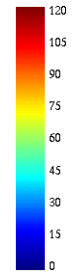
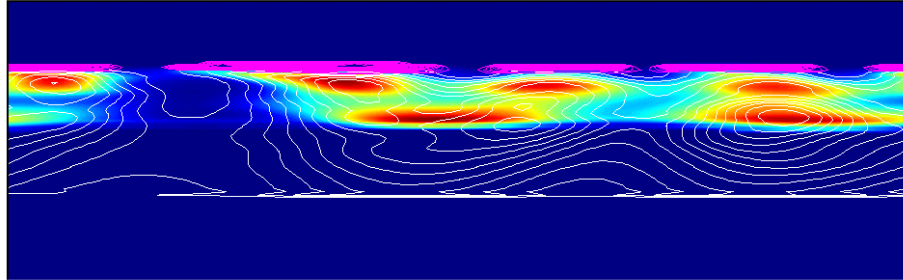
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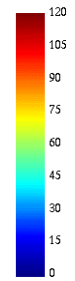
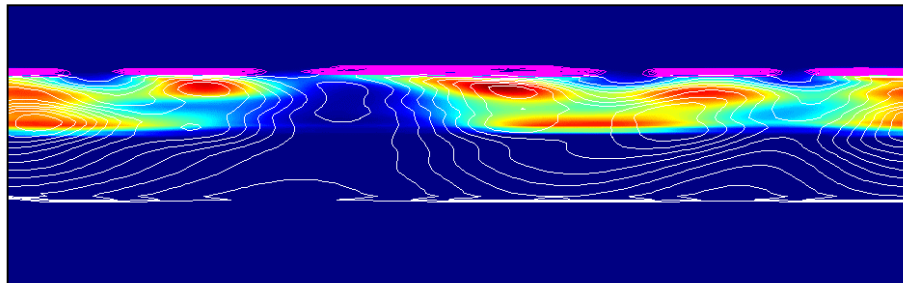
MC-P- 5 mb-1000- 1-V21310417 192910-NUAG-EA



MC-P- 5 mb-1050- 1-V21310419 212910-NUAG-EA



MC-P- 5 mb-1100- 1-V21310421 232910-NUAG-EA



MI-P- 5 mb-1100- 1-V21310421 232910-MICE

MS-P- 5 mb-1100- 1-V21310421 232910-MAGG

