

Modélisation de Nawdex à méso-échelle: comparaison des effets diabatiques entre microphysique paramétrée et microphysique détaillée

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Objectif:

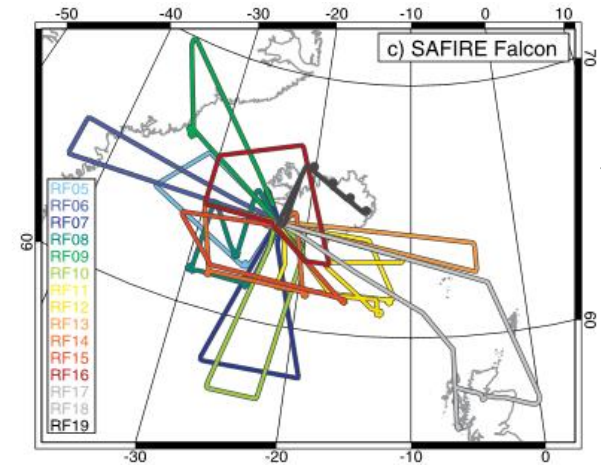
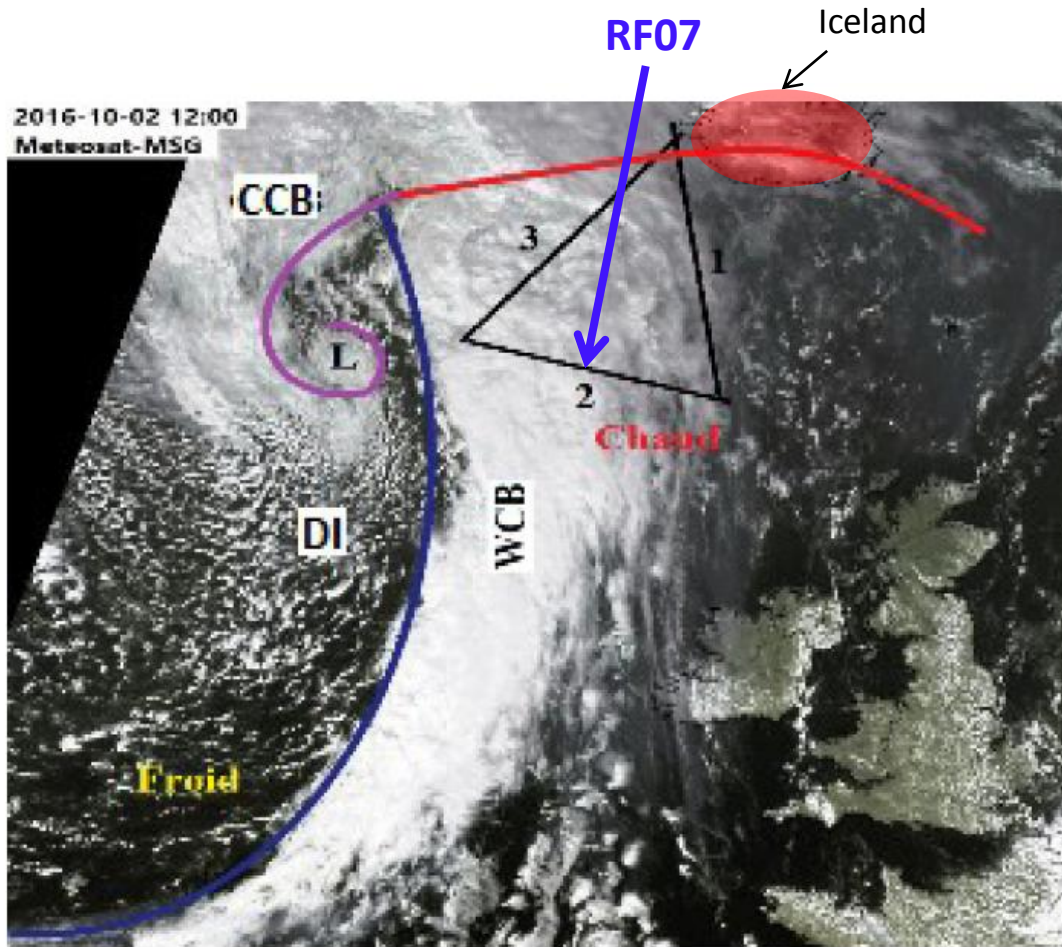
comparer les effets diabatiques résultant des différentes approches microphysiques (et radiatives)

- avec microphysique explicite paramétrée
(WRF + Thompson ou Morrison + RRTM)
- avec microphysique détaillée
(modèle de Clark + DESCAM + RRTM)

Méthodologie:

- poursuivre l'évolution individuelle des parcelles d'air
à l'aide des trajectoires (backward ou forward) et
- analyser le taux de réchauffement/refroidissement
dû à la condensation/évaporation, déposition/
sublimation, givrage et fonte des hydrométéores

Case study: 2nd October 2016



From A.
Schäfler et al.
(2018, BAMS)

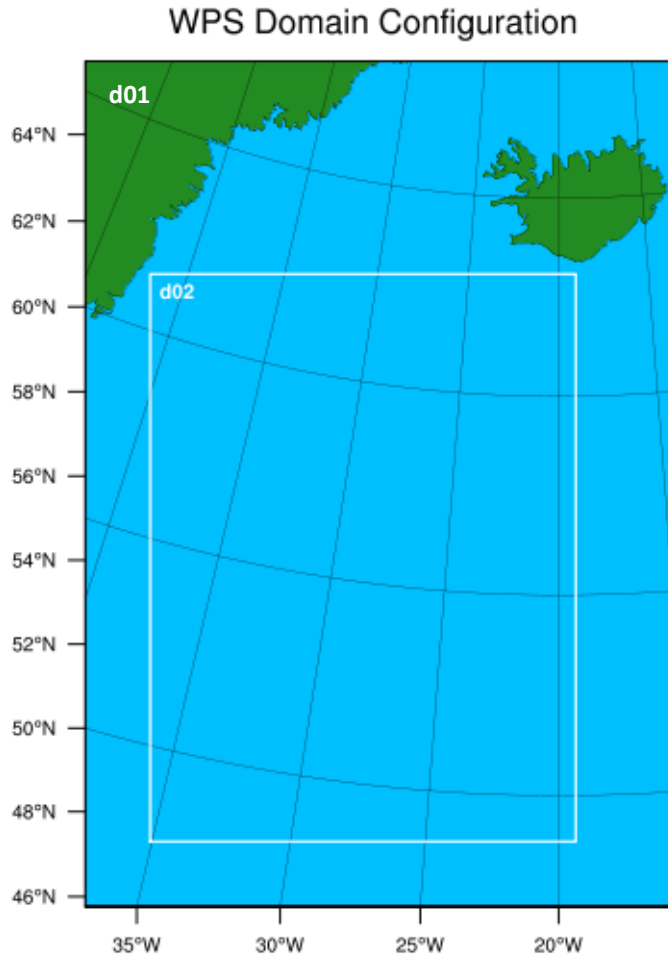
Fig. 6. Image issue du satellite MSG le 02/10/2016 à 1200 UTC.

Le trajet de l'avion est représenté par le tracé en noir avec le segment 1 de 1300 à 1430 UTC, le segment 2 de 1430 à 1515 UTC et le segment 3 de 1515 à 1600 UTC.

Le front froid est tracé en bleu, le front chaud en rouge, le front occlus en violet. Le symbole L montre le centre de la tempête.

From Nicolas Blanchard's master thesis

Model set-up (WRF)



- Case study: 2nd October 2016
- 2 nested domains with increasing horizontal resolution (d01 = 16 km, d02 = 4 km)
- Number of grid points:
 - 100 x 144 for d01
 - 289 x 355 for d02
- Non-equidistant vertical grid with 72 levels
- Initial time: 02/10/16 at 00:00 UTC
- Forcing data: ECMWF ERA-Interim reanalysis
- Simulation duration: 18 hours

Model set-up (DESCAM)

Outmost domain:

16 km, 128 x 144 points

2nd domain:

4 km, 384 x 384 points

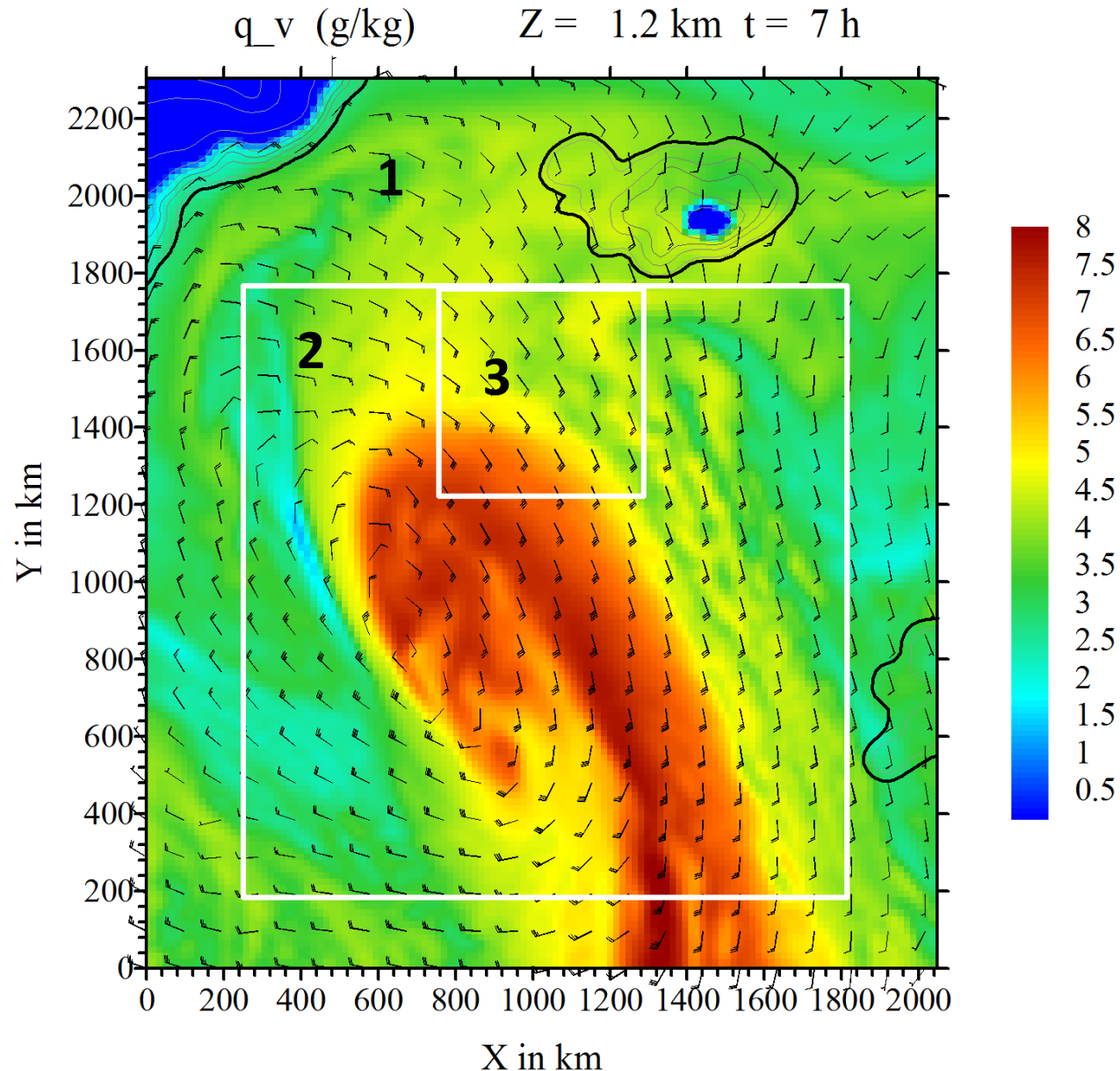
innermost domain:

1 km, 384 x 384 points

First tests with IFS and
ERA:

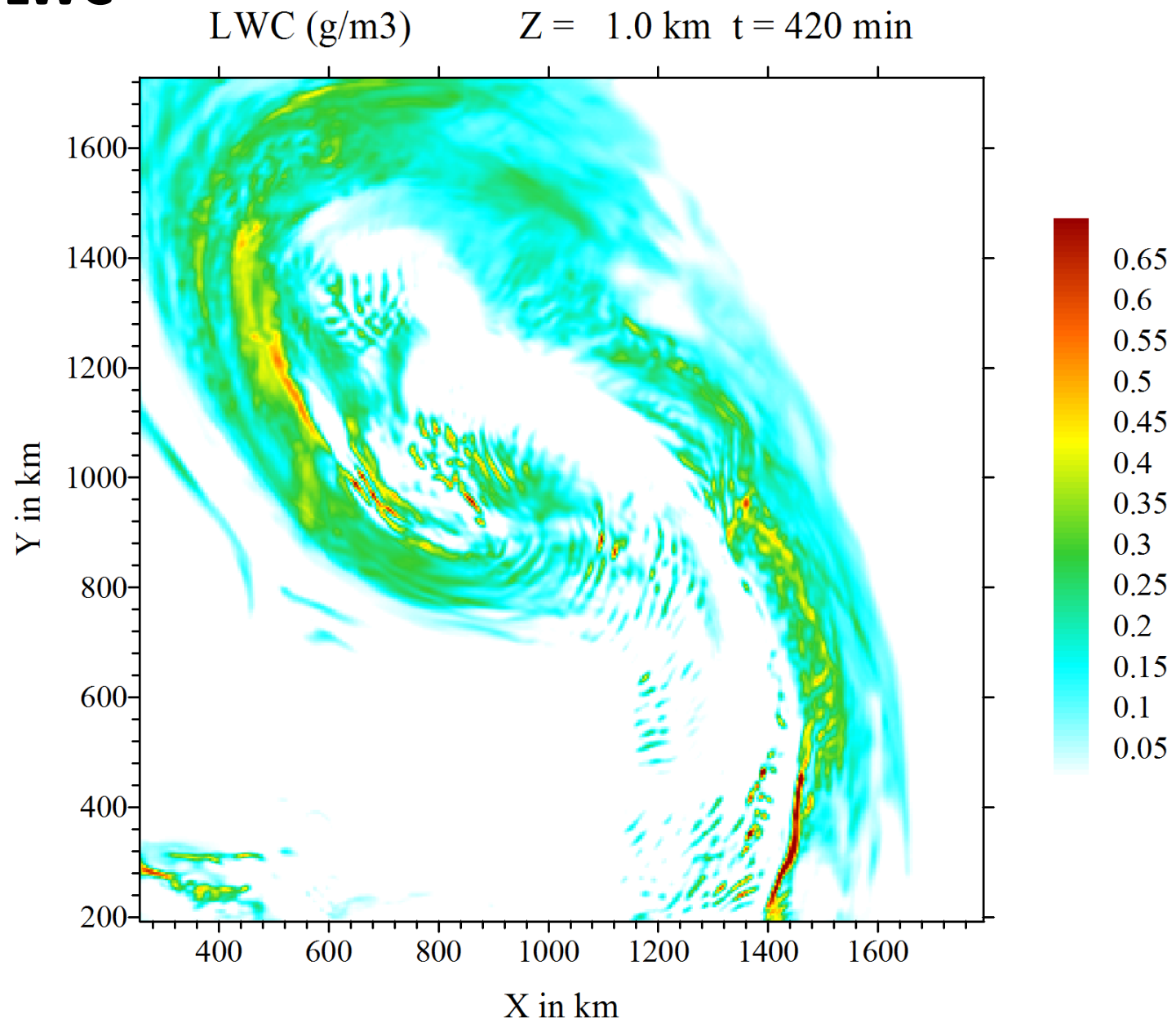
IFS: start 0h 2 oct 2016

ERA: start 6h



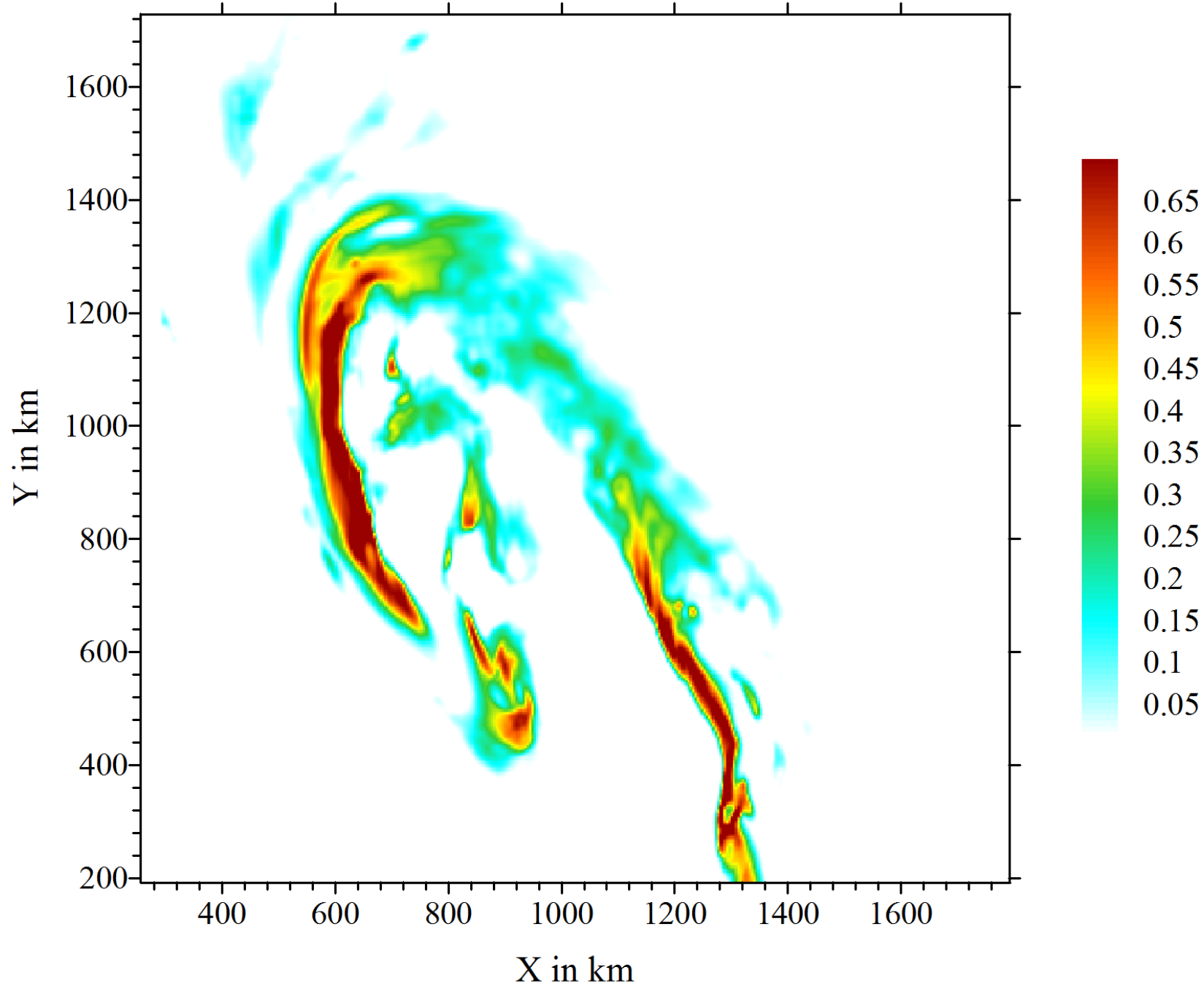
**Simulation of LWC
in domain 2
from 6 – 14 h**

DESCAM



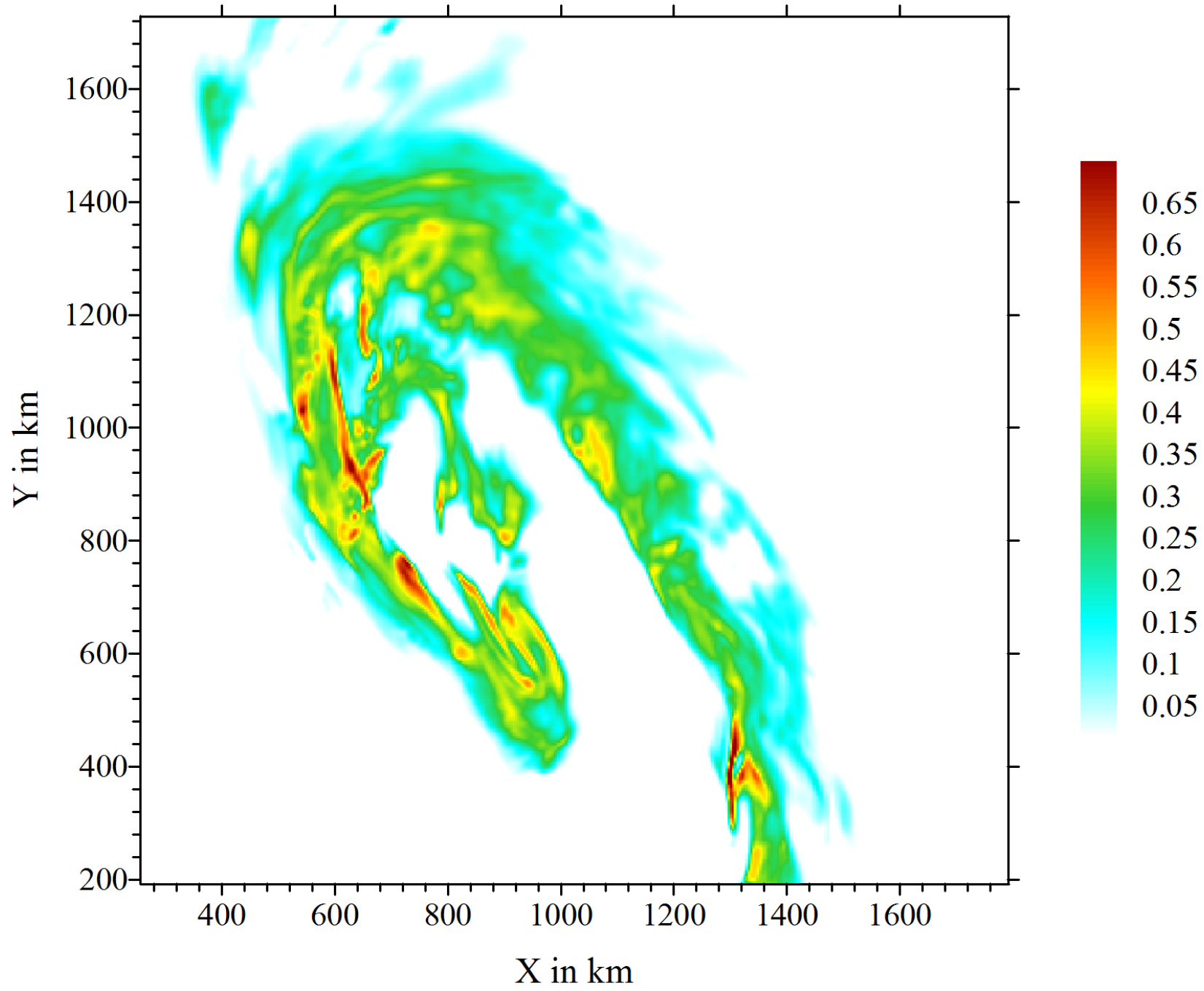
LWC (g/m³)

Z = 1.0 km t = 60 min



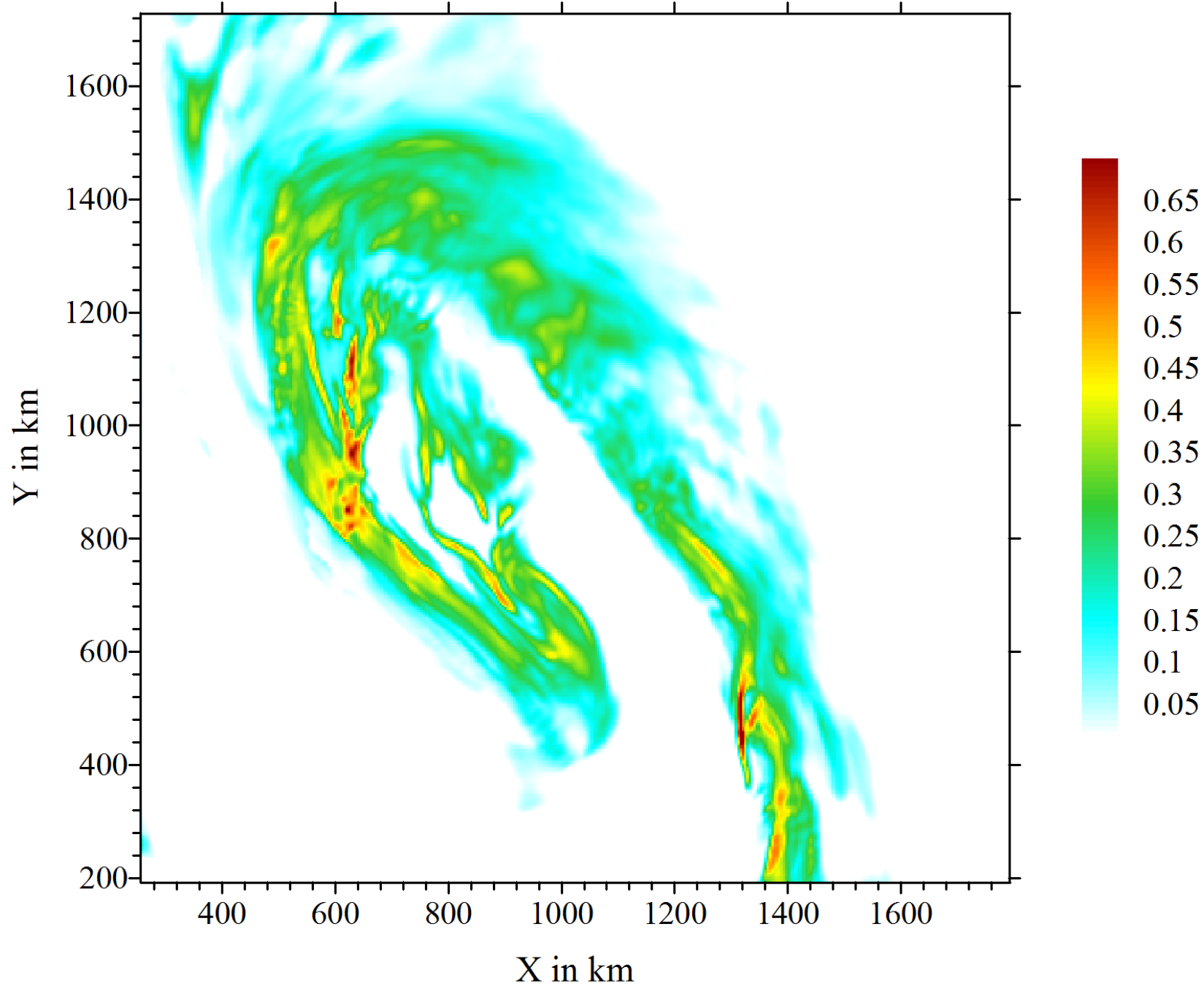
LWC (g/m³)

Z = 1.0 km t = 120 min



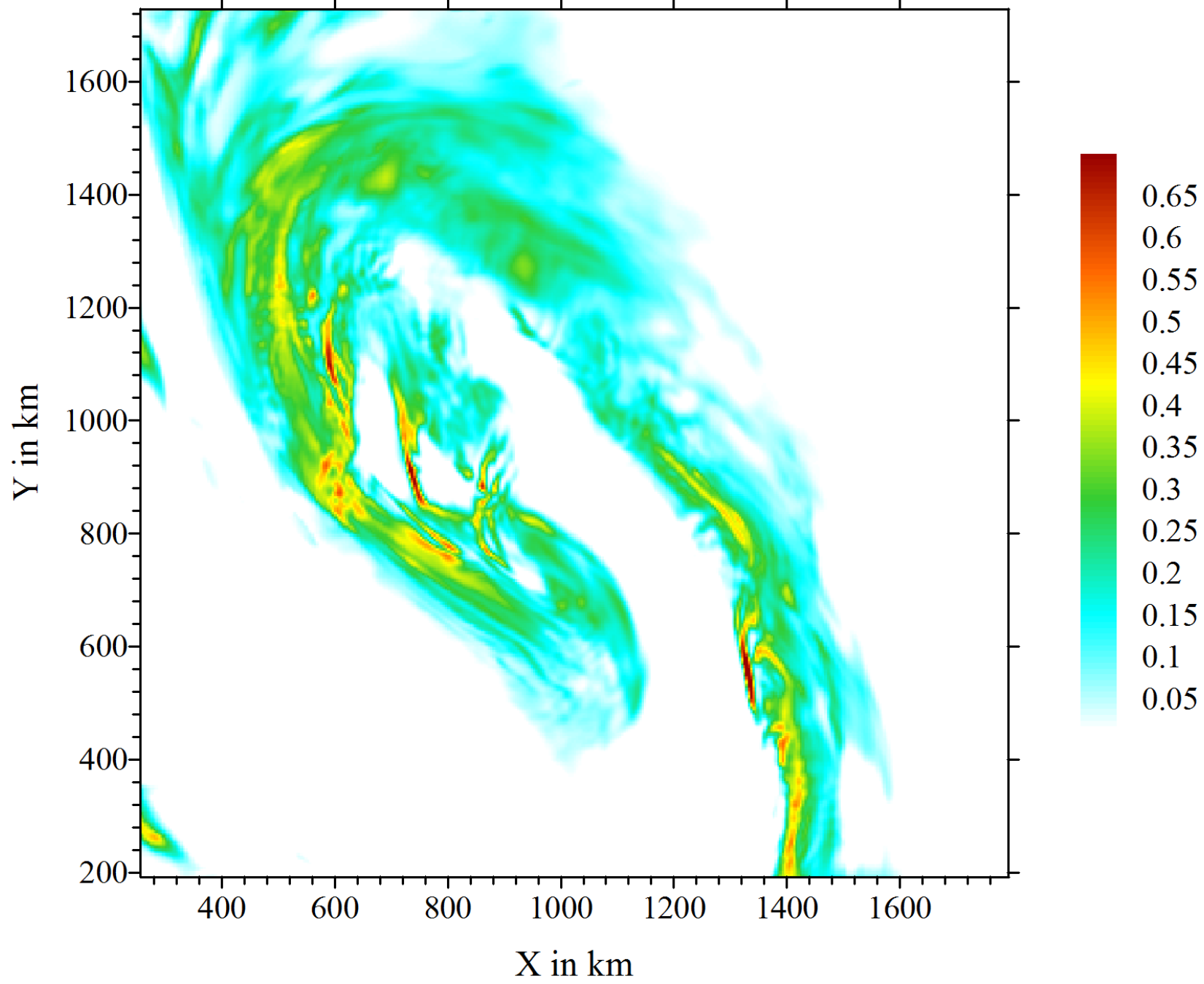
LWC (g/m³)

Z = 1.0 km t = 180 min



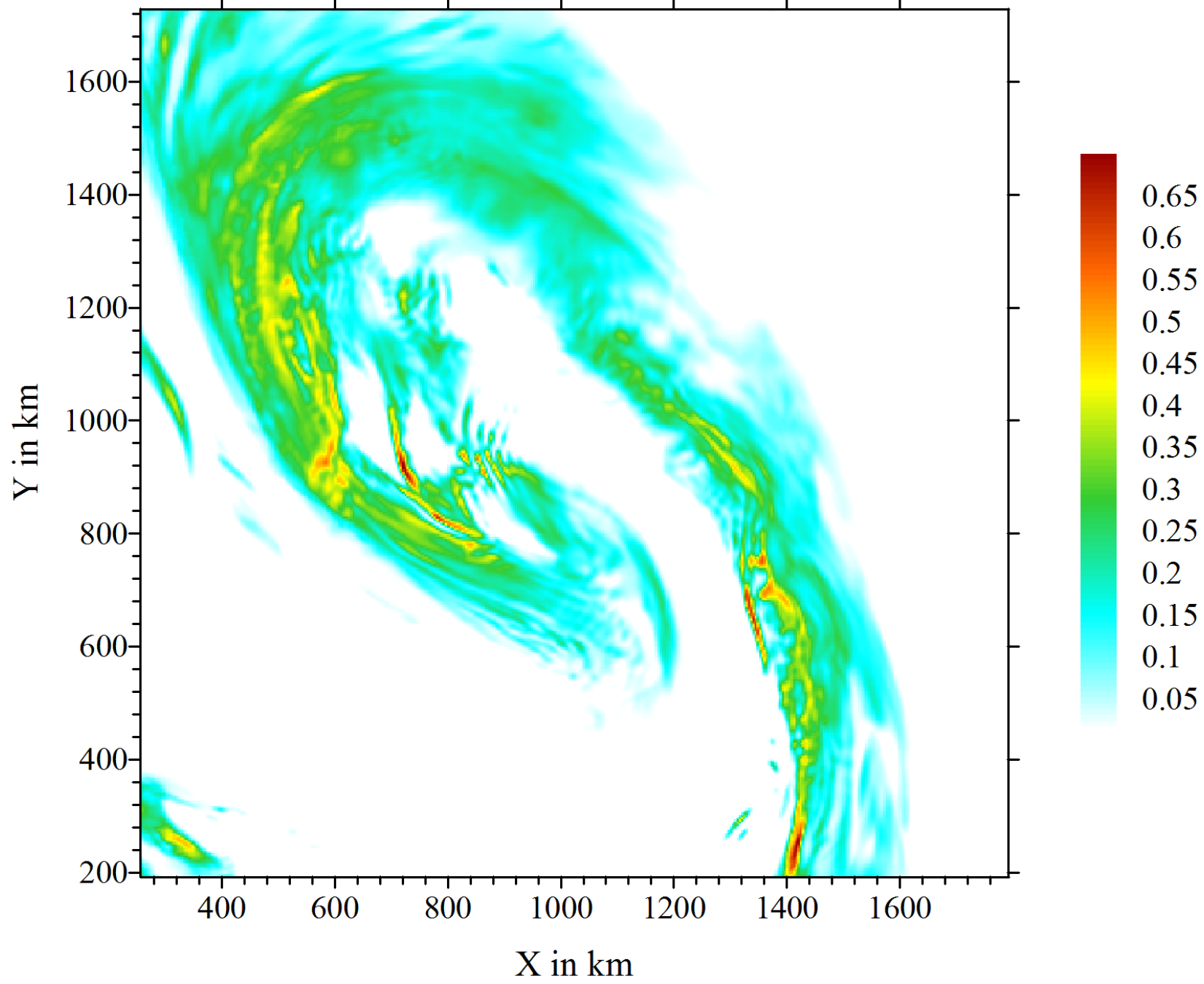
LWC (g/m³)

Z = 1.0 km t = 240 min



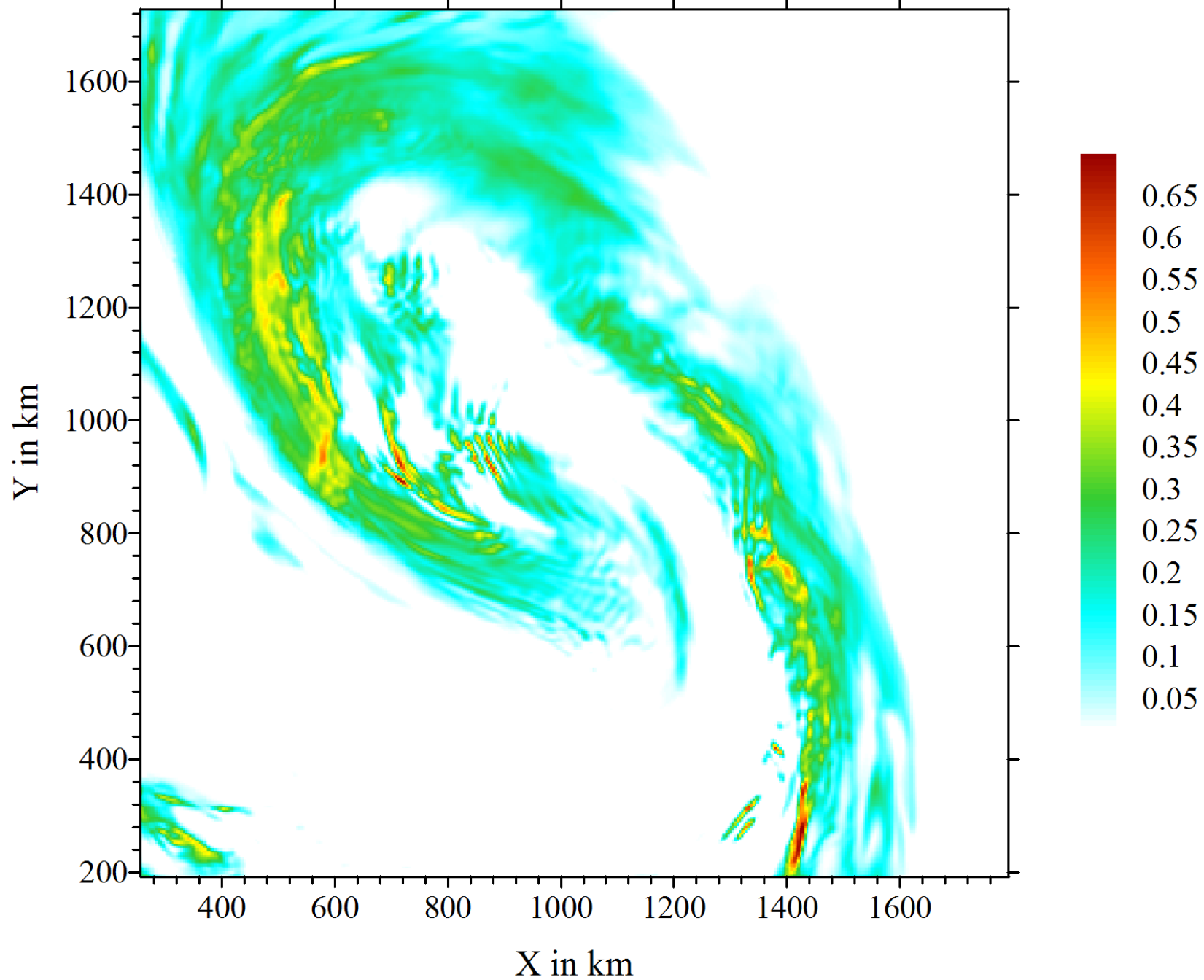
LWC (g/m³)

Z = 1.0 km t = 300 min



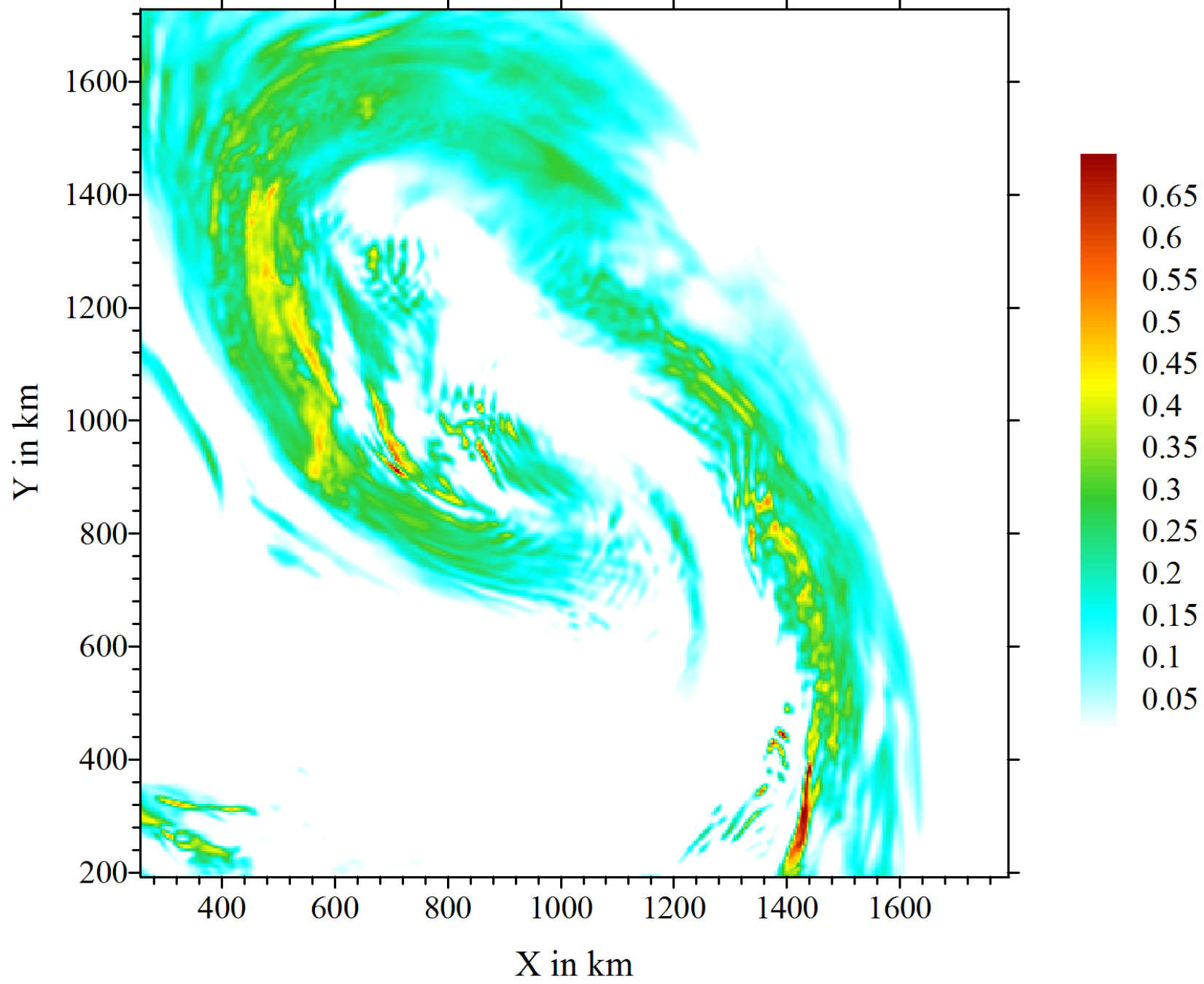
LWC (g/m³)

Z = 1.0 km t = 330 min



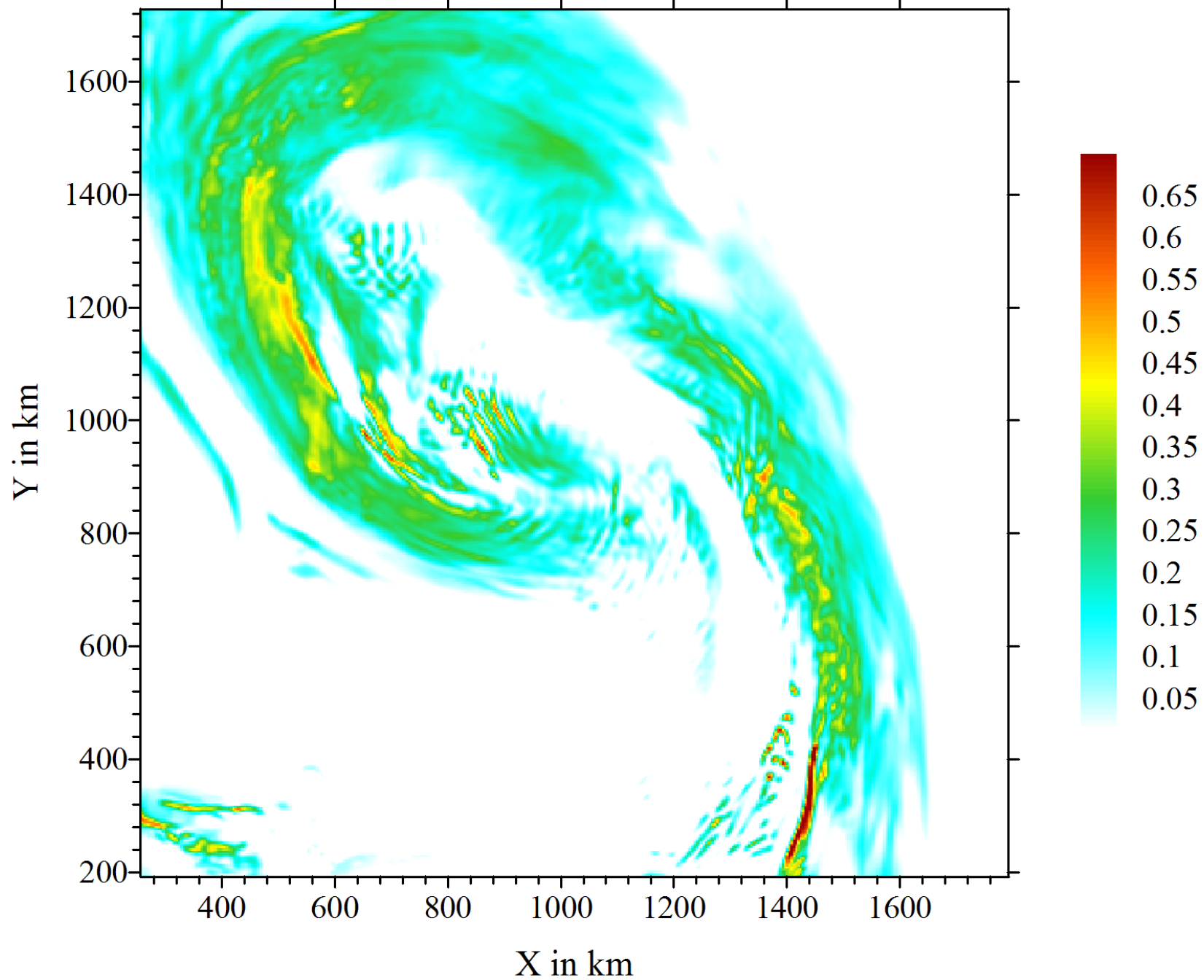
LWC (g/m³)

Z = 1.0 km t = 360 min



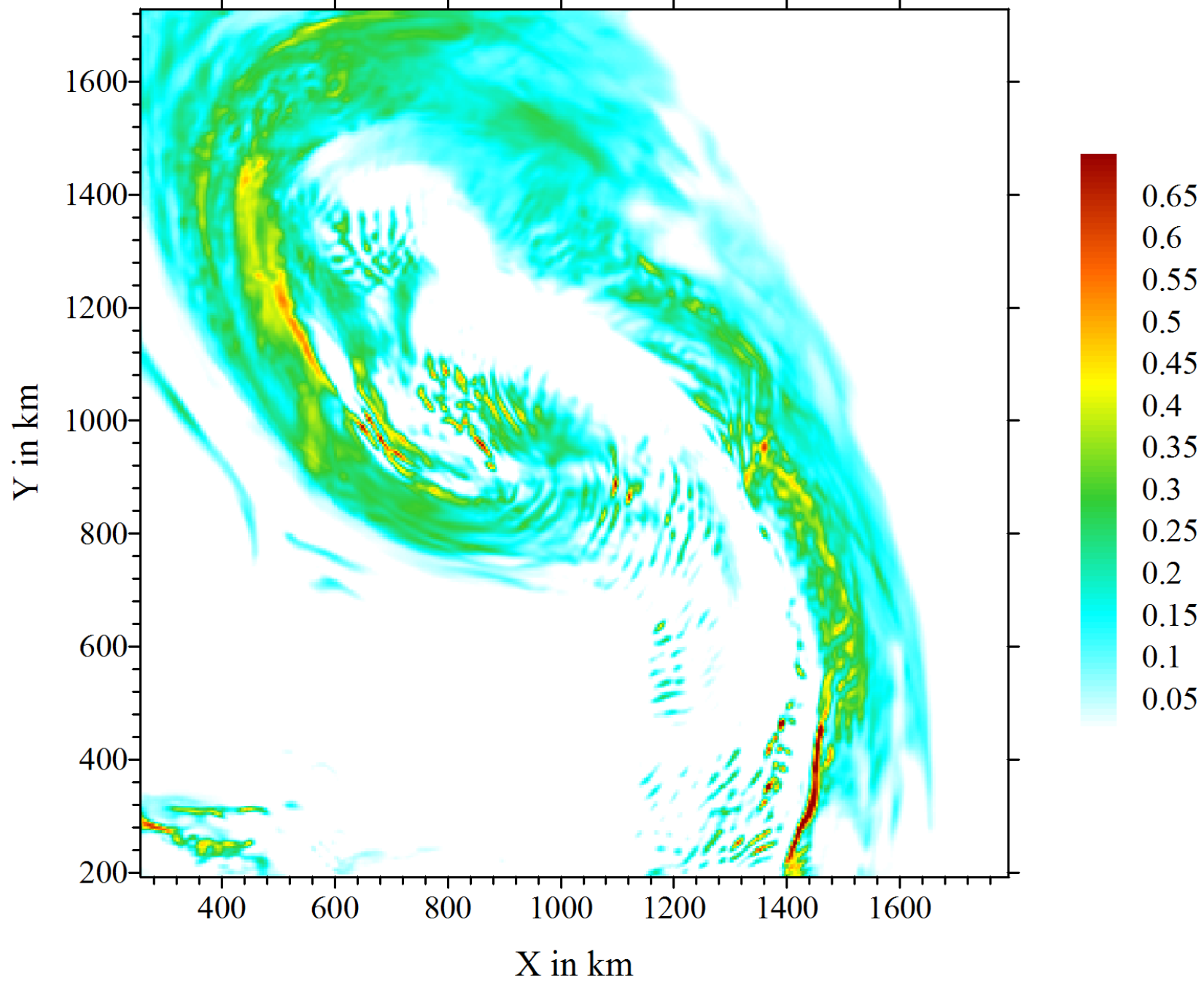
LWC (g/m³)

Z = 1.0 km t = 390 min



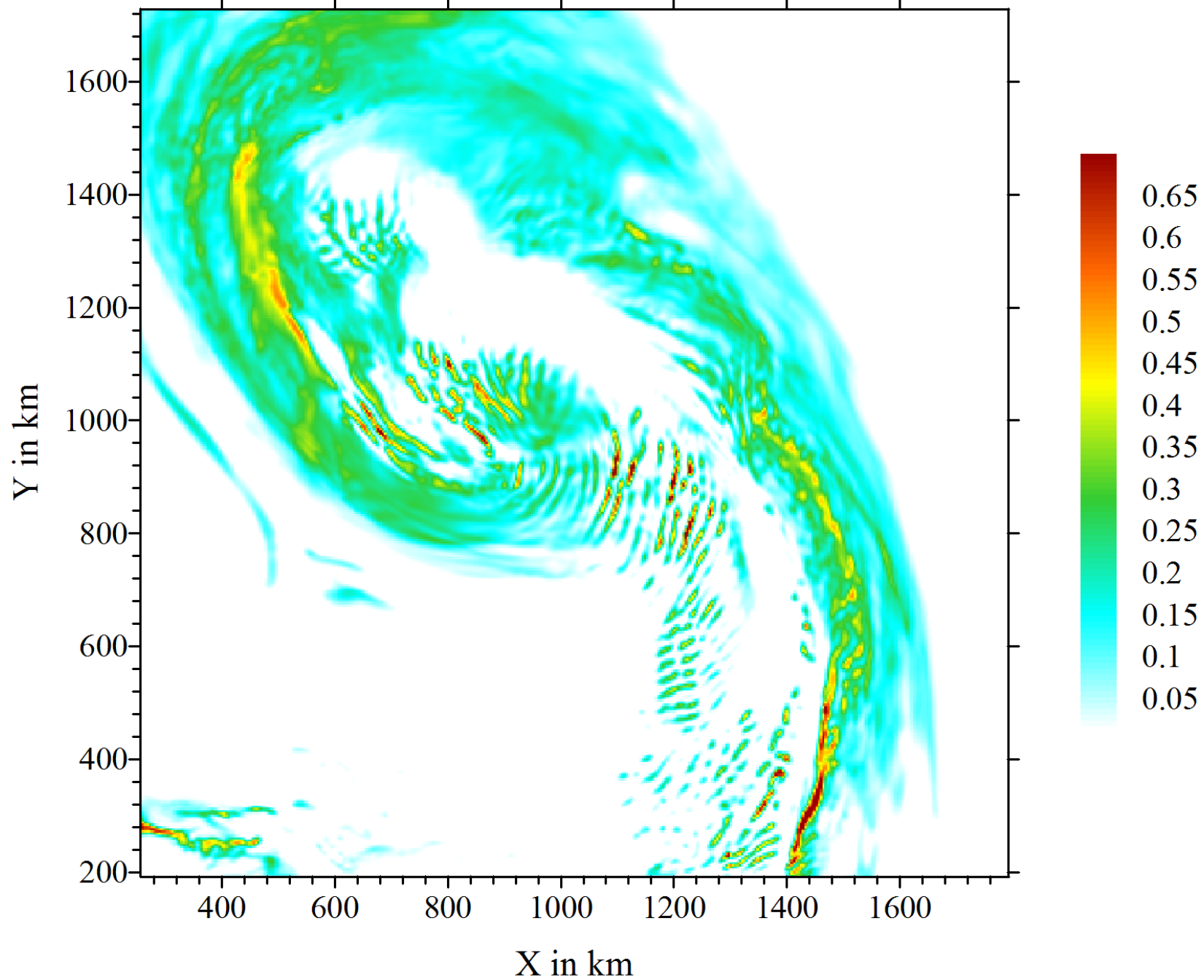
LWC (g/m³)

Z = 1.0 km t = 420 min



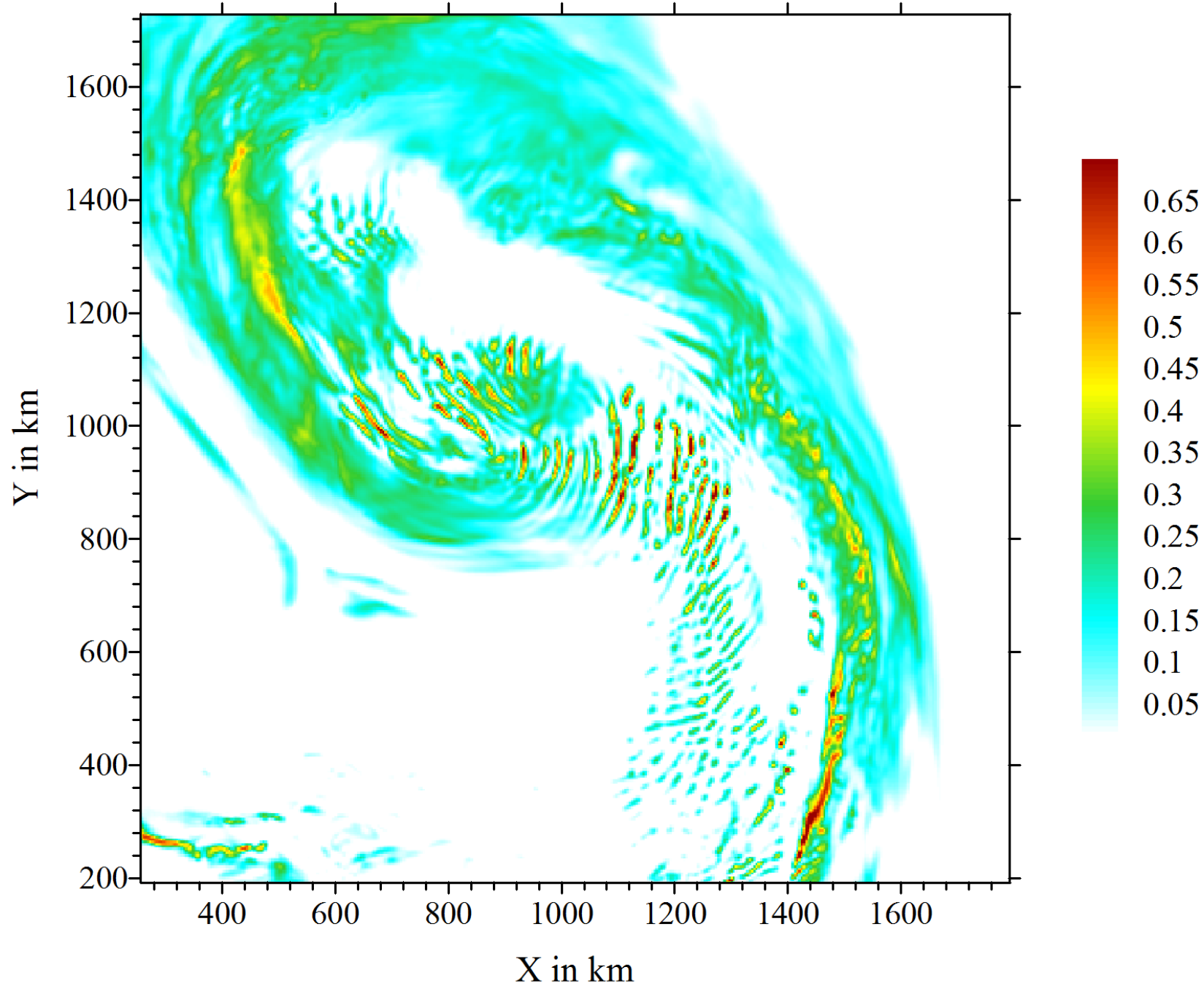
LWC (g/m³)

Z = 1.0 km t = 450 min



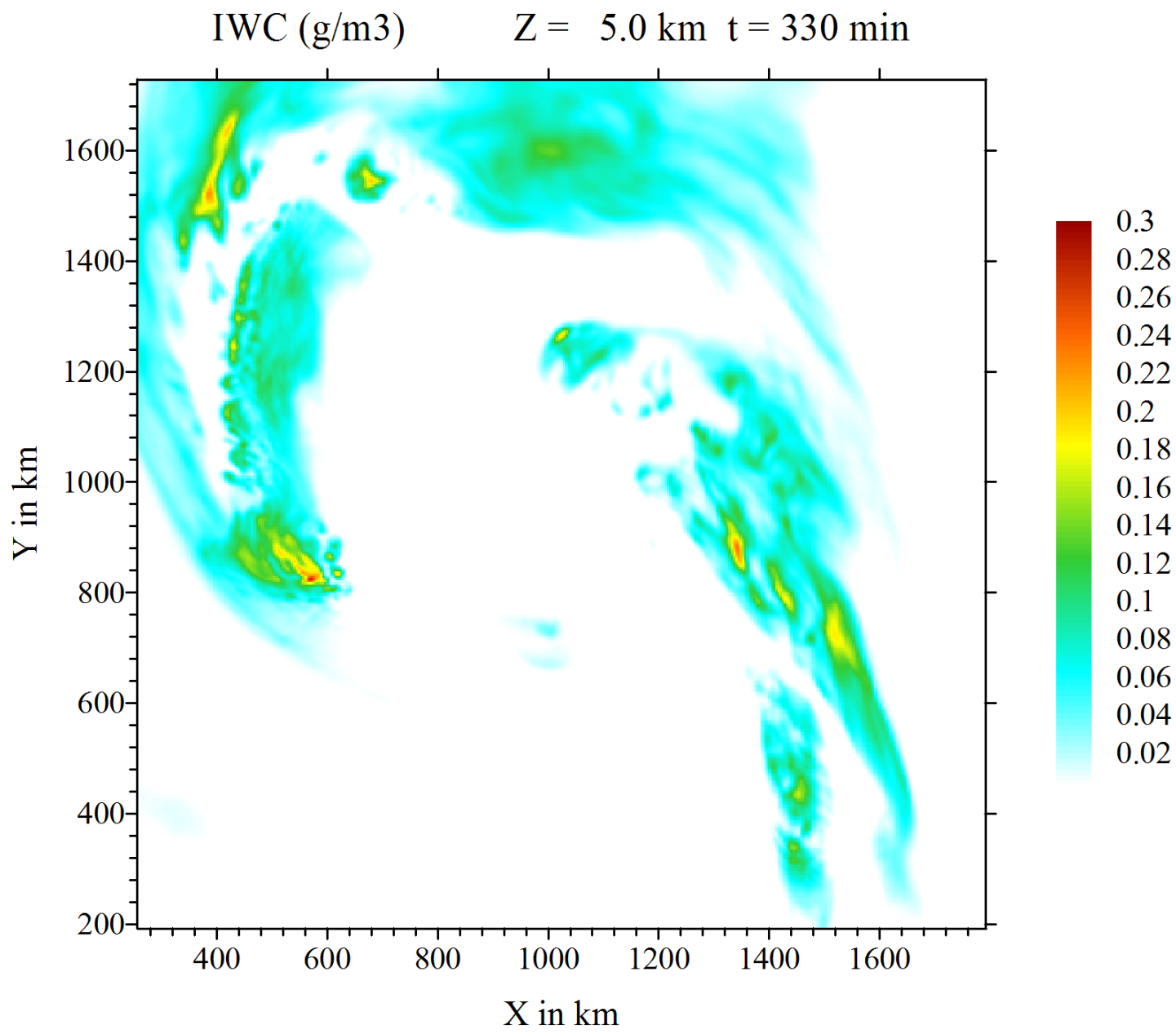
LWC (g/m³)

Z = 1.0 km t = 480 min



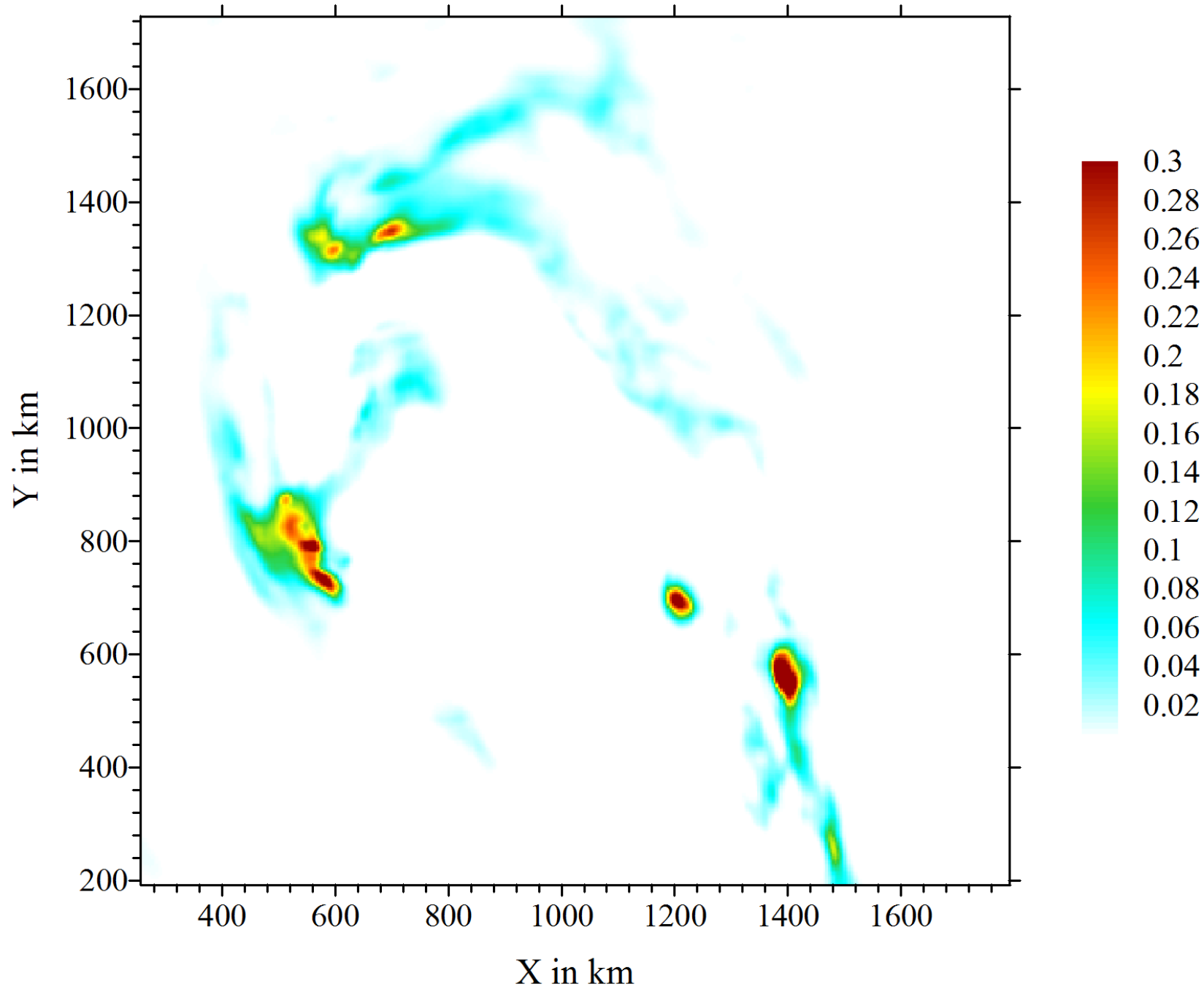
**Simulation of IWC
in domain 2
from 6 – 14 h**

DESCAM



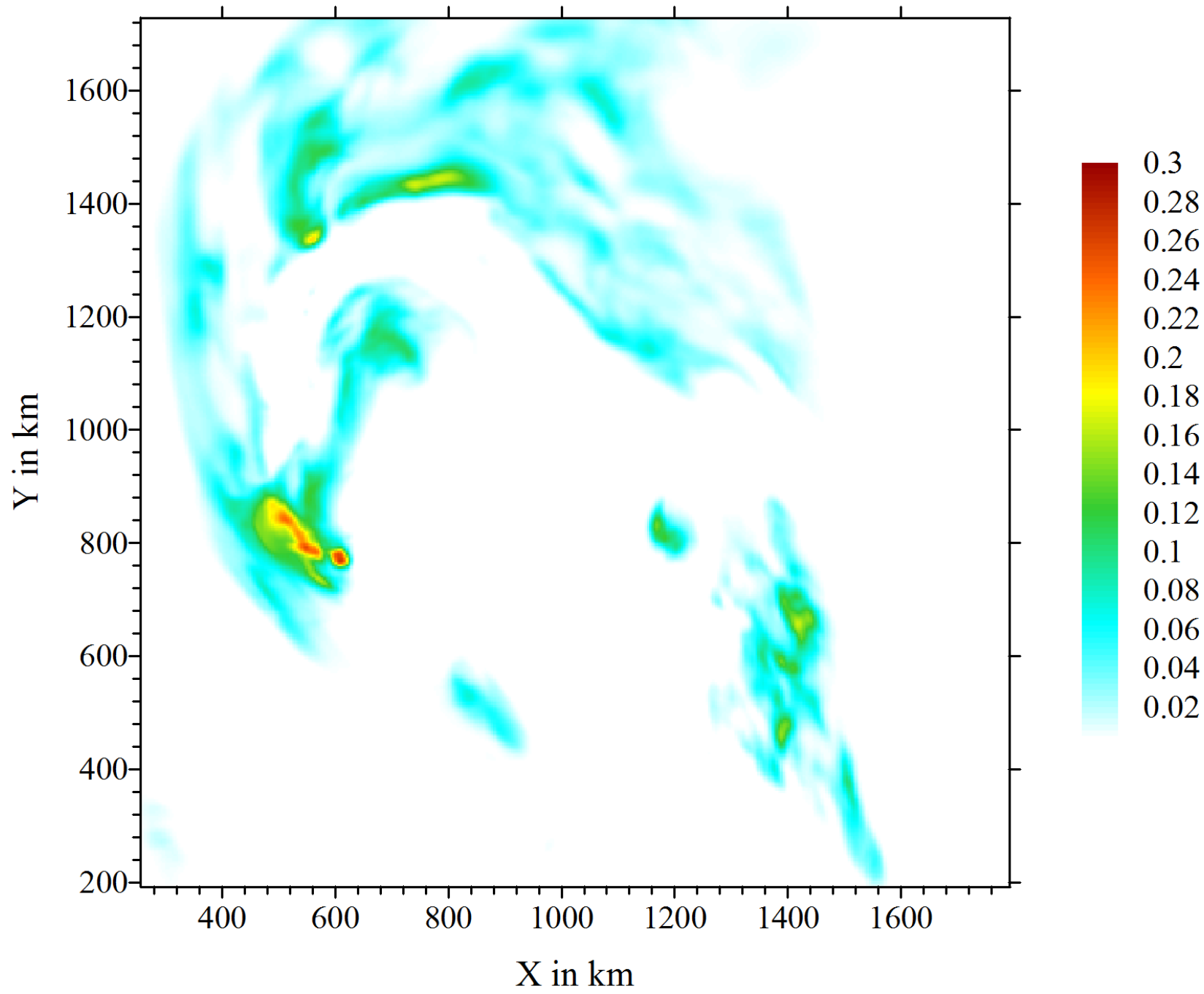
IWC (g/m³)

Z = 5.0 km t = 60 min



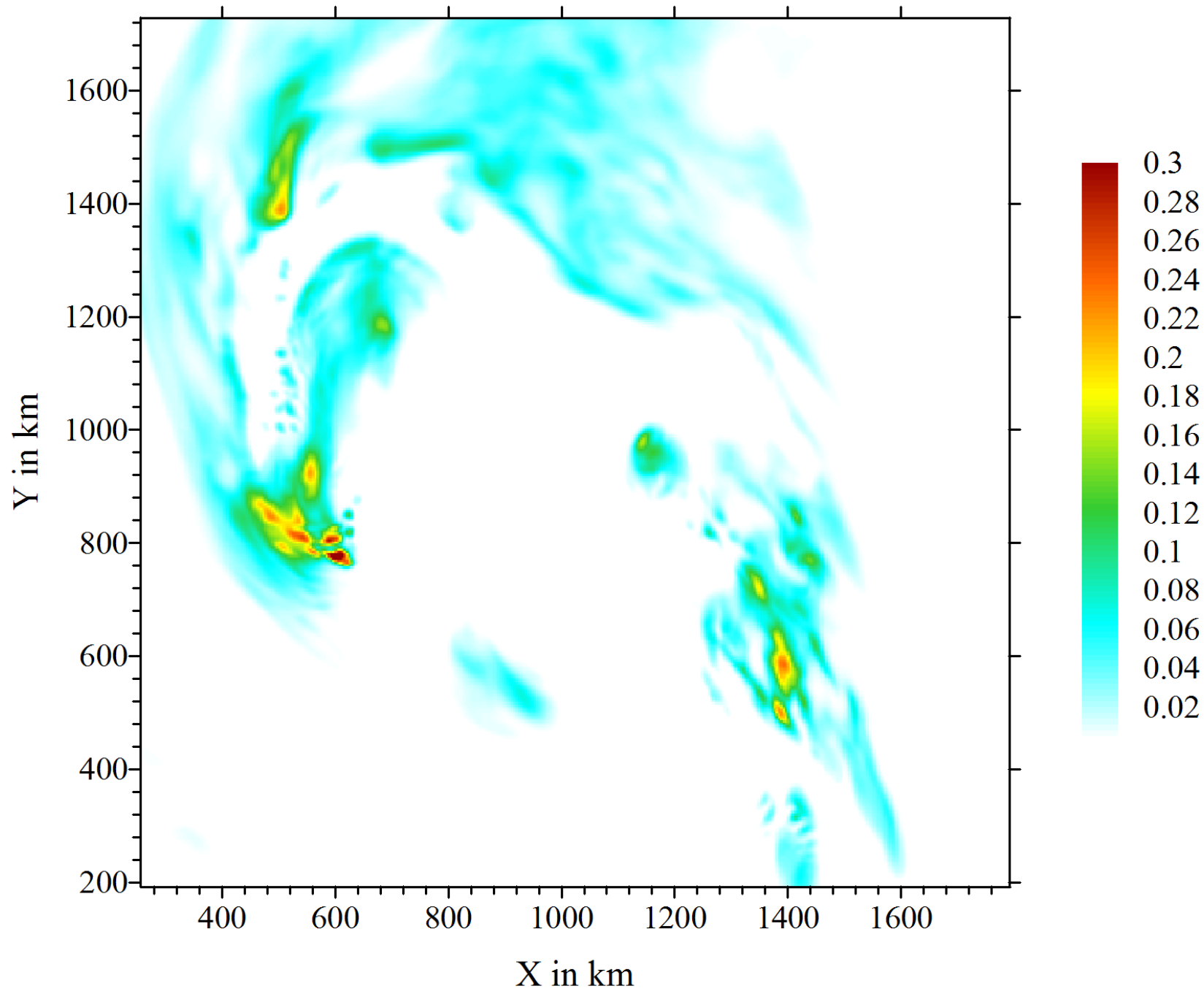
IWC (g/m³)

Z = 5.0 km t = 120 min



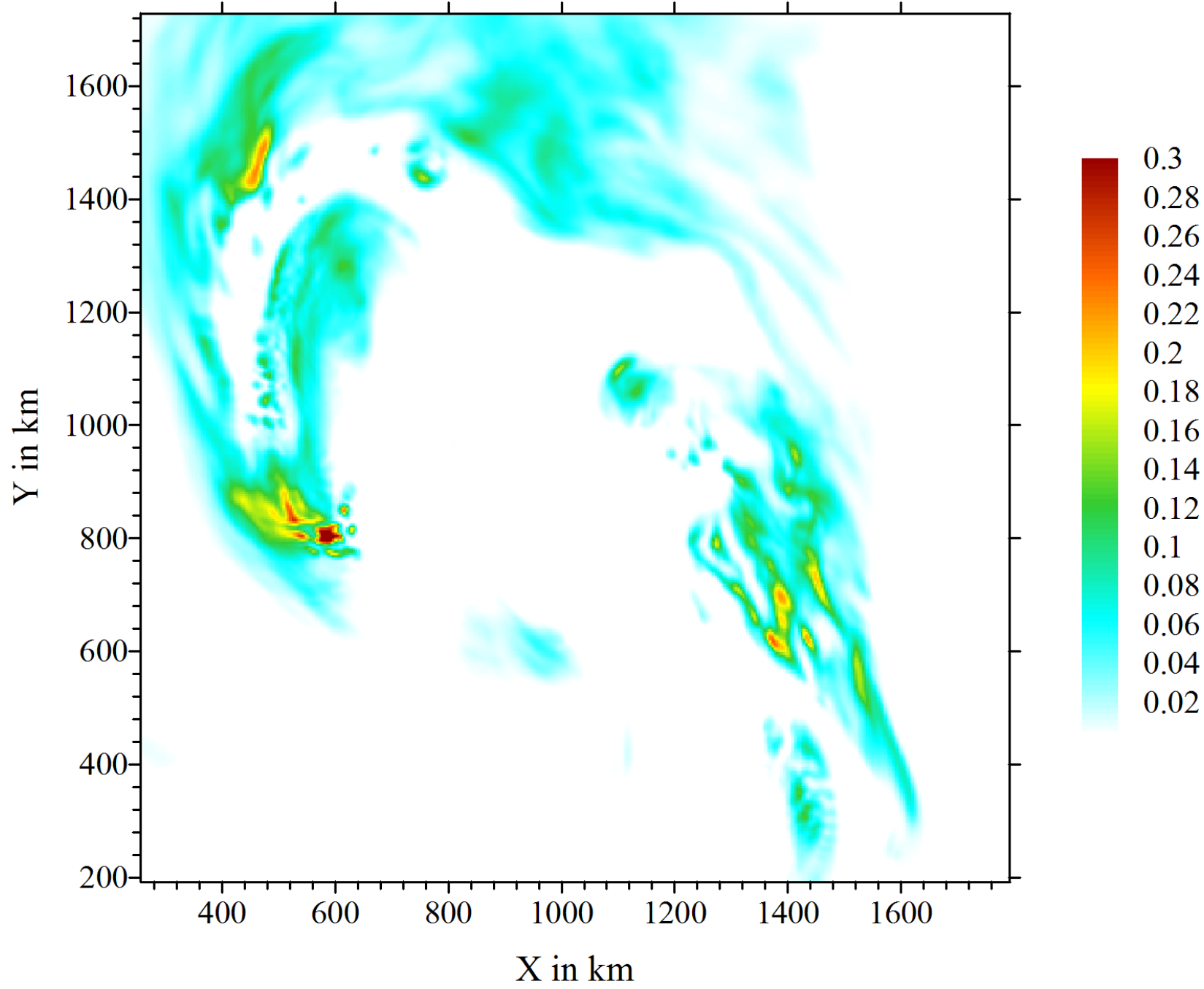
IWC (g/m³)

Z = 5.0 km t = 180 min



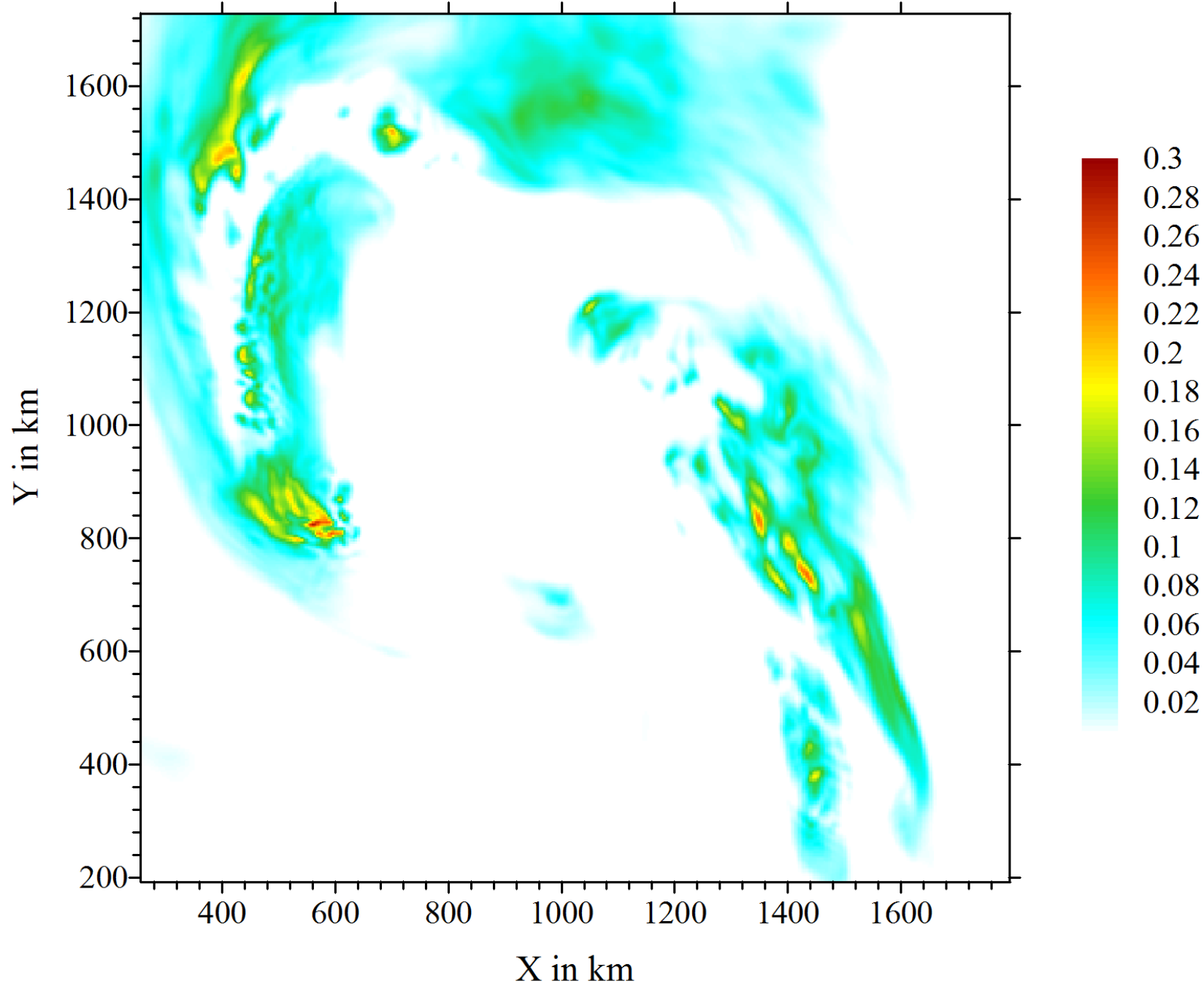
IWC (g/m³)

Z = 5.0 km t = 240 min



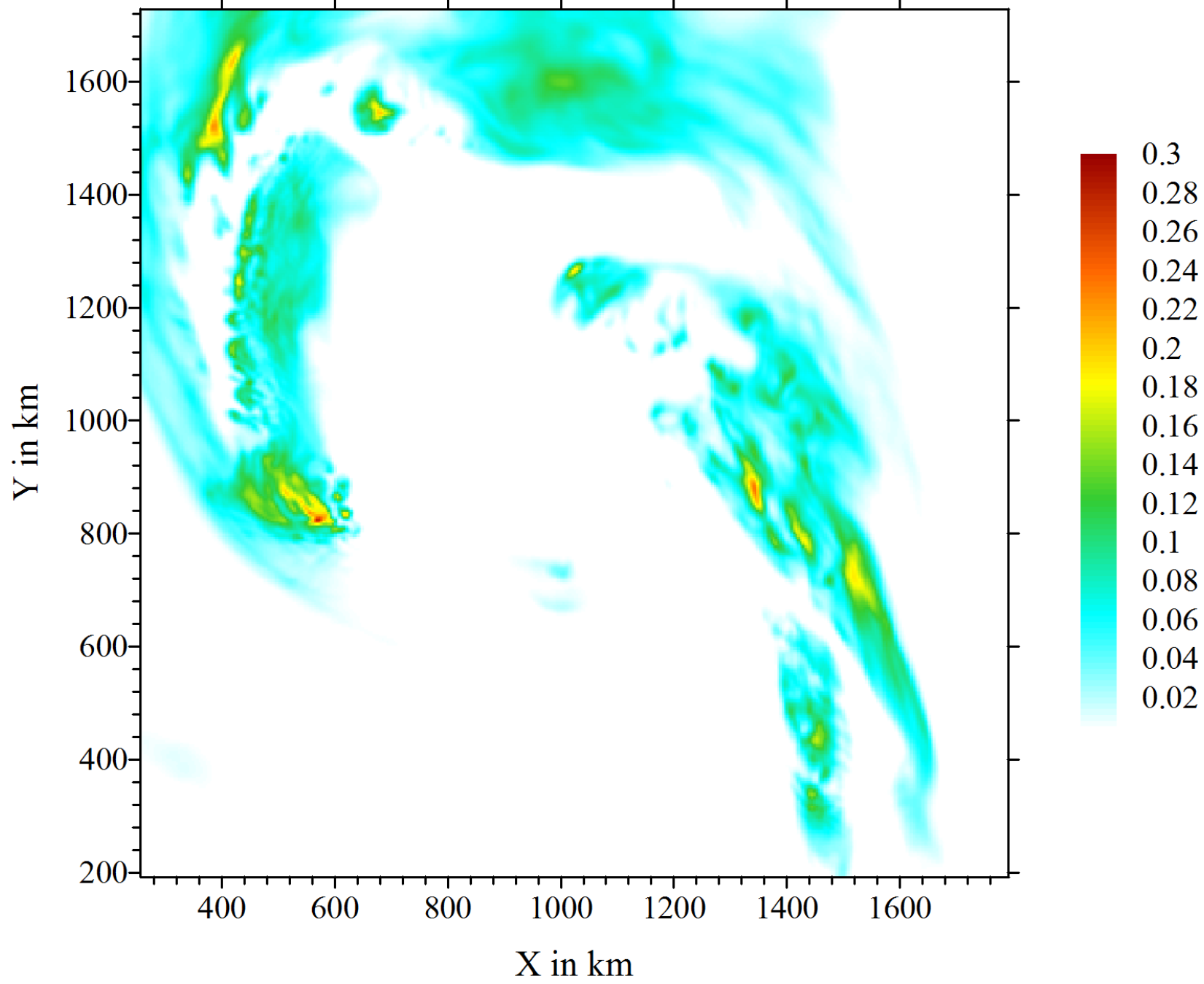
IWC (g/m³)

Z = 5.0 km t = 300 min



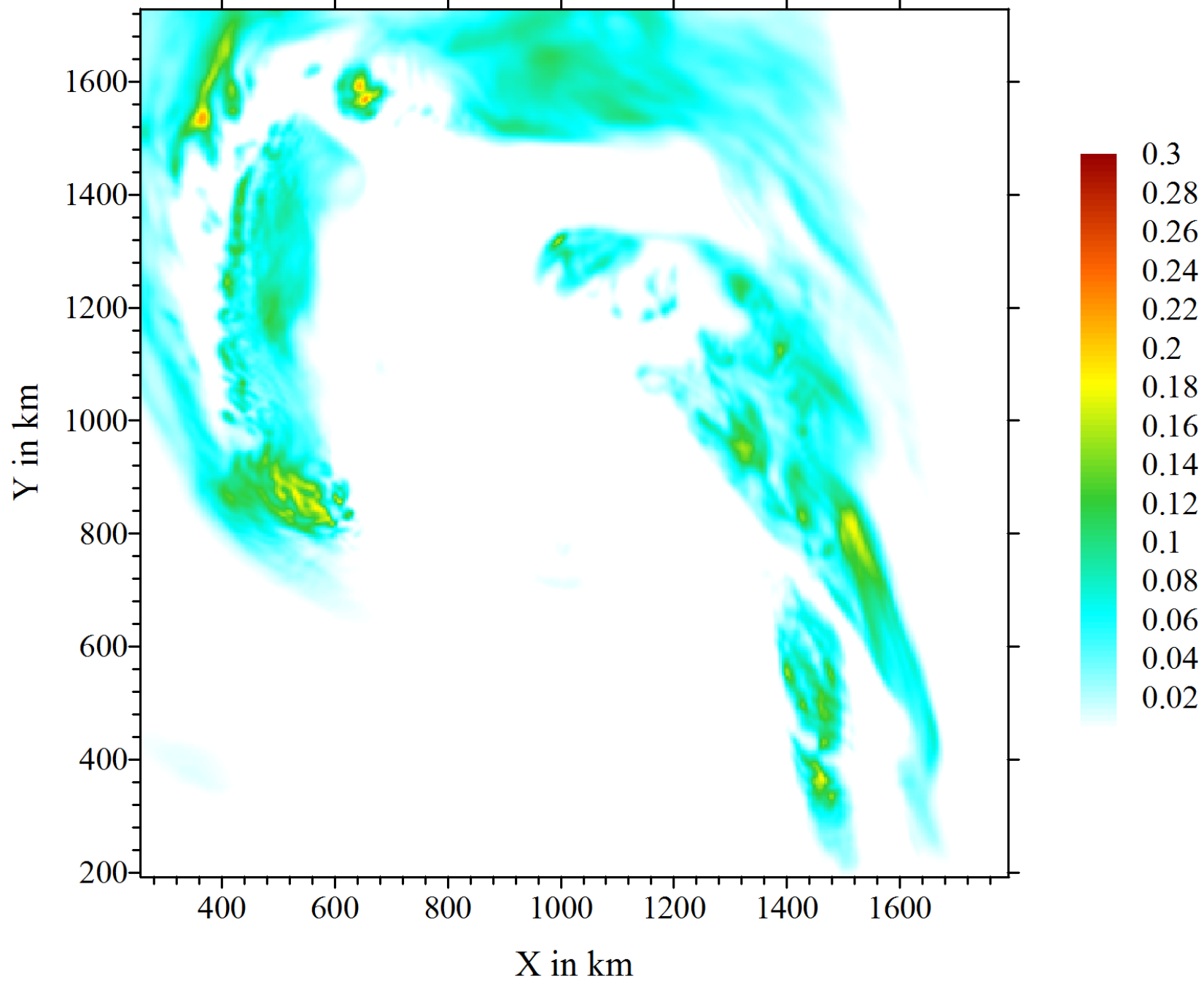
IWC (g/m³)

Z = 5.0 km t = 330 min



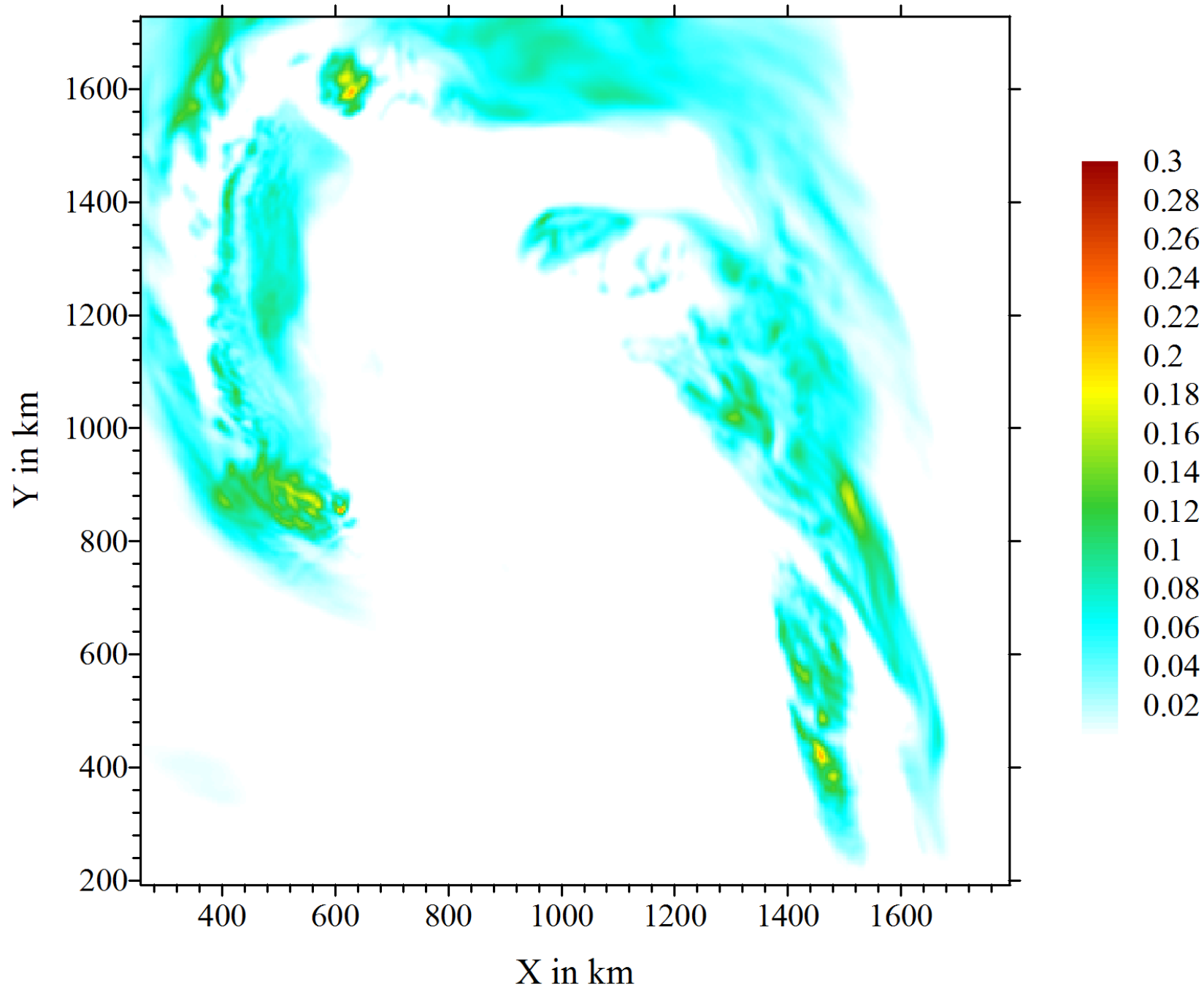
IWC (g/m³)

Z = 5.0 km t = 360 min



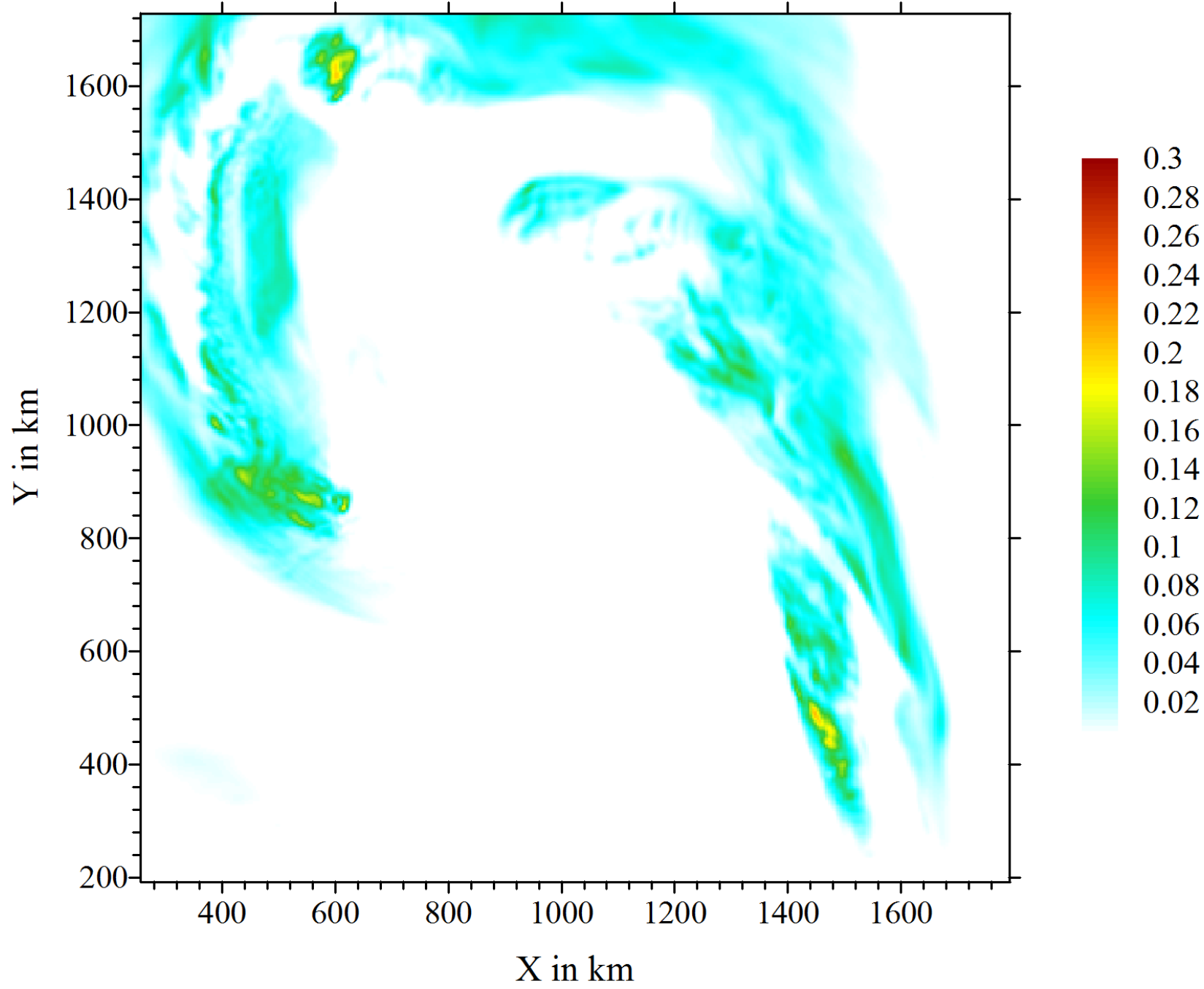
IWC (g/m³)

Z = 5.0 km t = 390 min



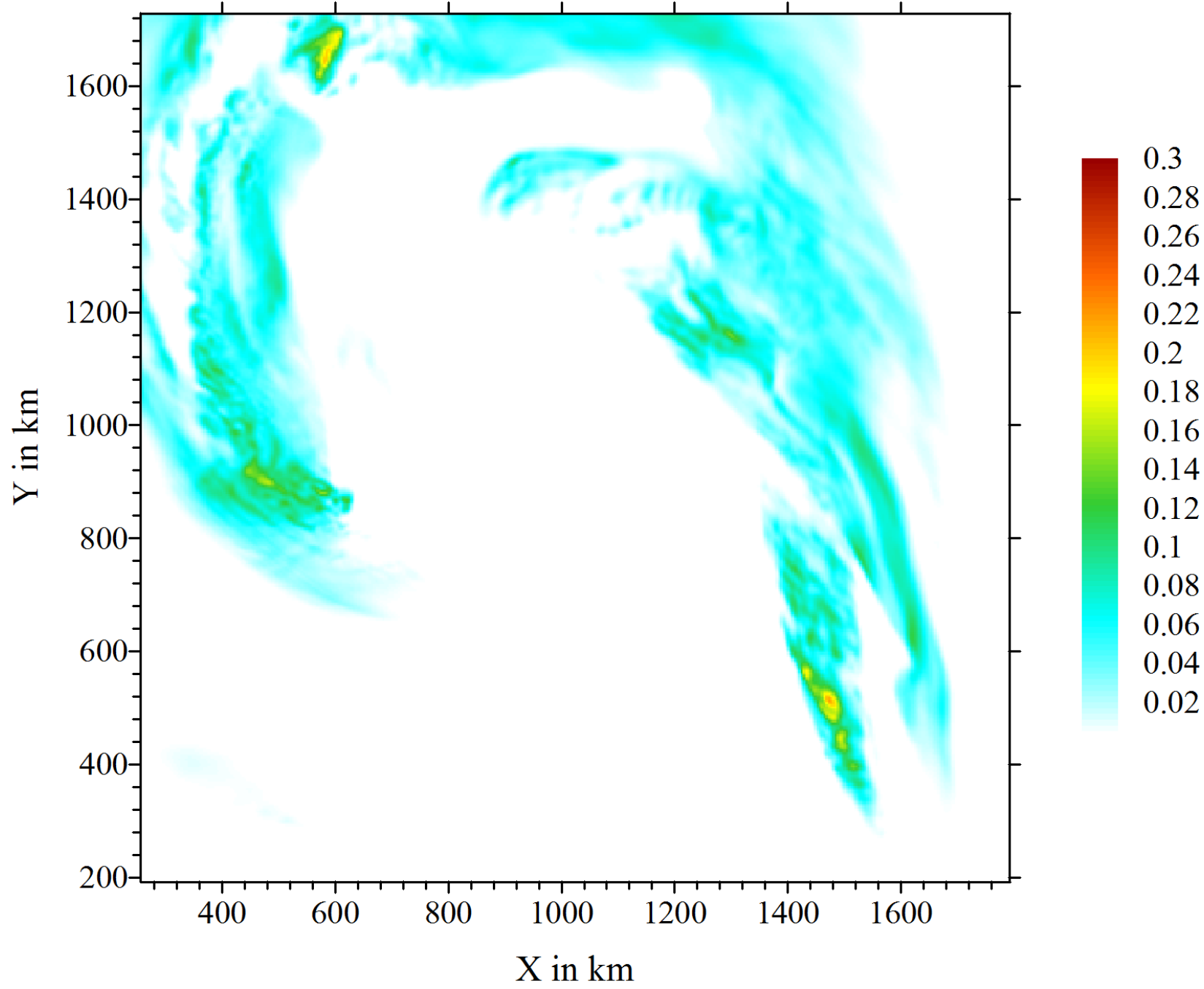
IWC (g/m³)

Z = 5.0 km t = 420 min



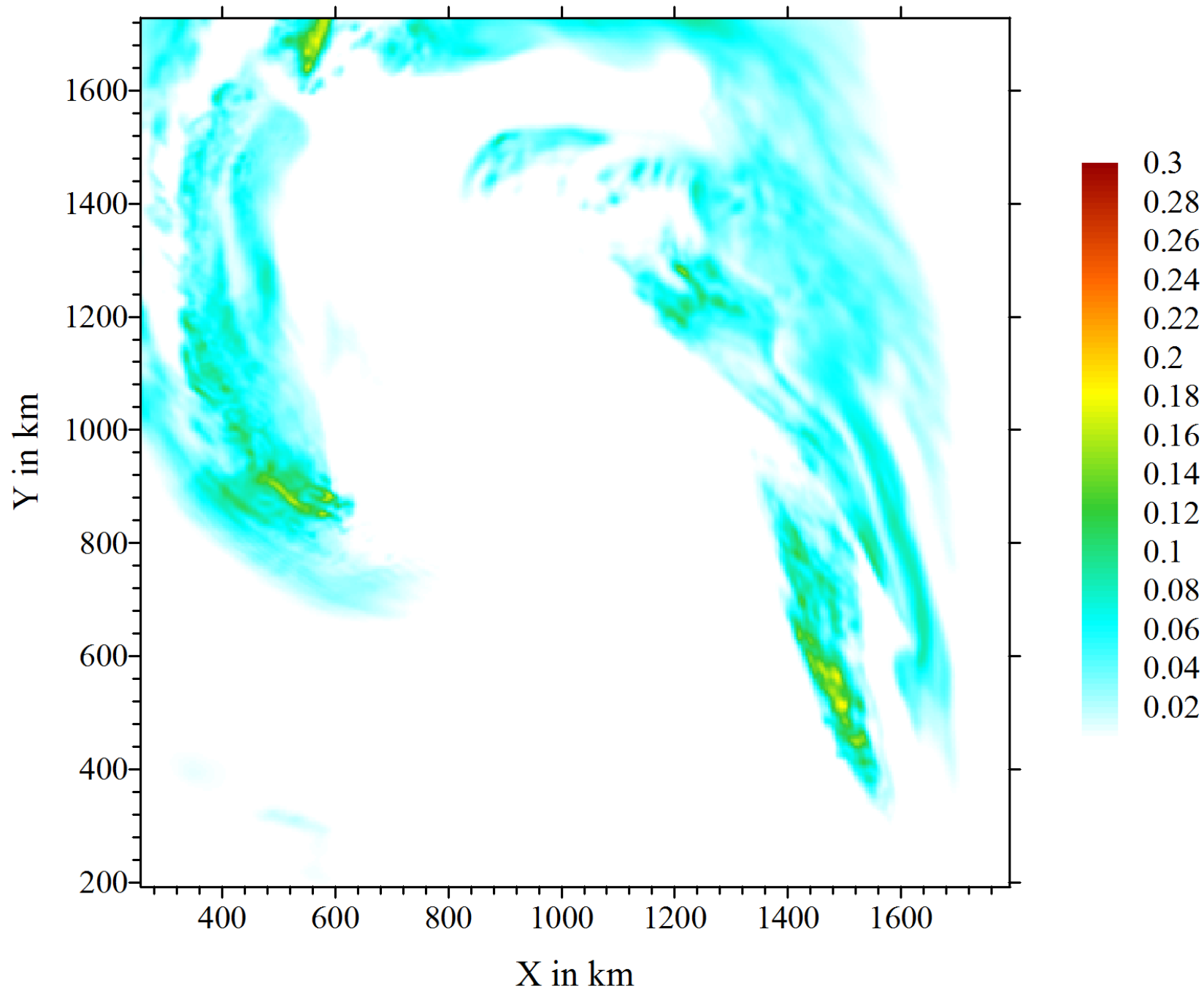
IWC (g/m³)

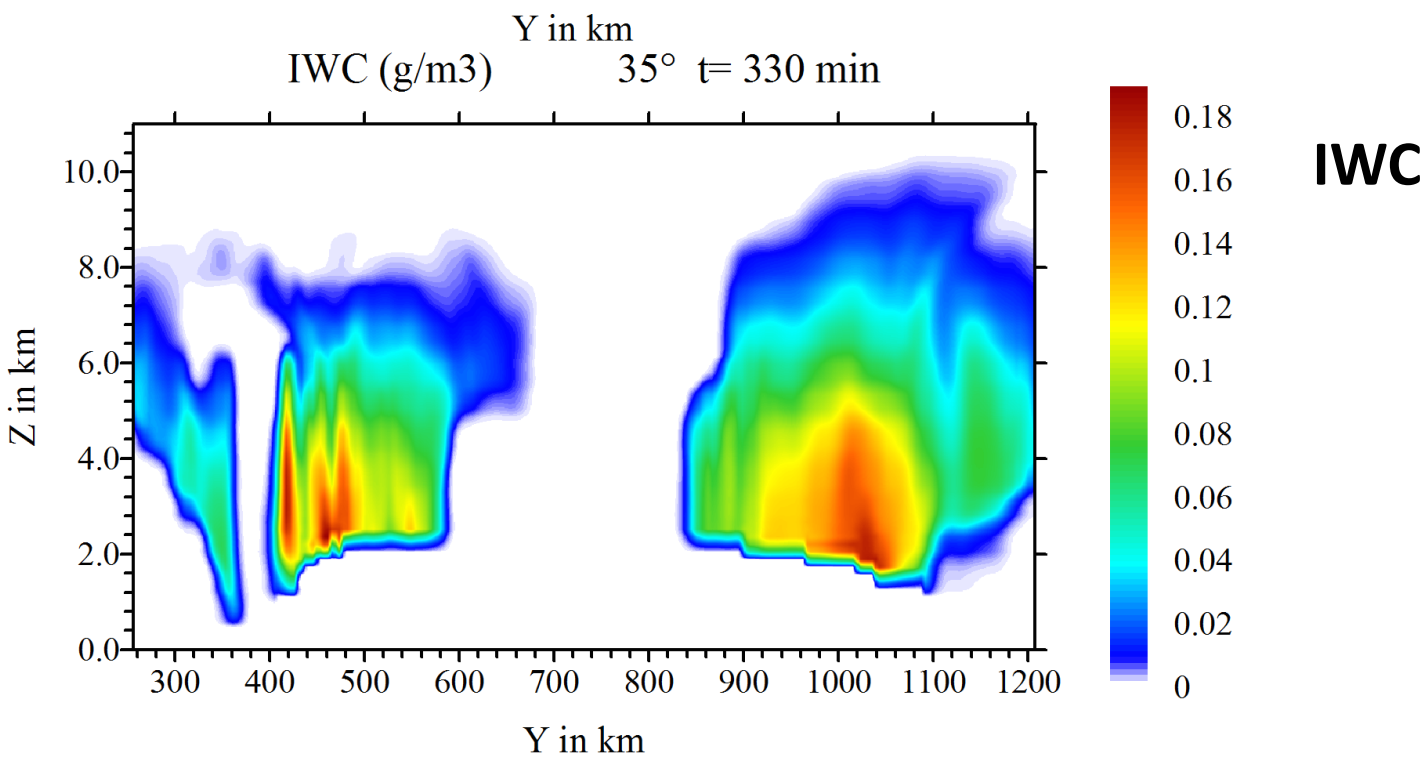
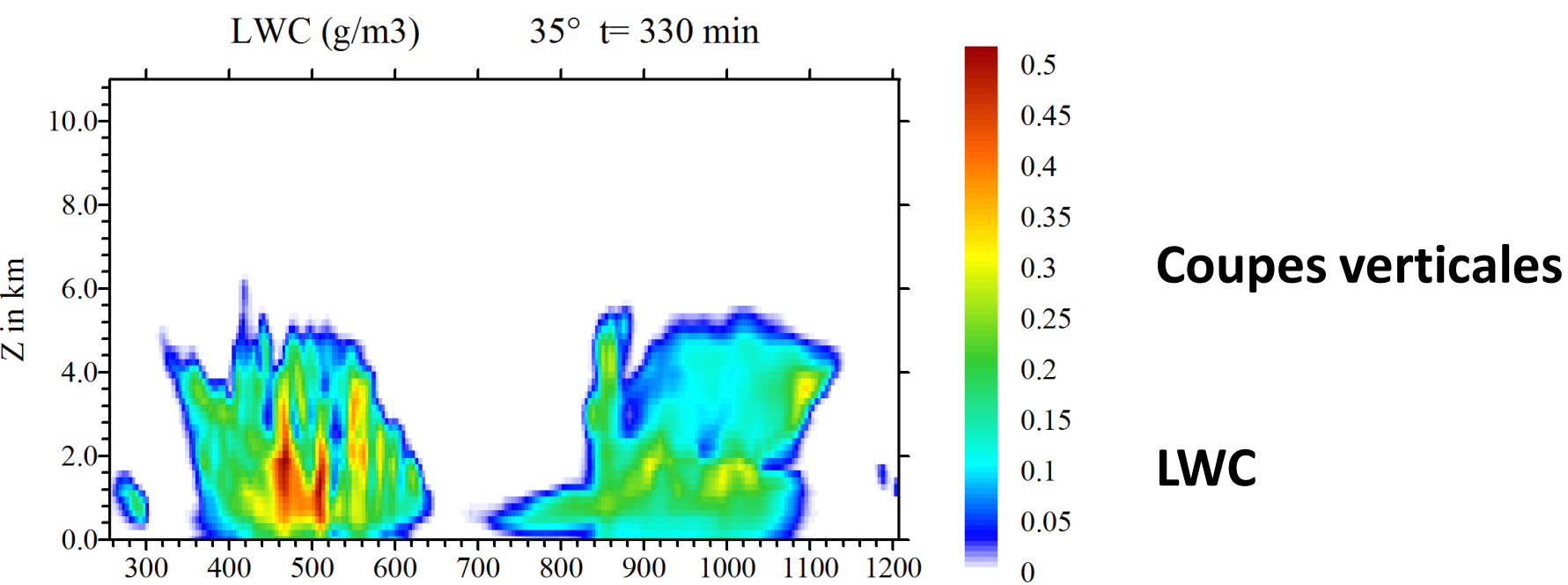
Z = 5.0 km t = 450 min



IWC (g/m³)

Z = 5.0 km t = 480 min





**Simulation of LWC
in domain 2
from 00 – 15 h**

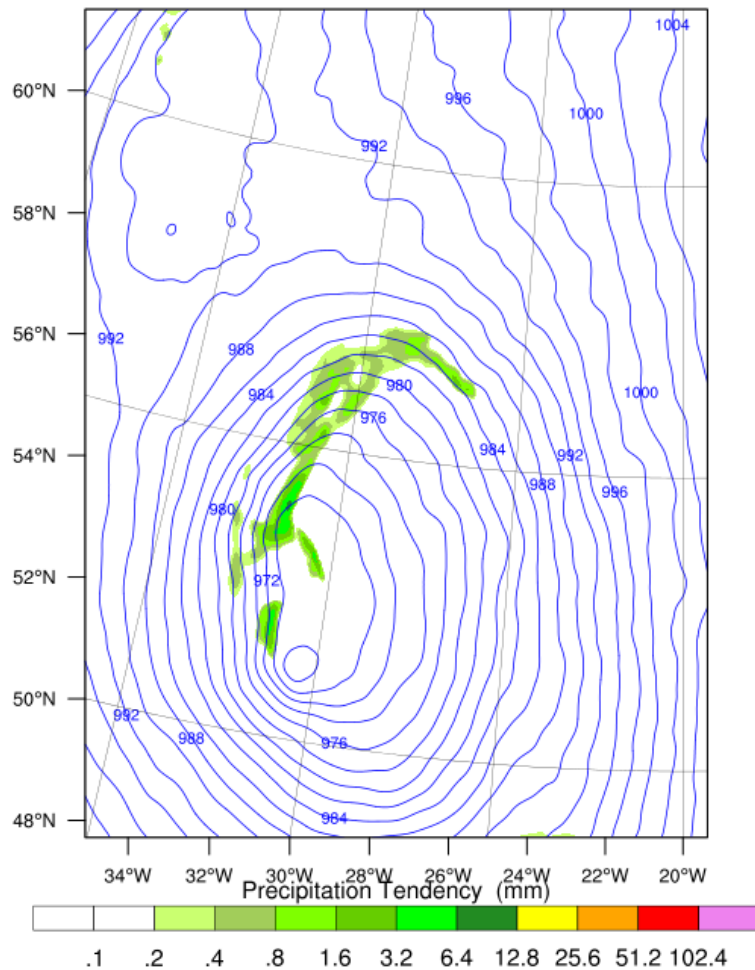
**WRF
–Thompson**

using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_01:00:00

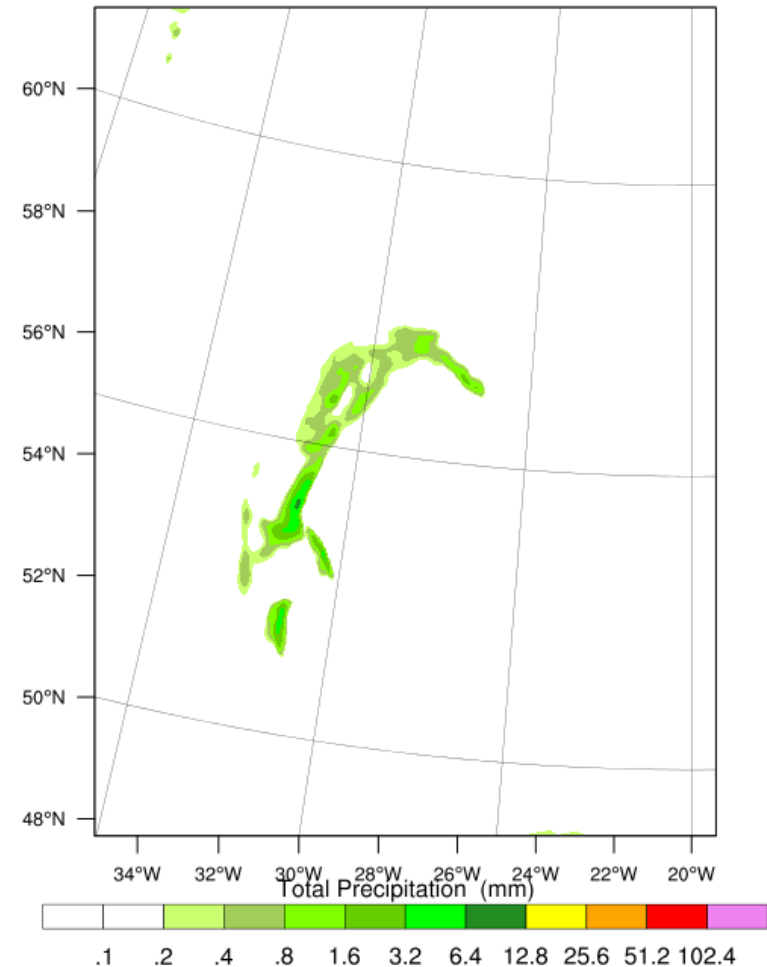
Precipitation Tendency from 2016-10-02_00:00:00 to 2016-10-02_01:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_01:00:00

Total Precipitation (mm)

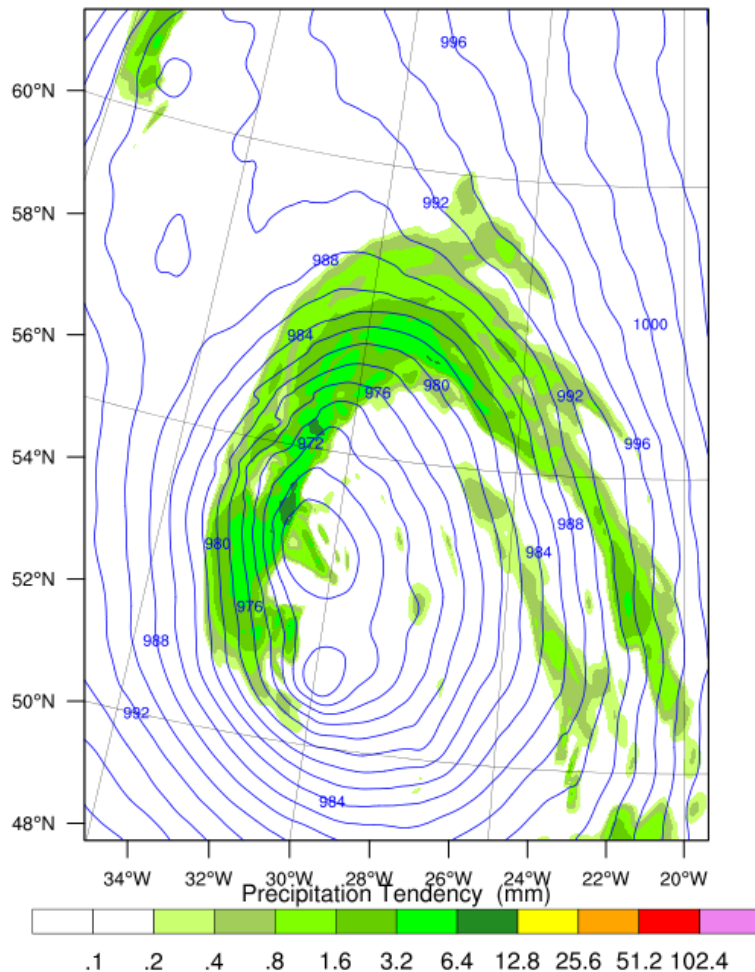


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_02:00:00

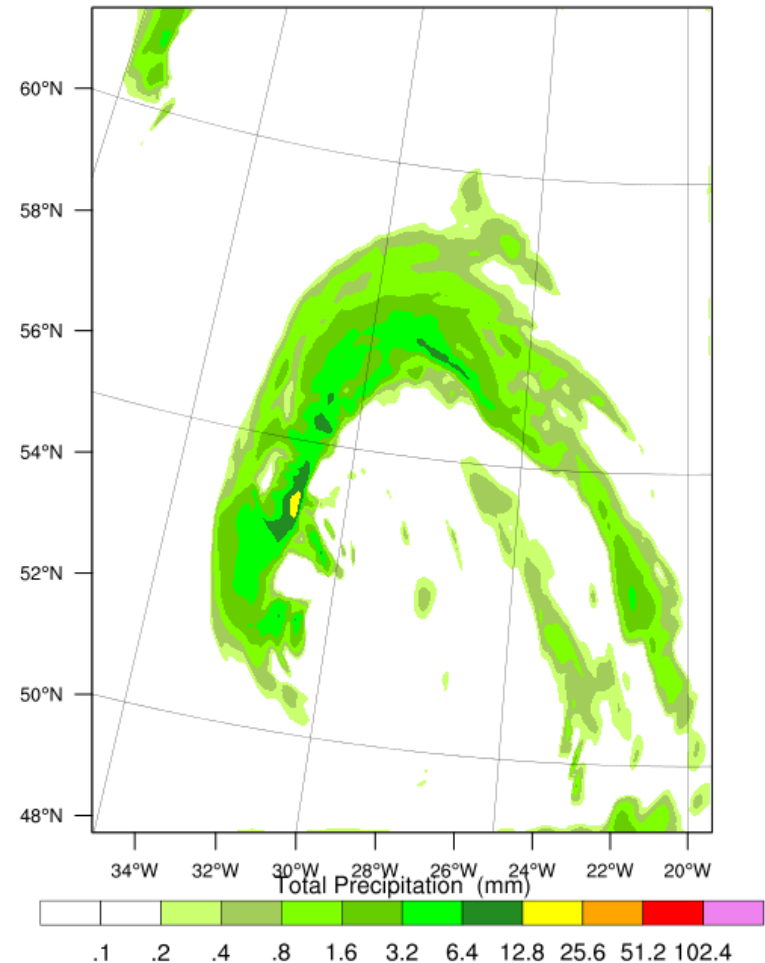
Precipitation Tendency from 2016-10-02_01:00:00 to 2016-10-02_02:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_02:00:00

Total Precipitation (mm)

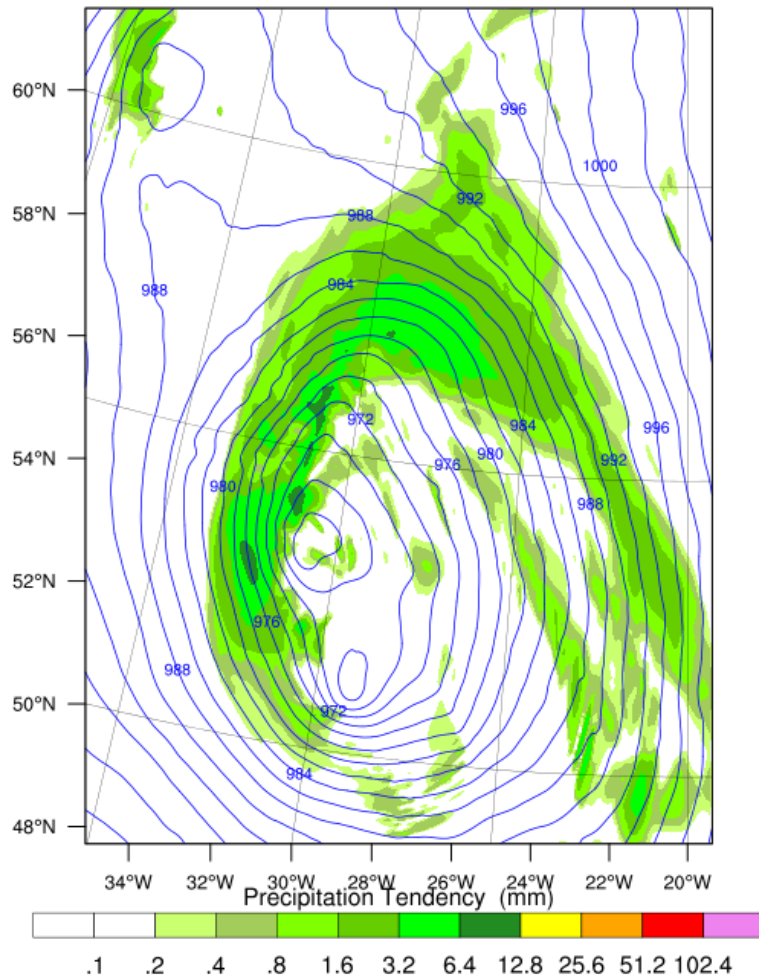


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_03:00:00

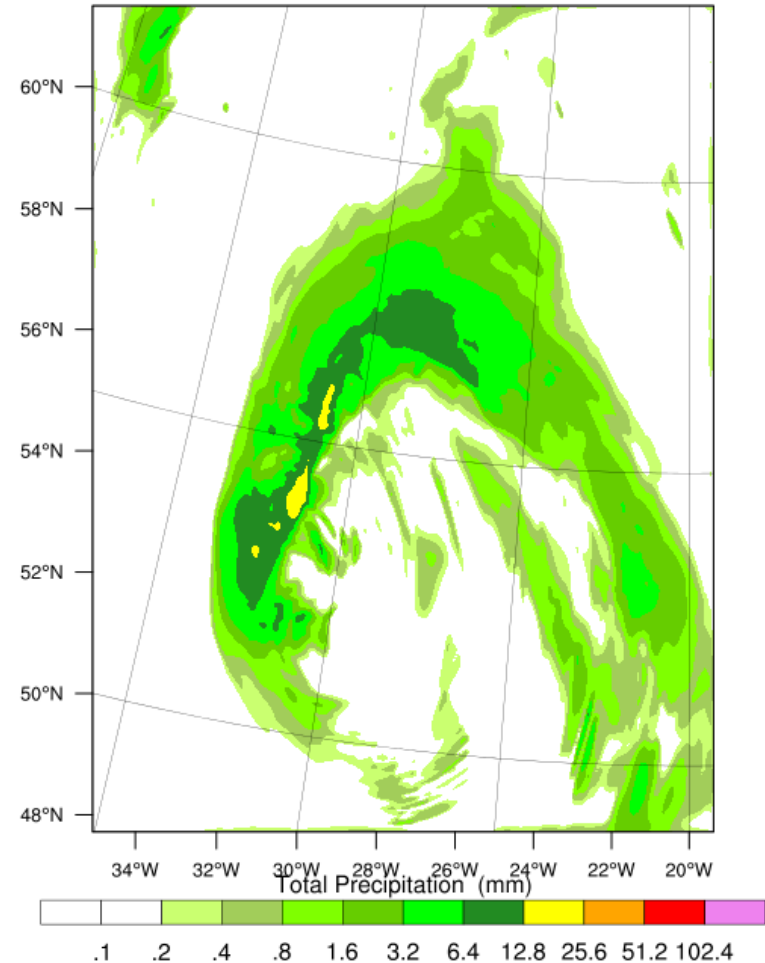
Precipitation Tendency from 2016-10-02_02:00:00 to 2016-10-02_03:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_03:00:00

Total Precipitation (mm)

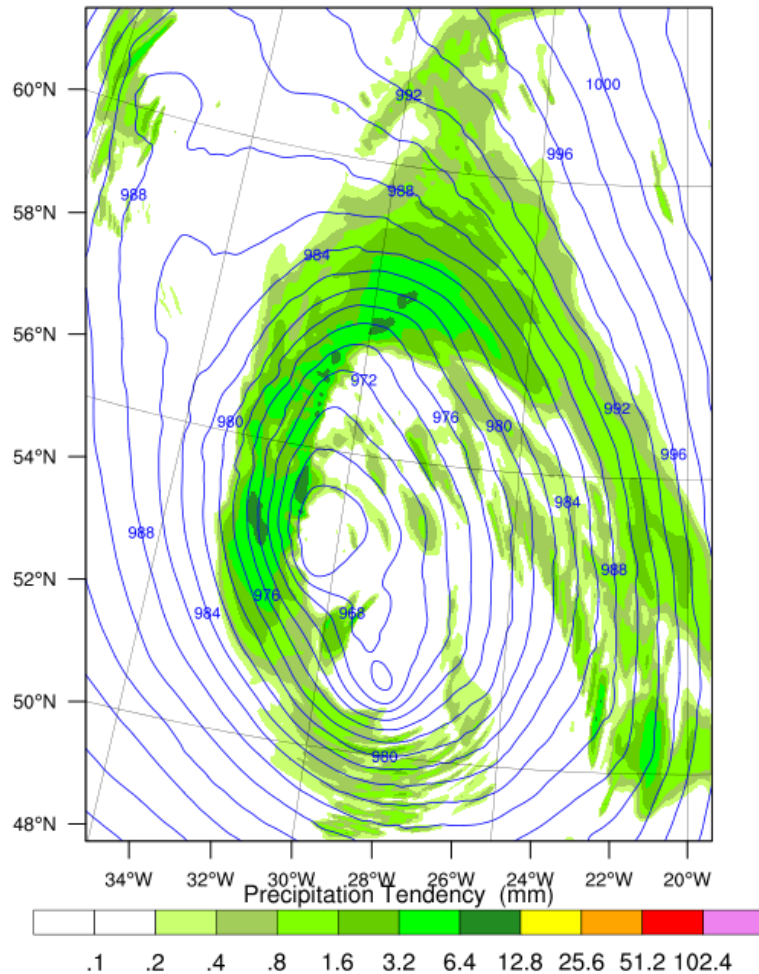


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_04:00:00

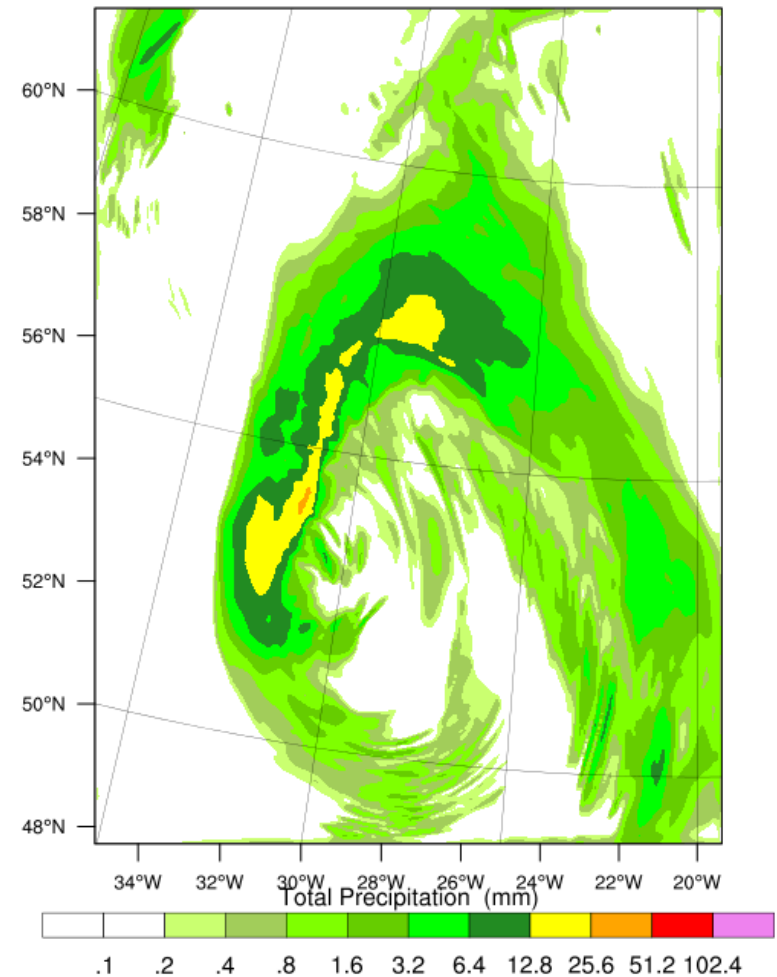
Precipitation Tendency from 2016-10-02_03:00:00 to 2016-10-02_04:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_04:00:00

Total Precipitation (mm)

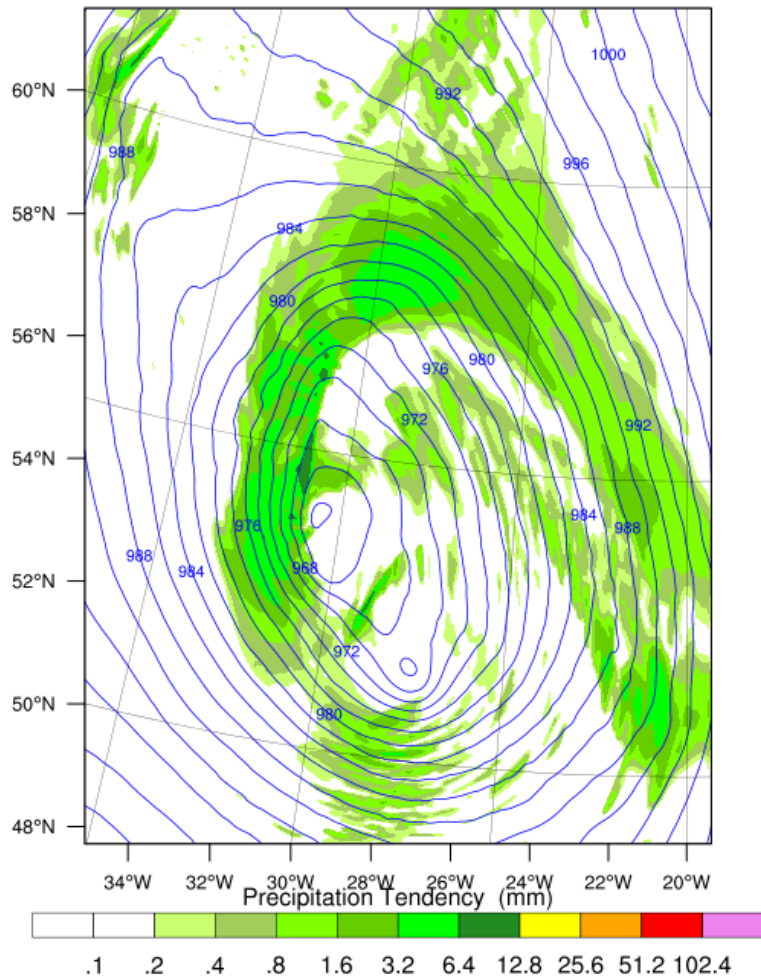


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_05:00:00

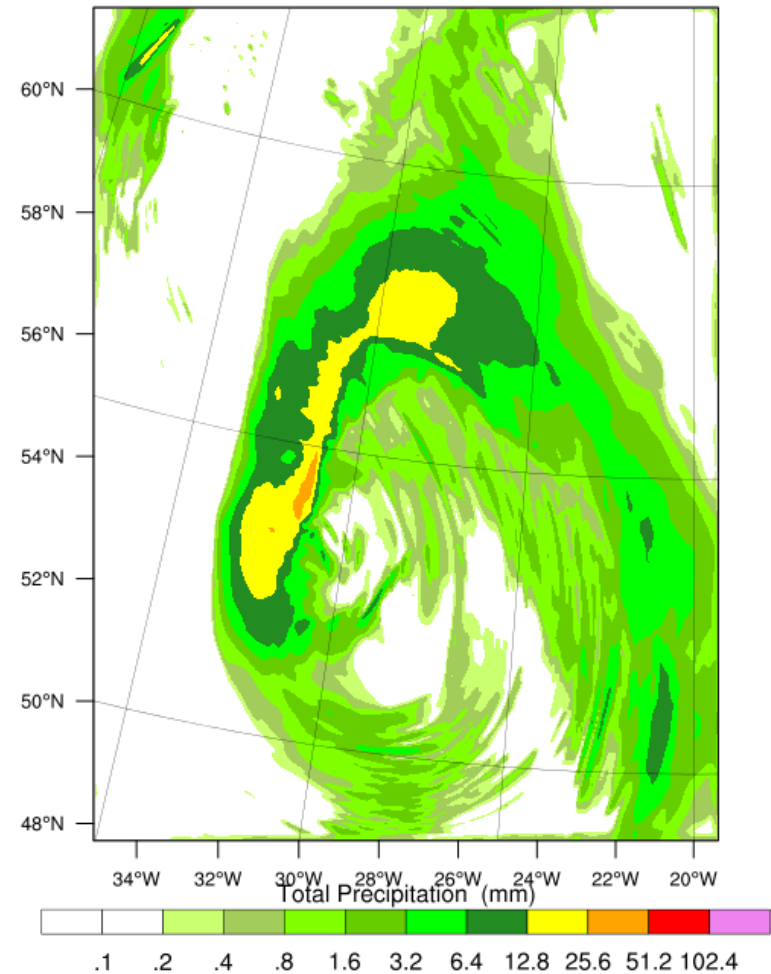
Precipitation Tendency from 2016-10-02_04:00:00 to 2016-10-02_05:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_05:00:00

Total Precipitation (mm)

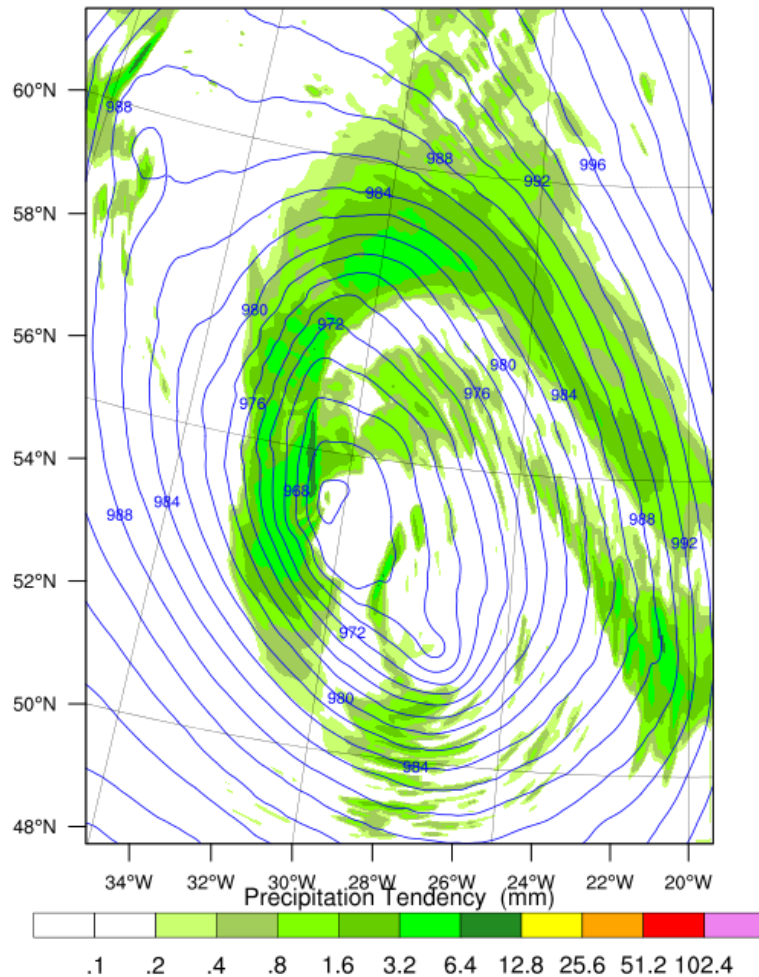


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_06:00:00

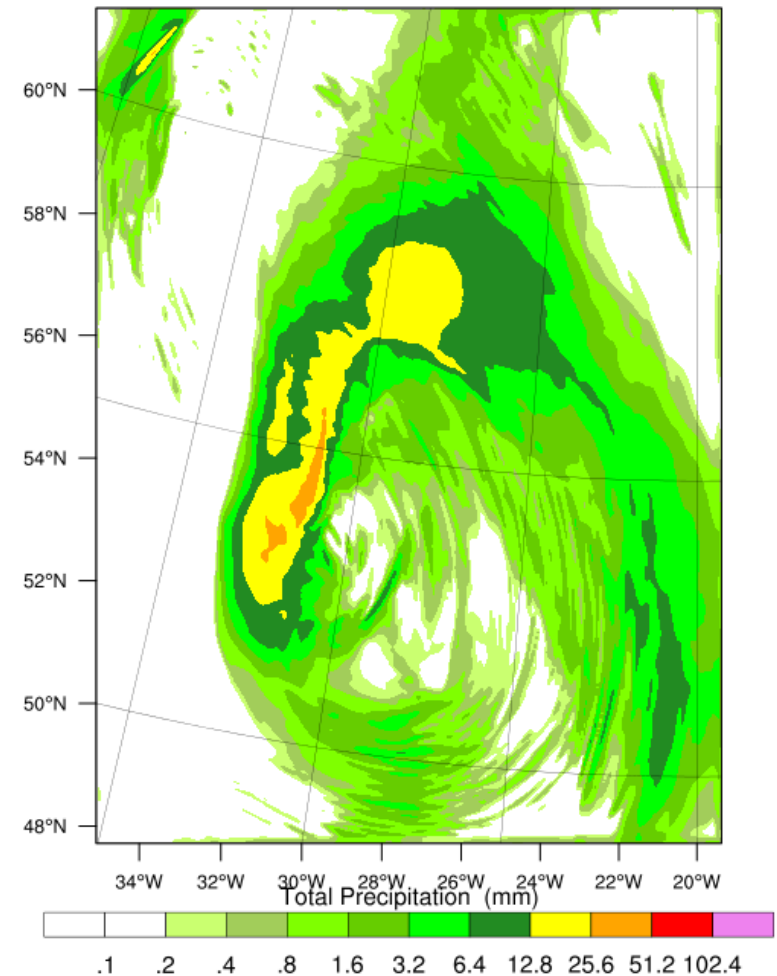
Precipitation Tendency from 2016-10-02_05:00:00 to 2016-10-02_06:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_06:00:00

Total Precipitation (mm)

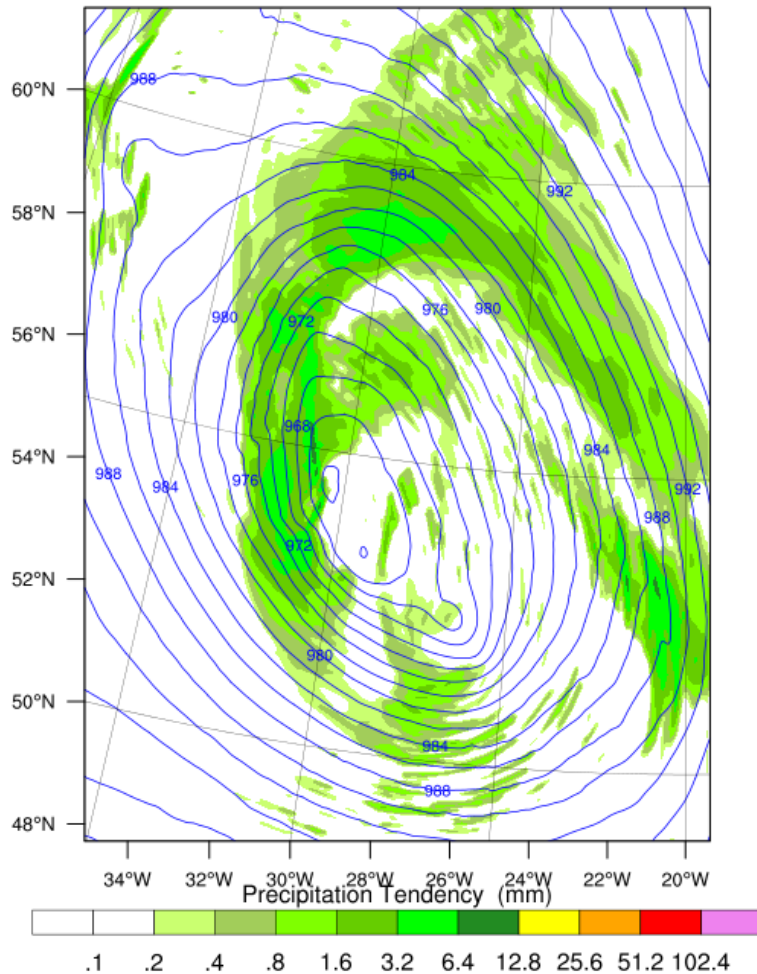


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_07:00:00

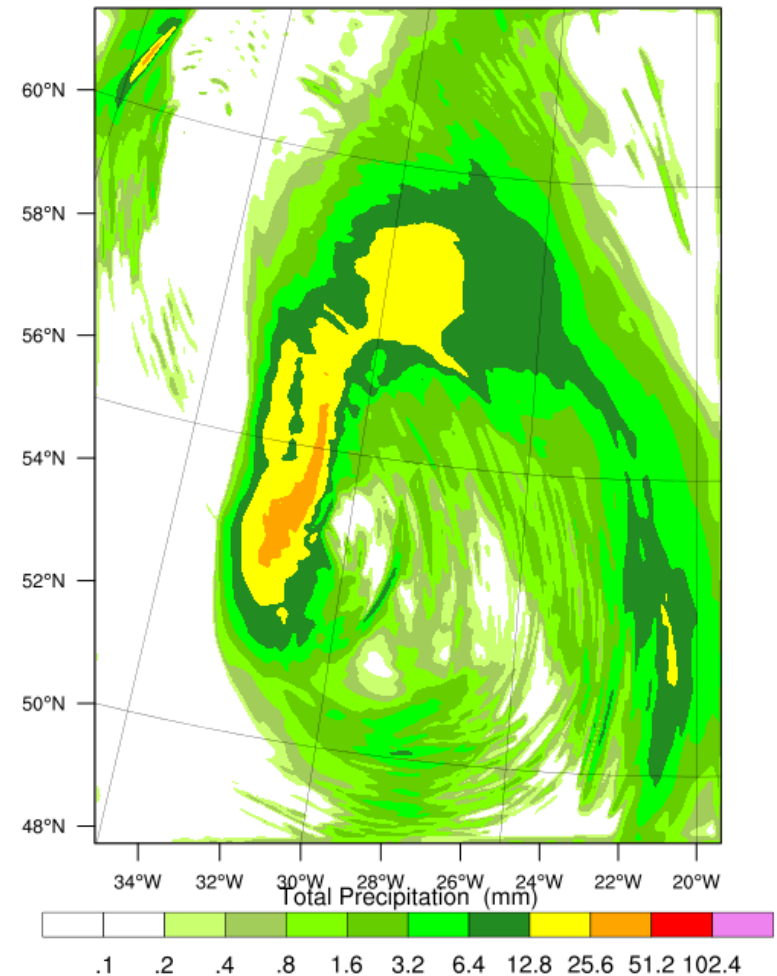
Precipitation Tendency from 2016-10-02_06:00:00 to 2016-10-02_07:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_07:00:00

Total Precipitation (mm)

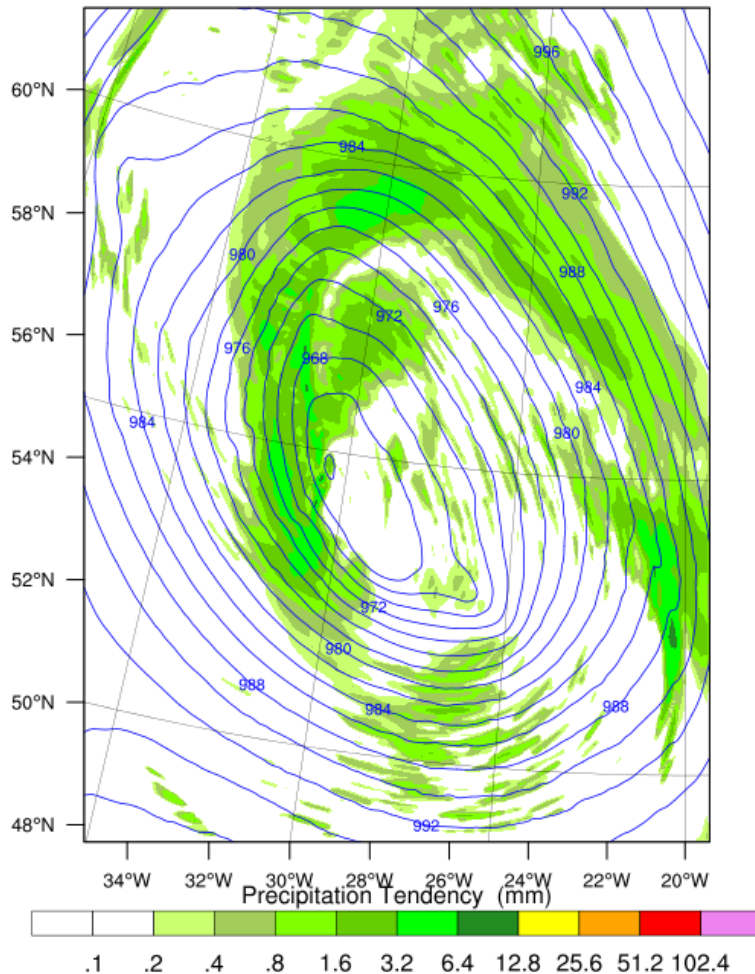


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_08:00:00

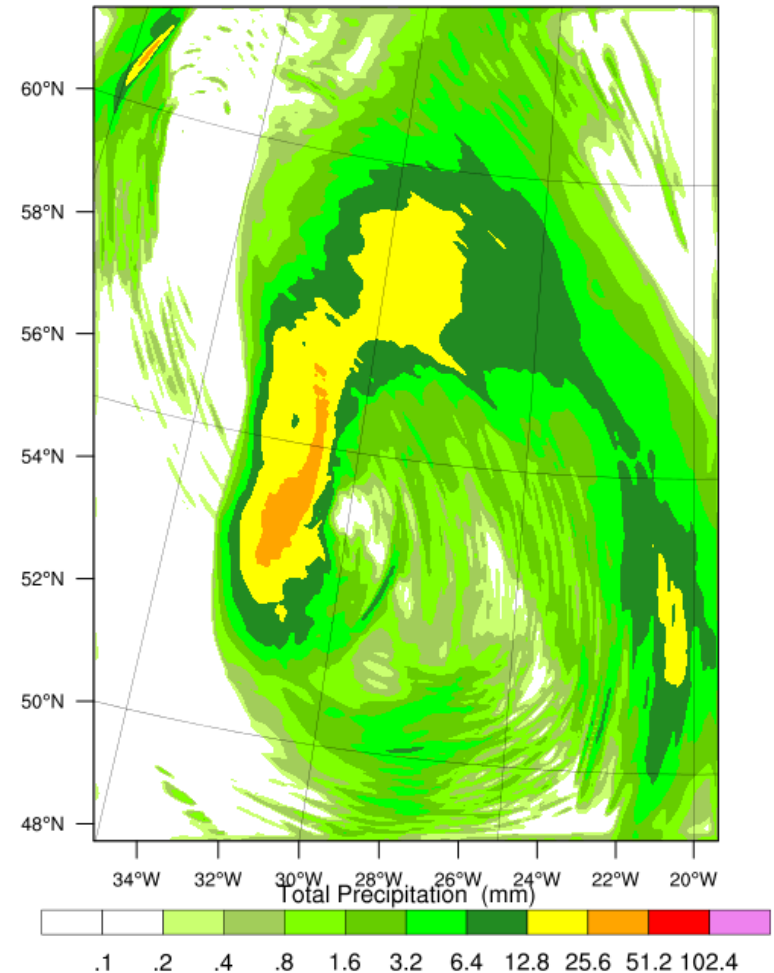
Precipitation Tendency from 2016-10-02_07:00:00 to 2016-10-02_08:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_08:00:00

Total Precipitation (mm)

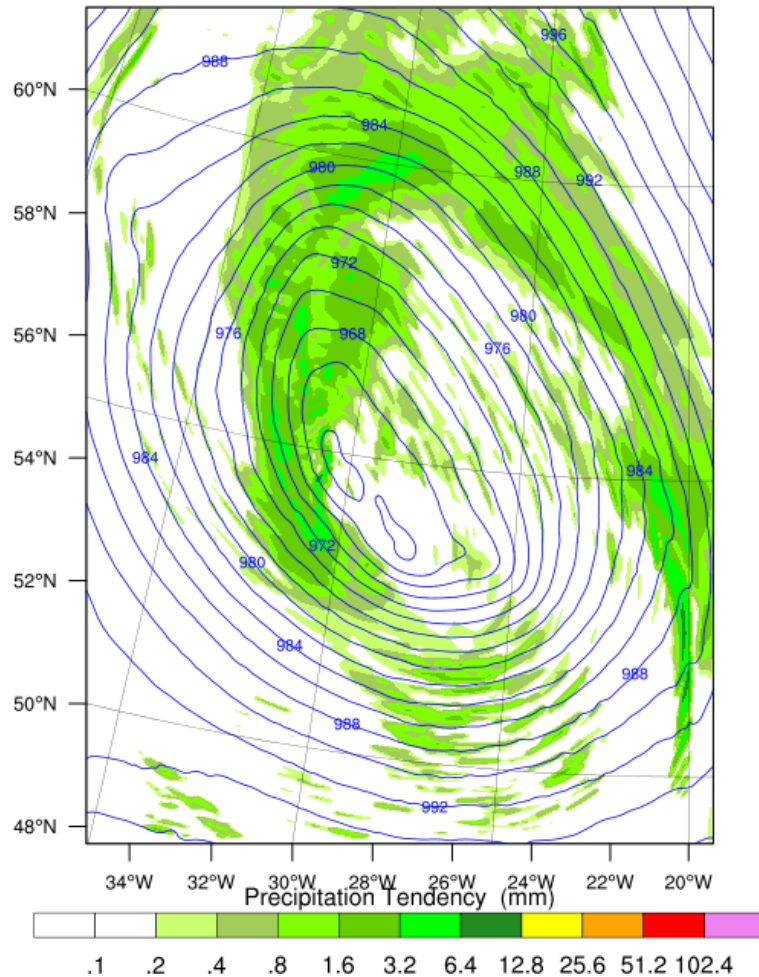


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_09:00:00

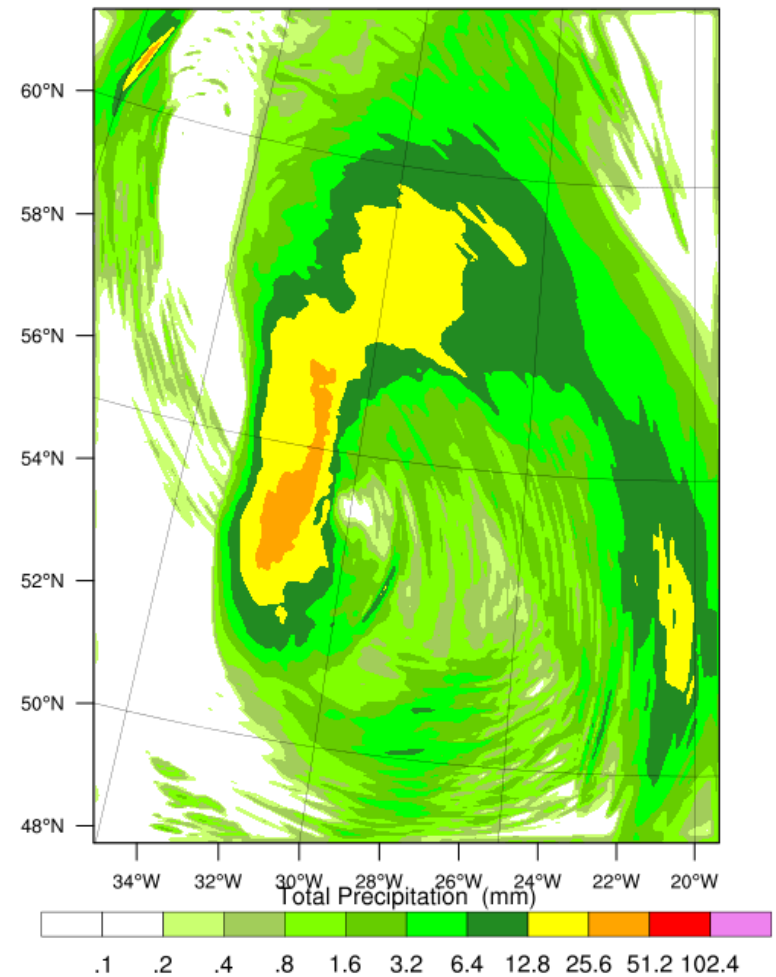
Precipitation Tendency from 2016-10-02_08:00:00 to 2016-10-02_09:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_09:00:00

Total Precipitation (mm)

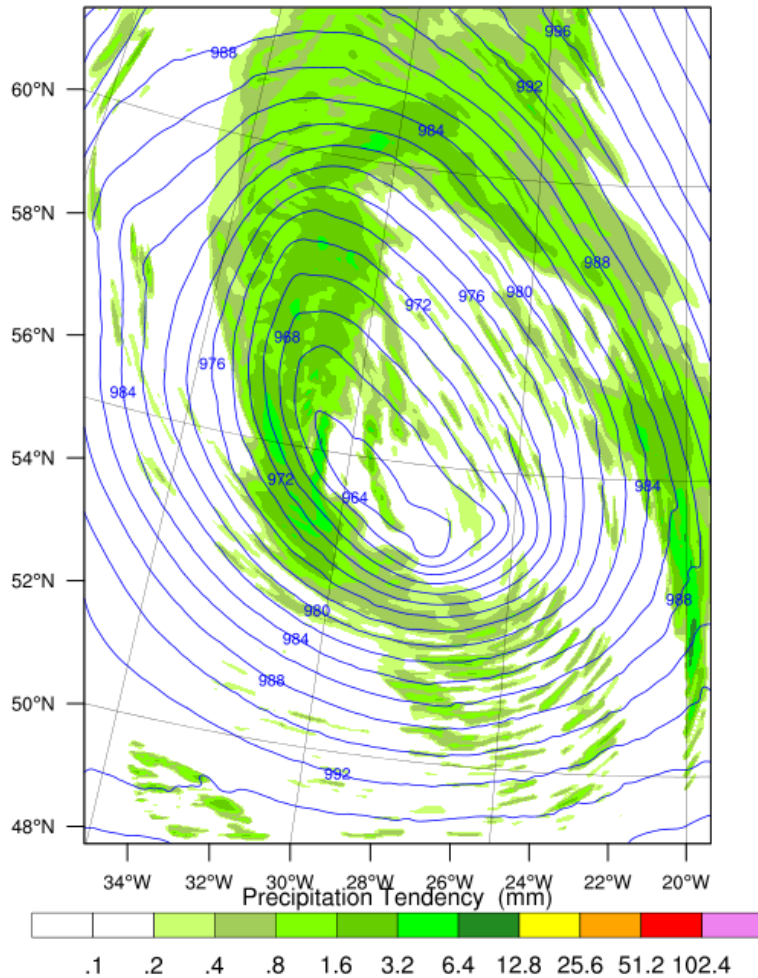


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_10:00:00

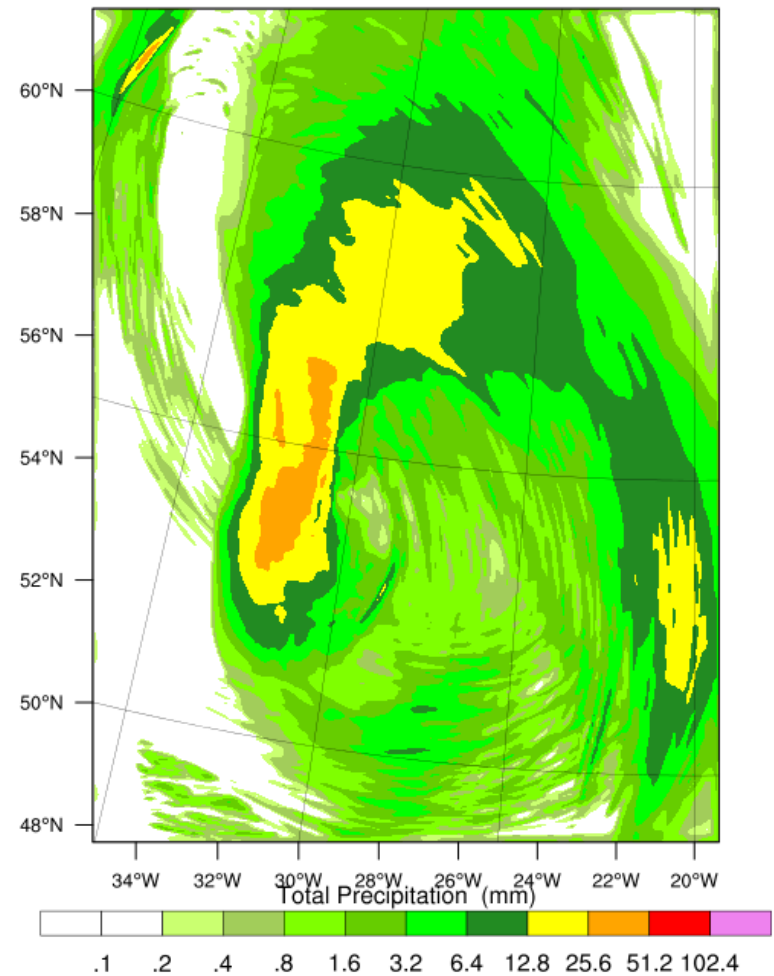
Precipitation Tendency from 2016-10-02_09:00:00 to 2016-10-02_10:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_10:00:00

Total Precipitation (mm)

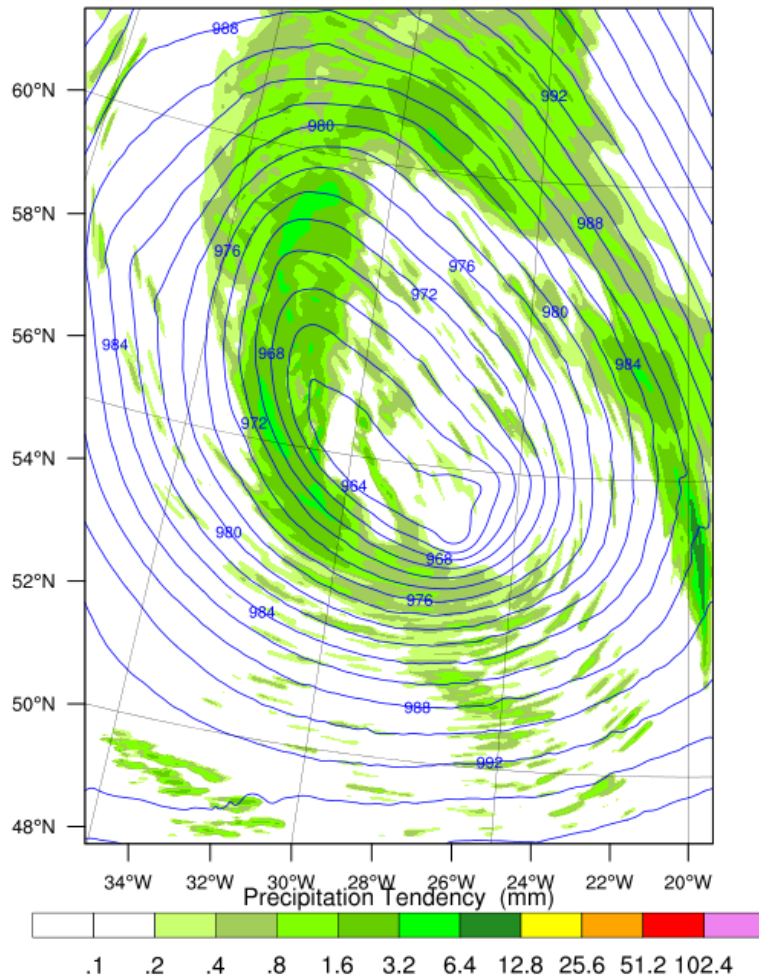


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_11:00:00

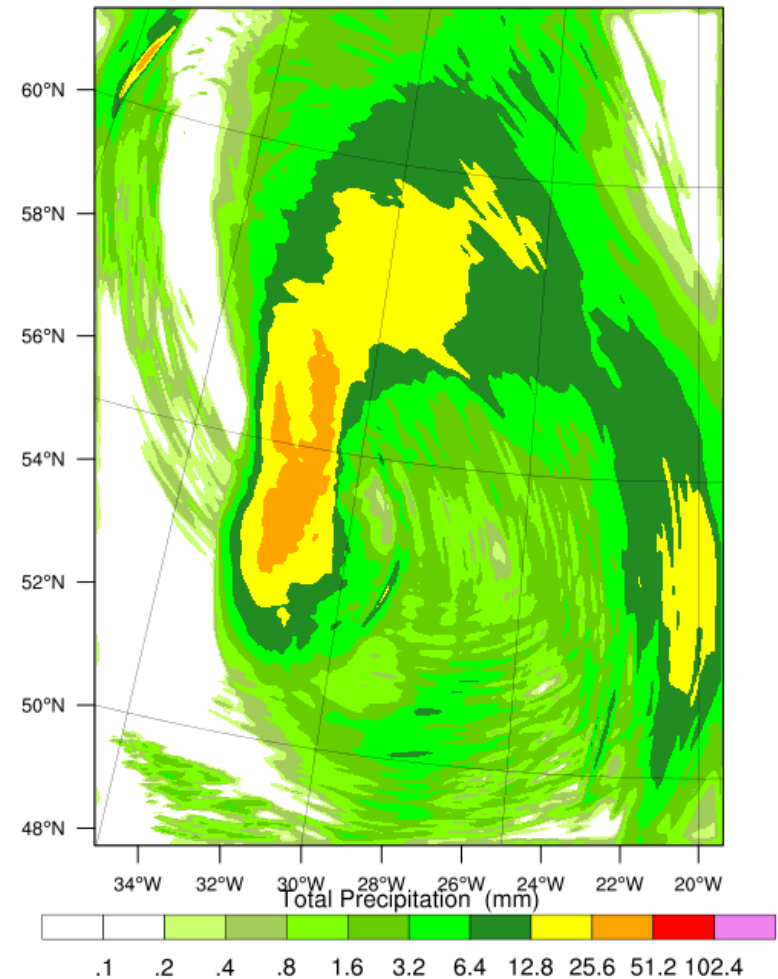
Precipitation Tendency from 2016-10-02_10:00:00 to 2016-10-02_11:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_11:00:00

Total Precipitation (mm)

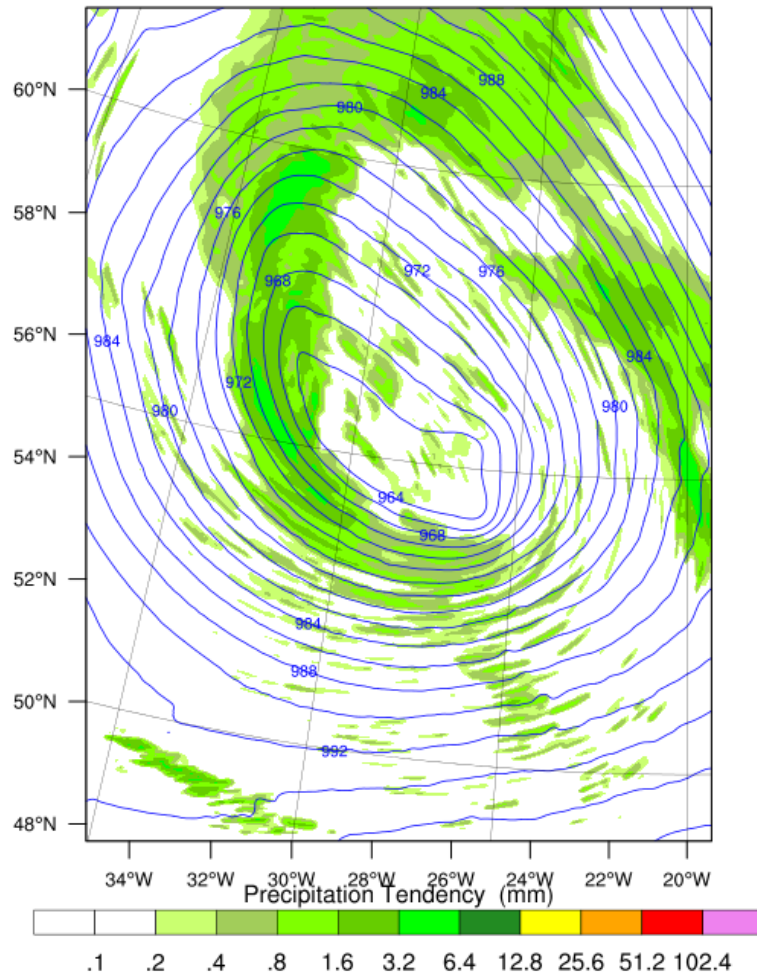


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_12:00:00

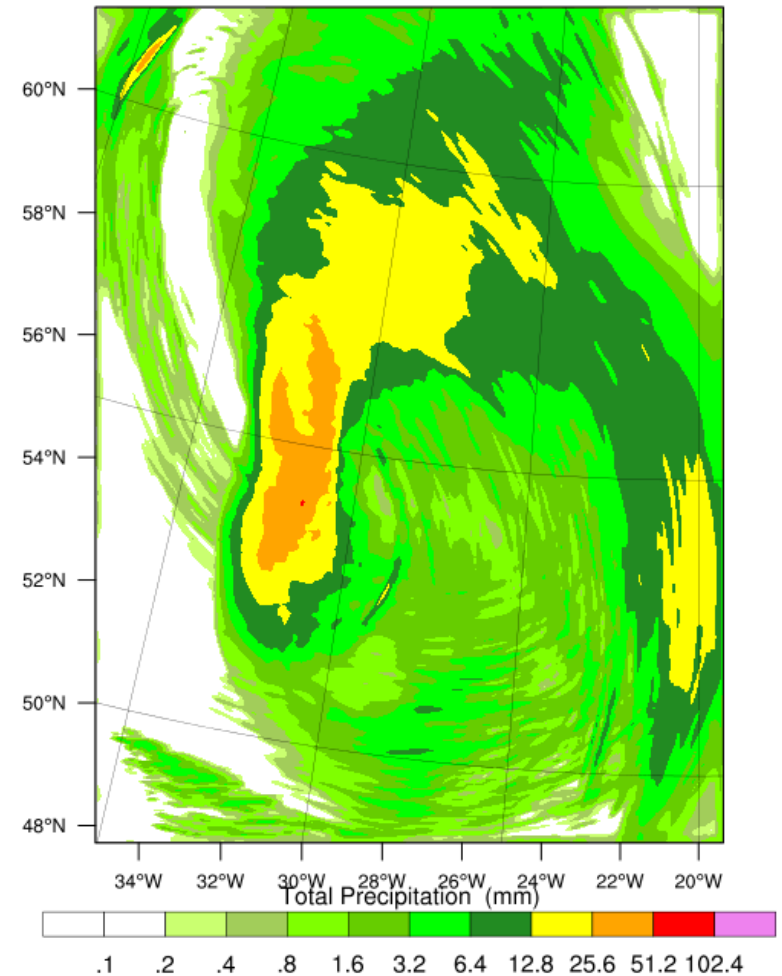
Precipitation Tendency from 2016-10-02_11:00:00 to 2016-10-02_12:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_12:00:00

Total Precipitation (mm)

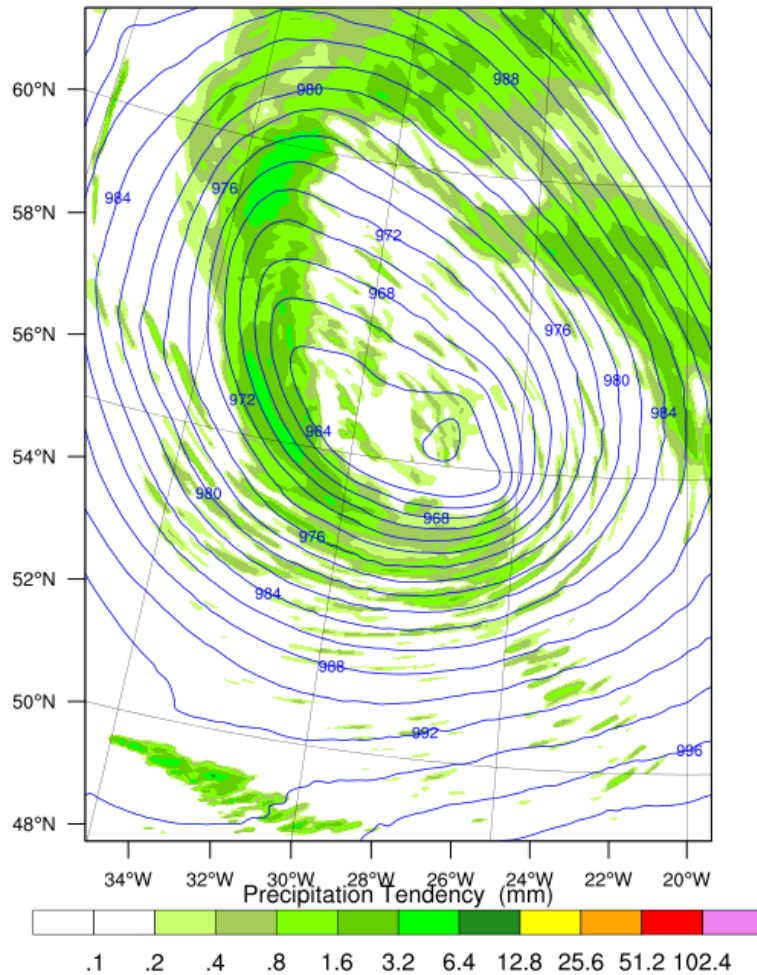


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_13:00:00

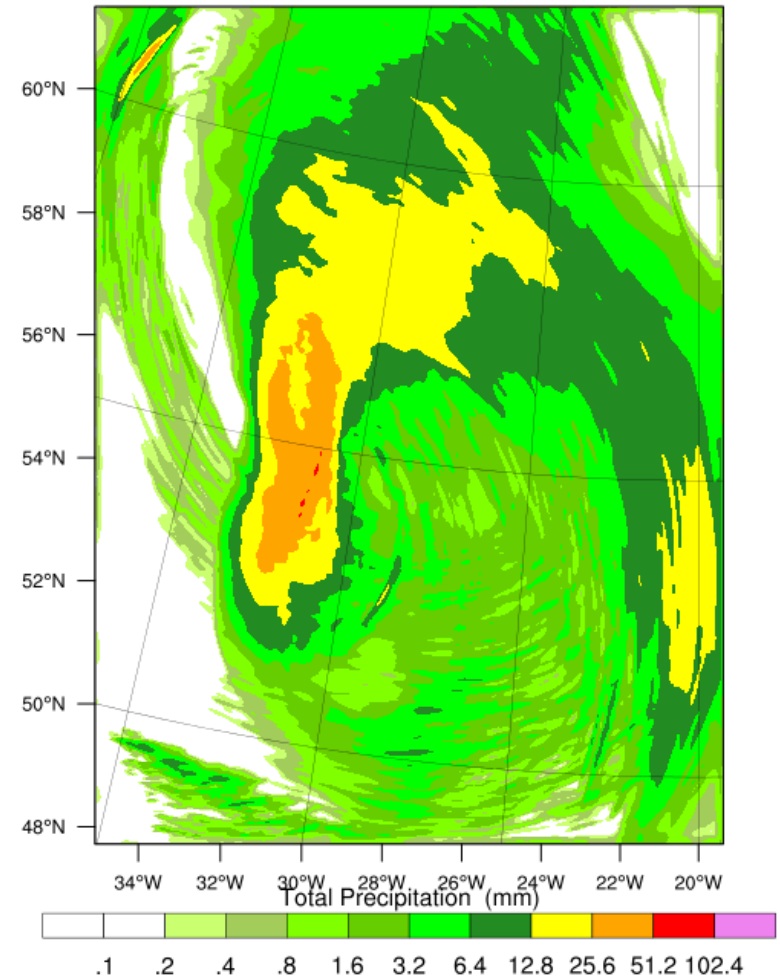
Precipitation Tendency from 2016-10-02_12:00:00 to 2016-10-02_13:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_13:00:00

Total Precipitation (mm)

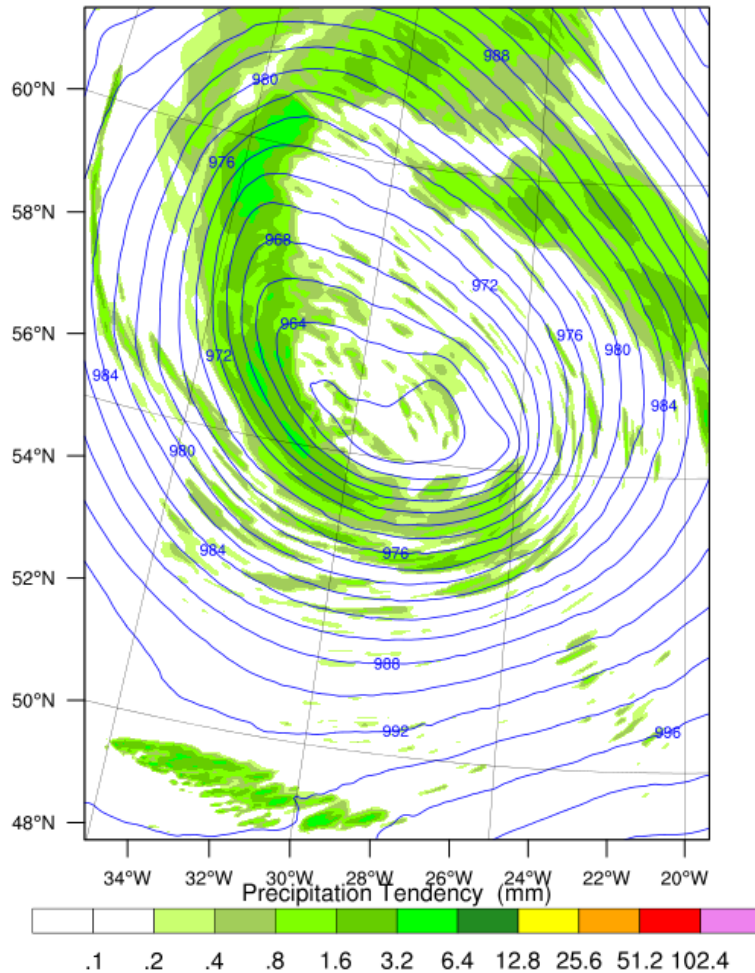


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_14:00:00

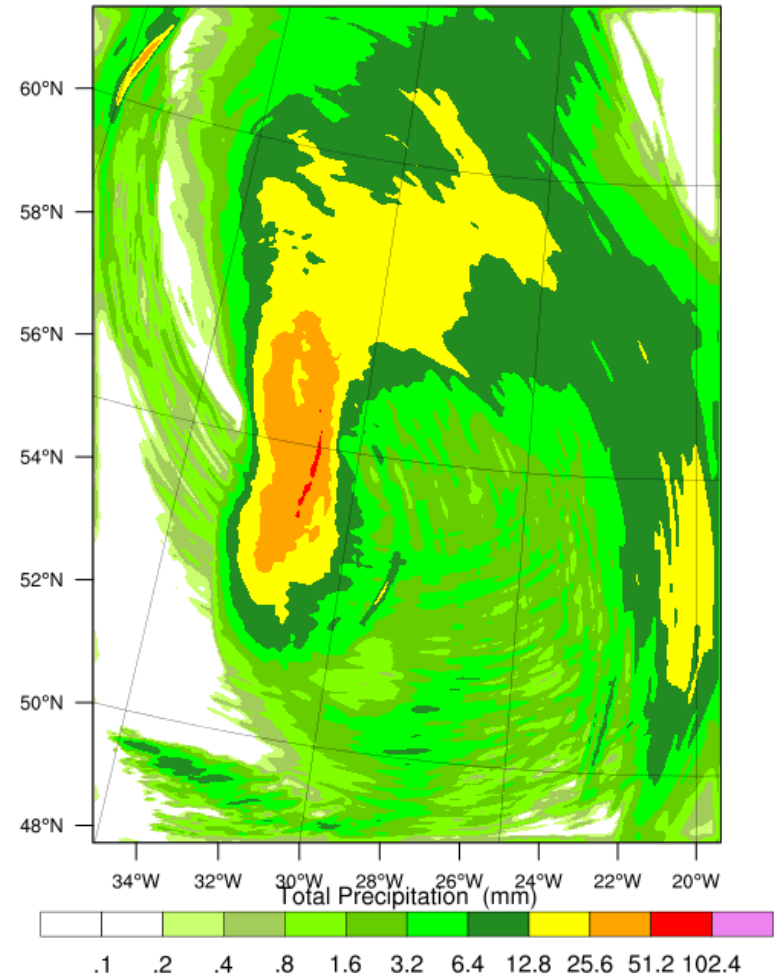
Precipitation Tendency from 2016-10-02_13:00:00 to 2016-10-02_14:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_14:00:00

Total Precipitation (mm)

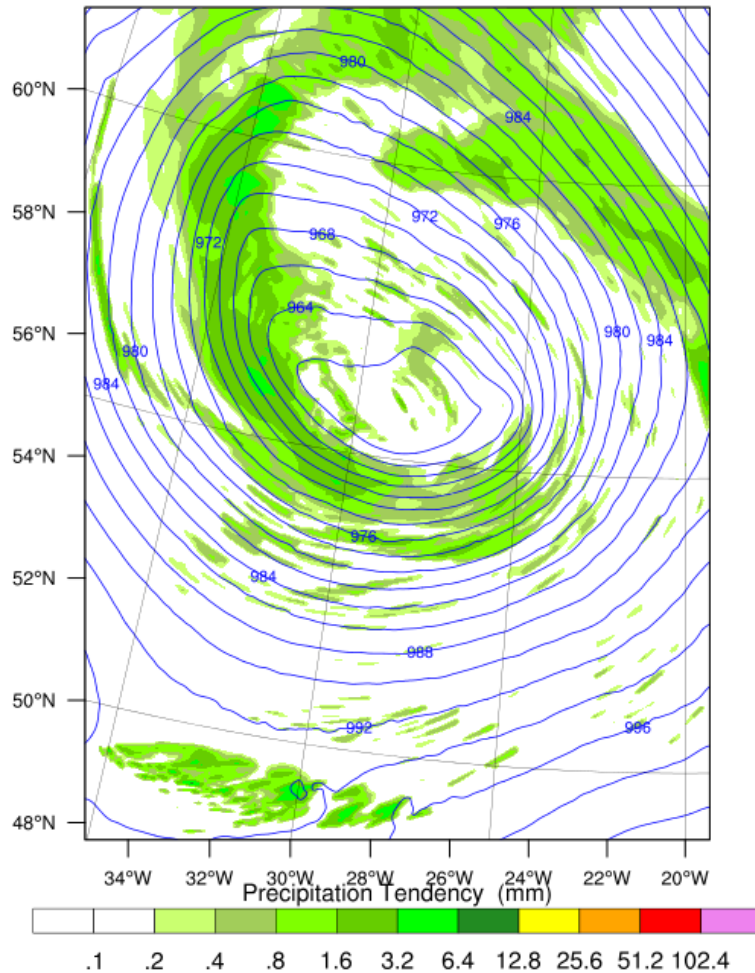


using the Thompson scheme

REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_15:00:00

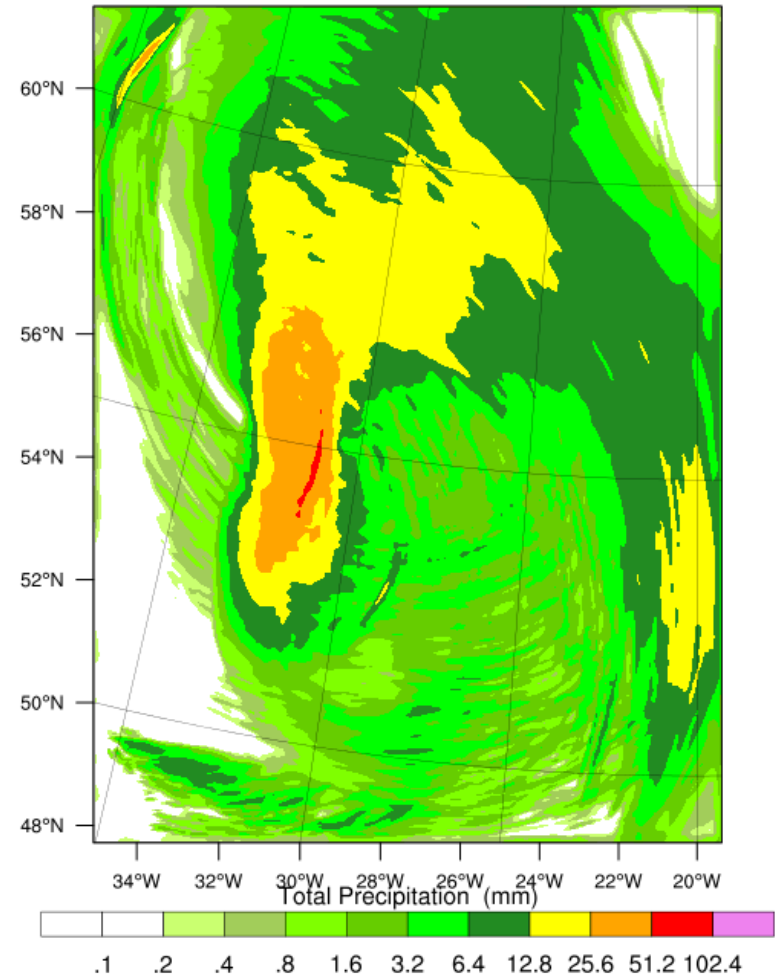
Precipitation Tendency from 2016-10-02_14:00:00 to 2016-10-02_15:00:00 (mm)
Sea Level Pressure (hPa)



REAL-TIME WRF

Init: 2016-10-02_00:00:00
Valid: 2016-10-02_15:00:00

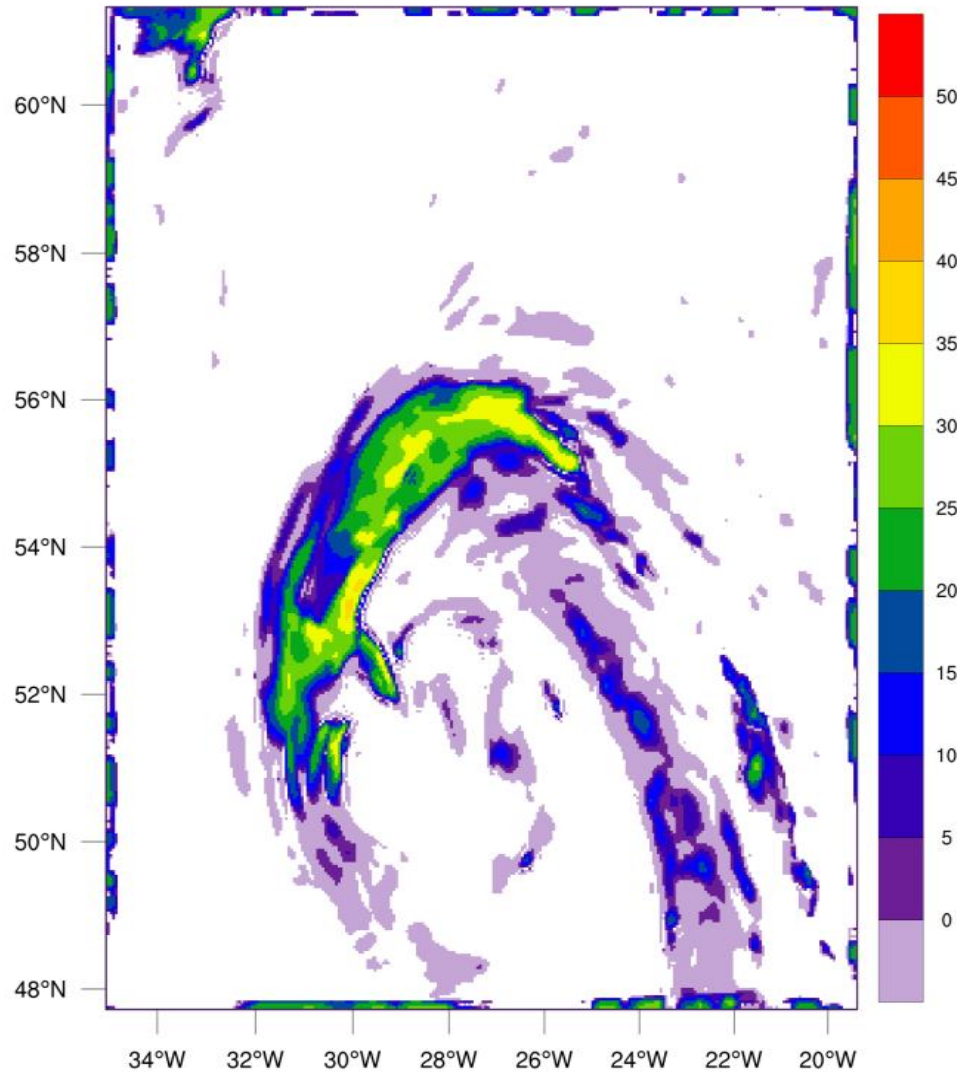
Total Precipitation (mm)



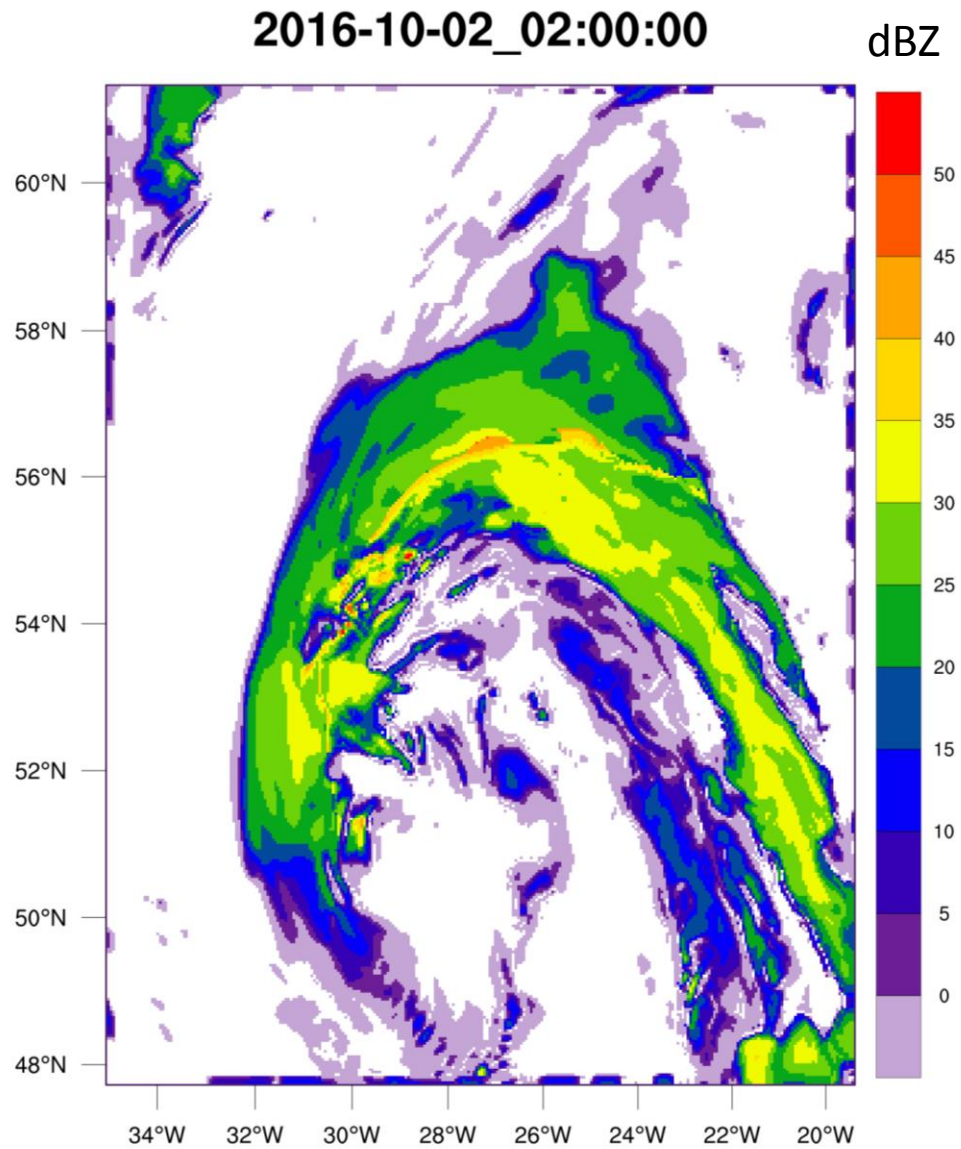
using the Thompson scheme

2016-10-02_01:00:00

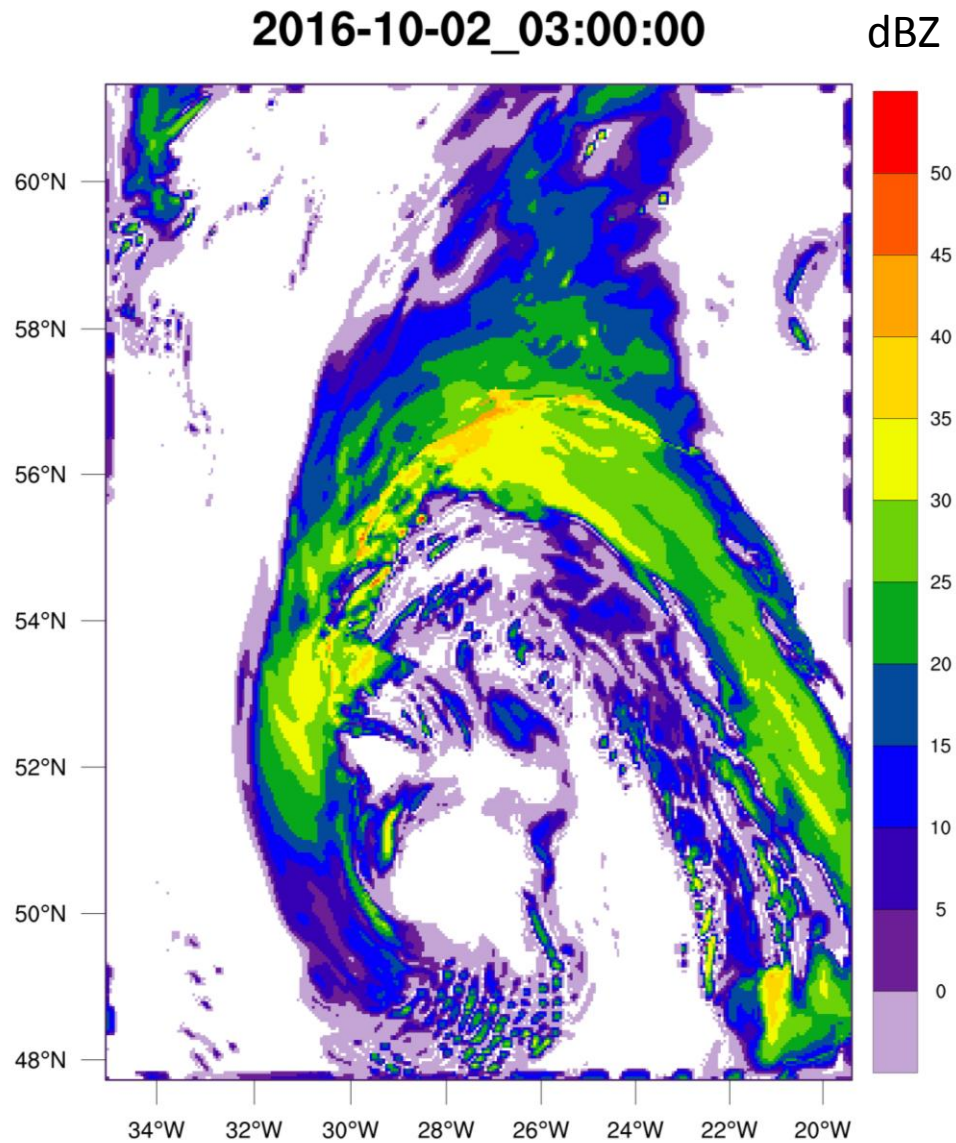
dBZ @ level 10



using the Thompson scheme



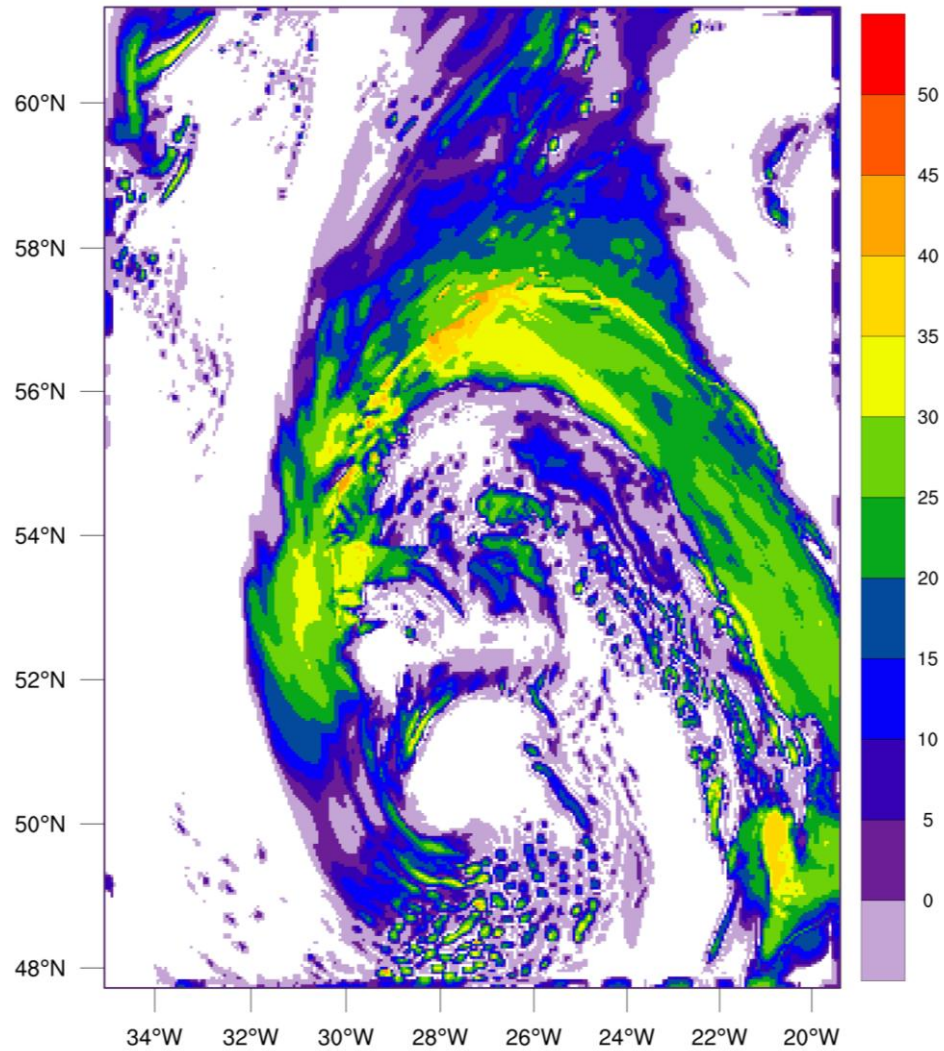
using the Thompson scheme



using the Thompson scheme

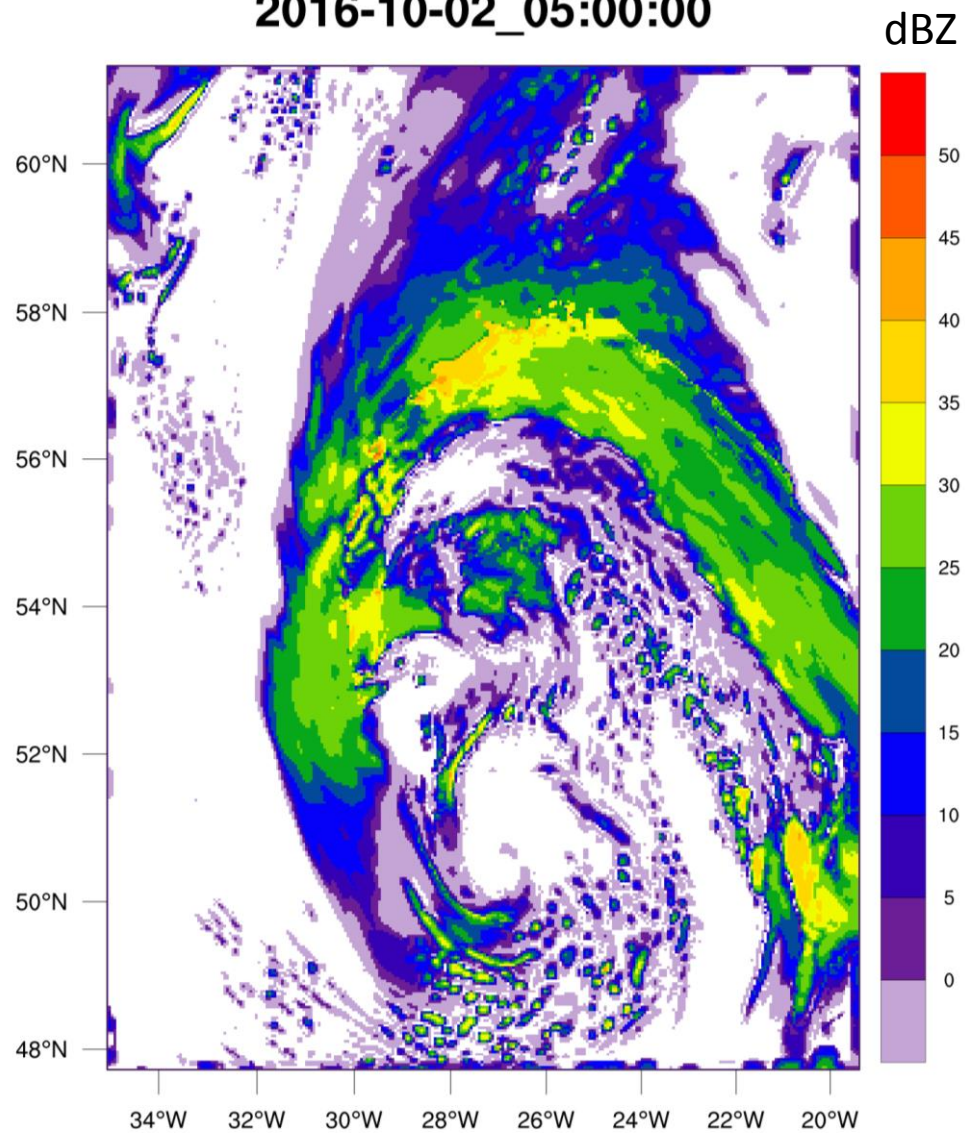
2016-10-02_04:00:00

dBZ



using the Thompson scheme

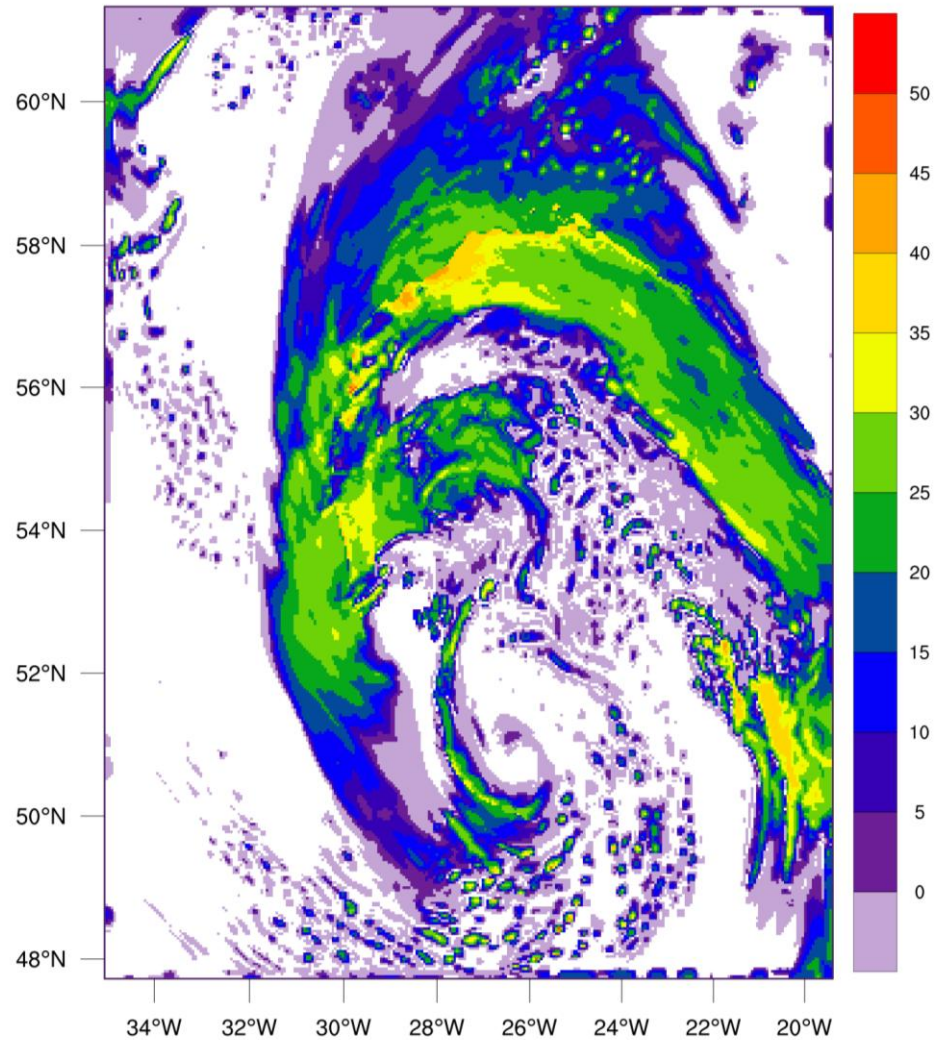
2016-10-02_05:00:00



using the Thompson scheme

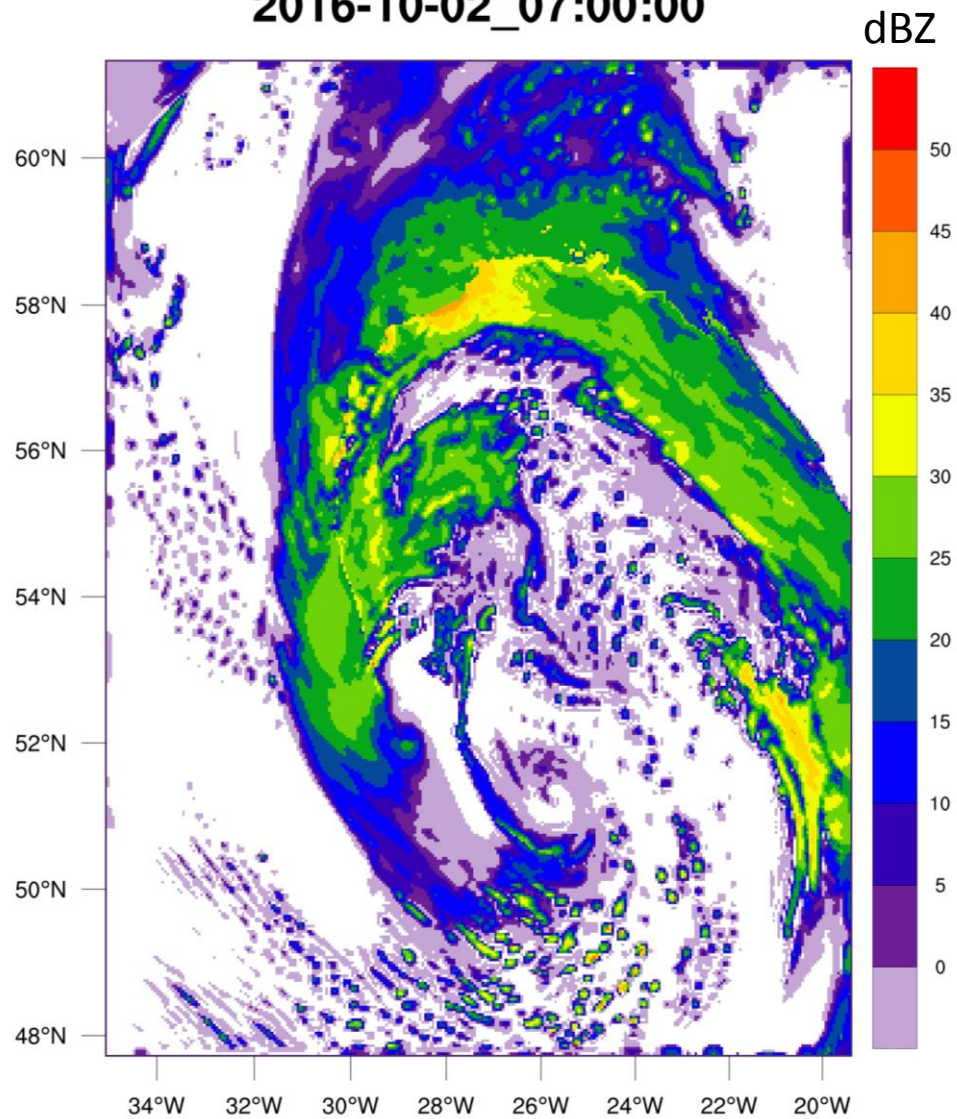
2016-10-02_06:00:00

dBZ



using the Thompson scheme

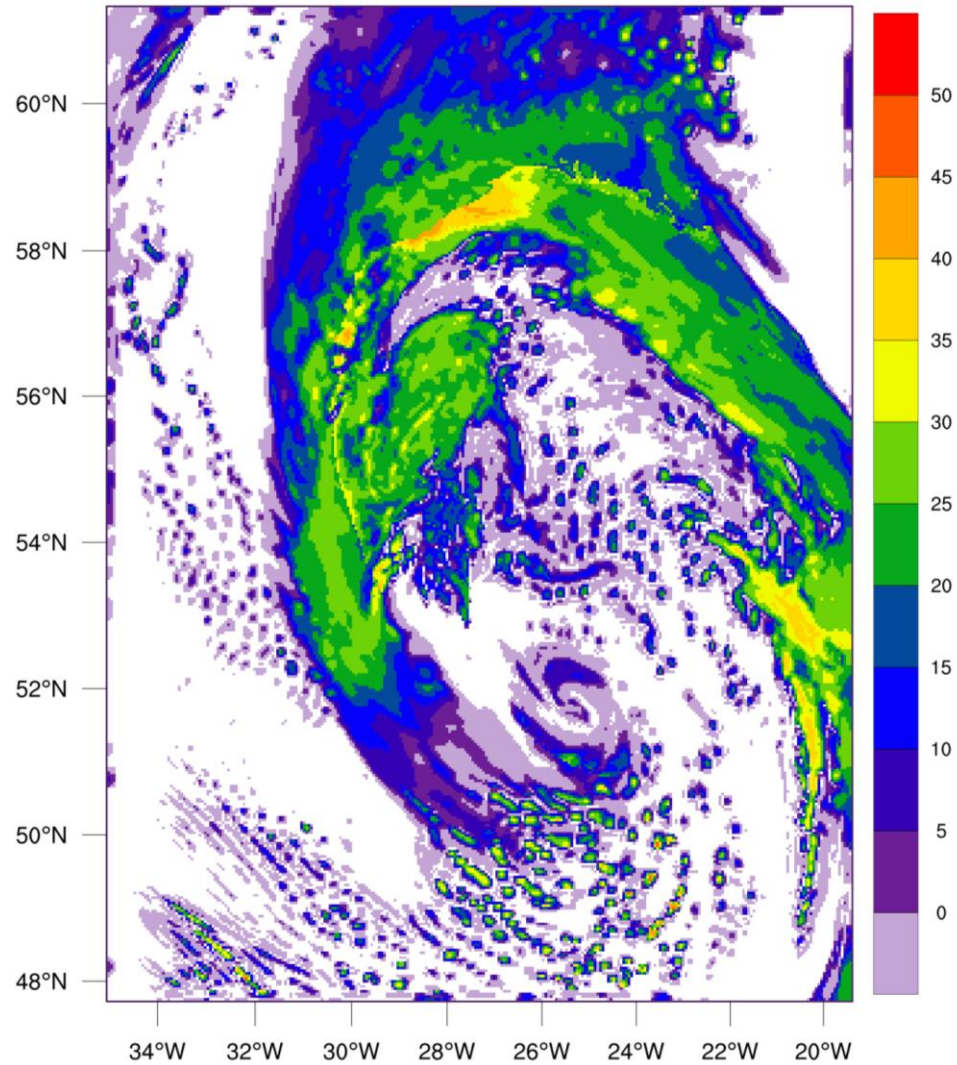
2016-10-02_07:00:00



using the Thompson scheme

2016-10-02_08:00:00

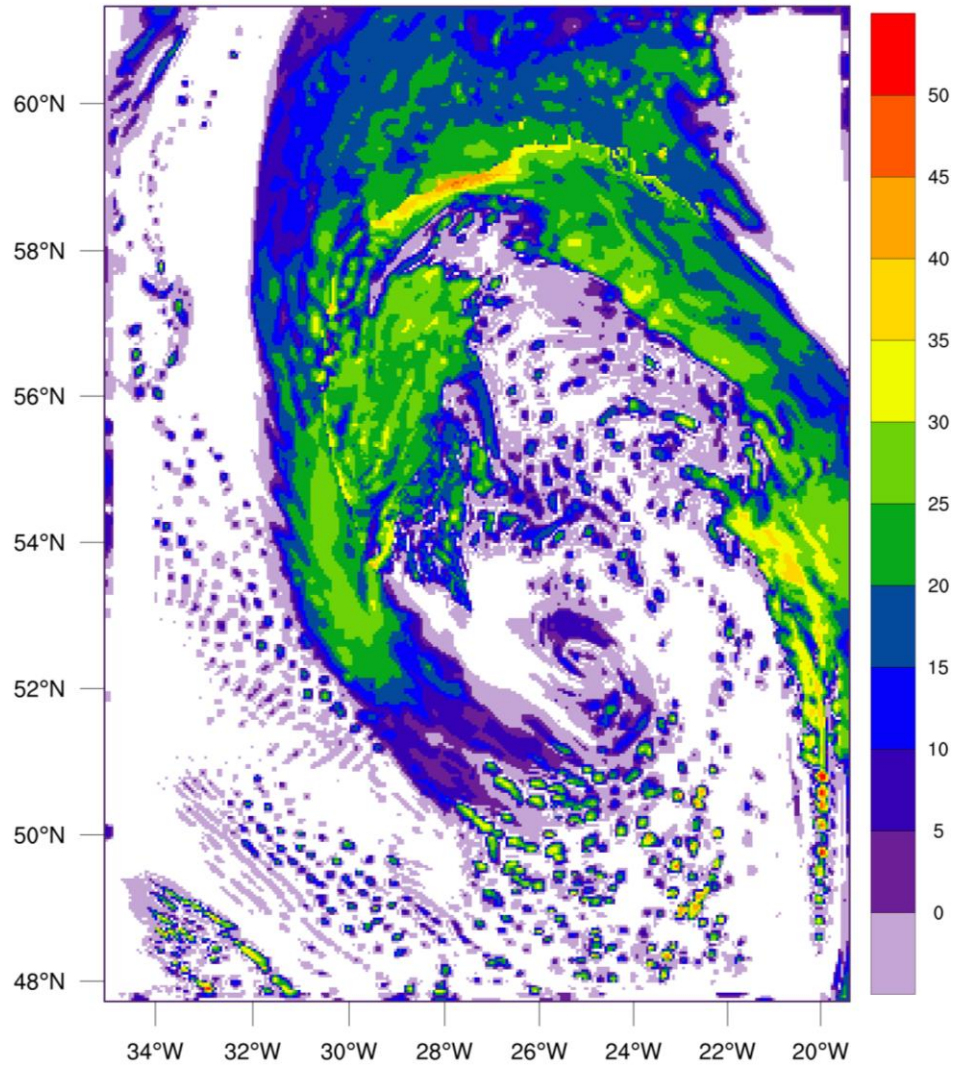
dBZ



using the Thompson scheme

2016-10-02_09:00:00

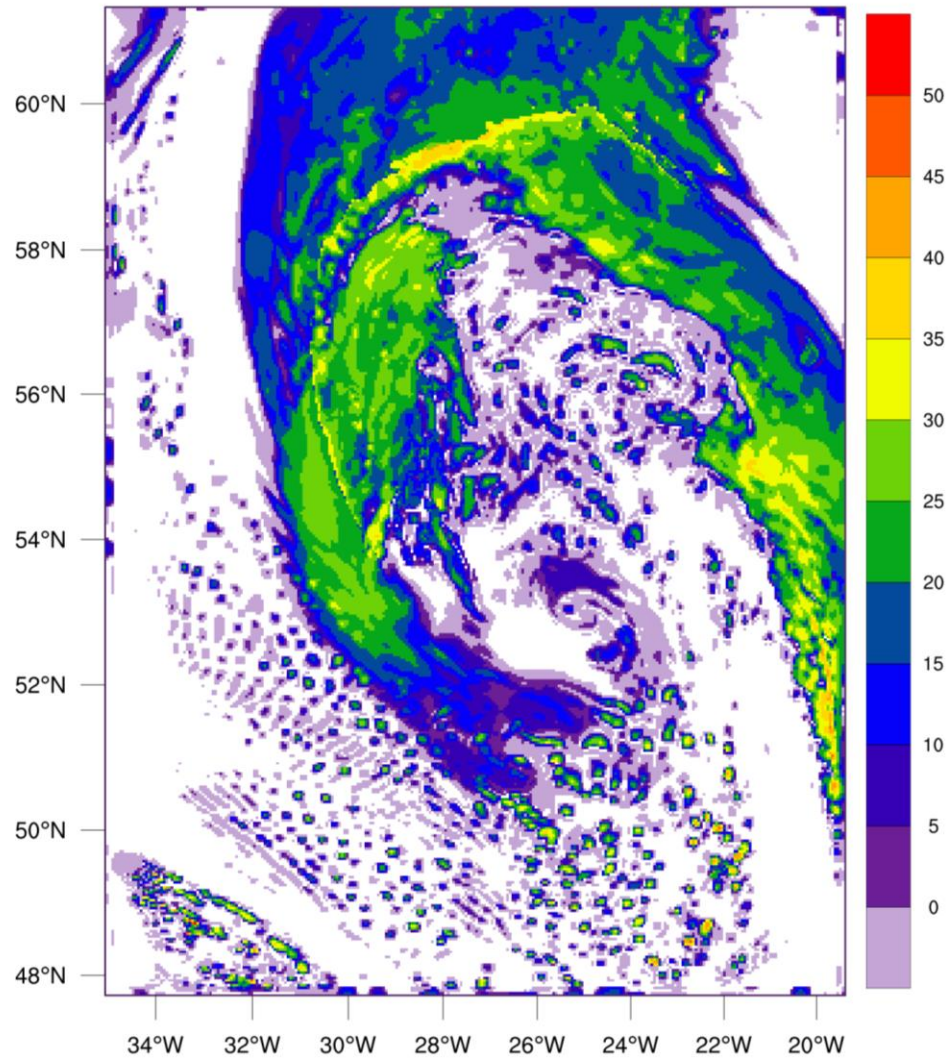
dBZ



using the Thompson scheme

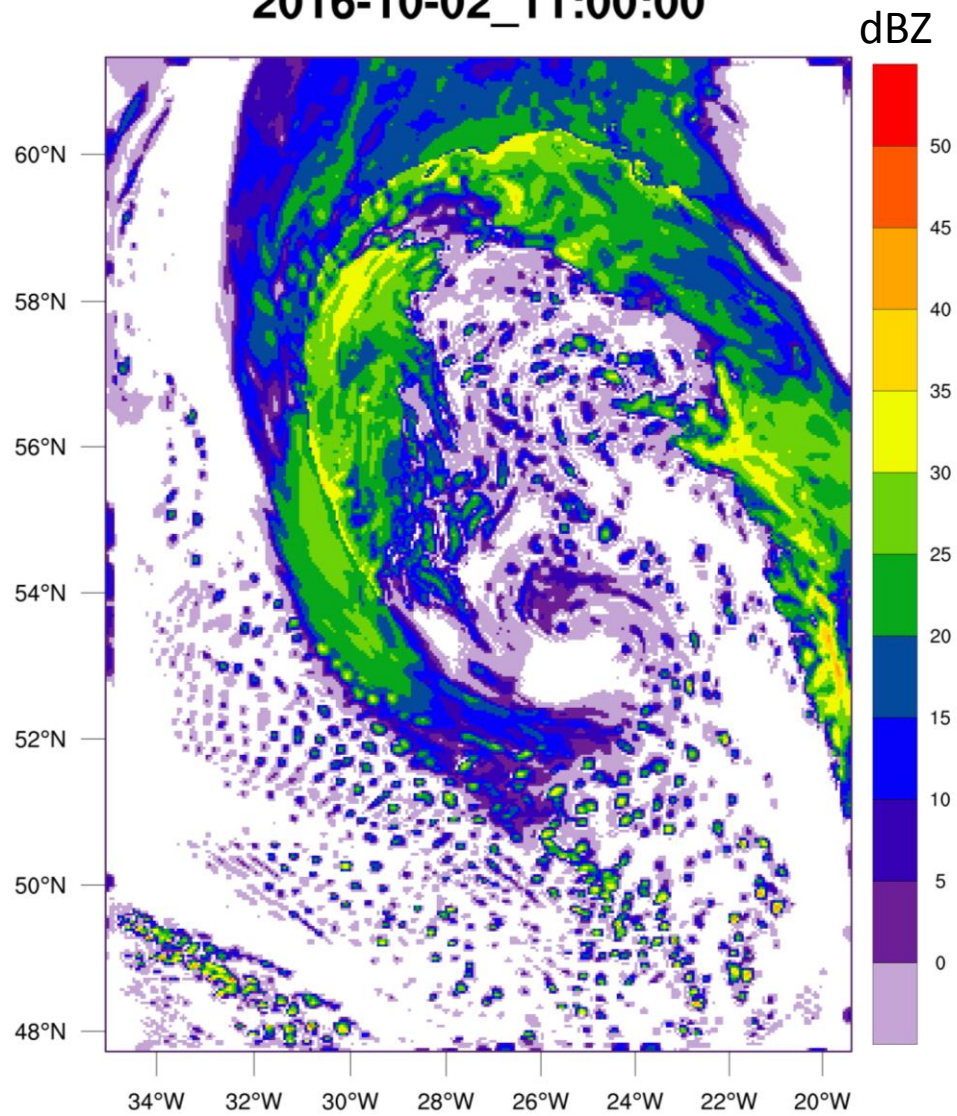
2016-10-02_10:00:00

dBZ

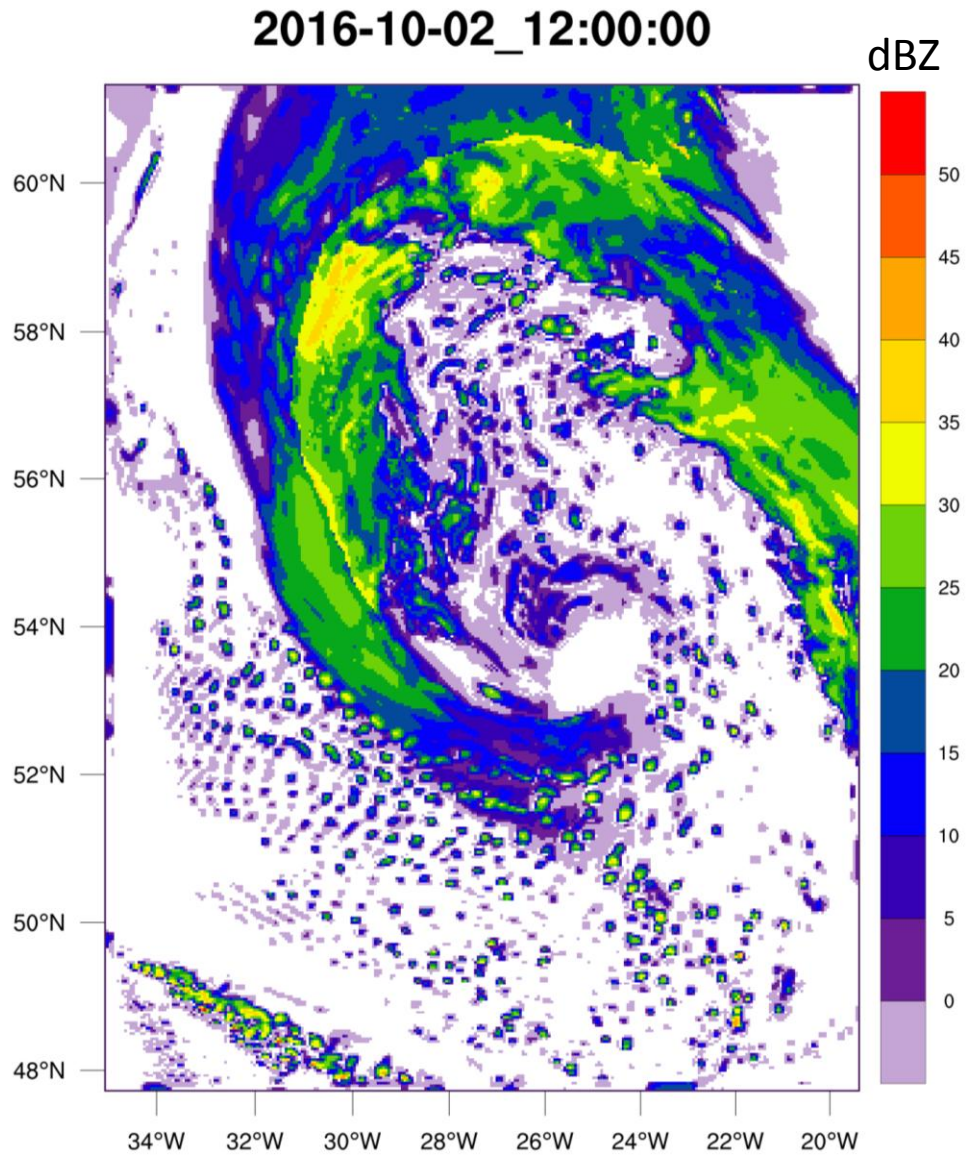


using the Thompson scheme

2016-10-02_11:00:00

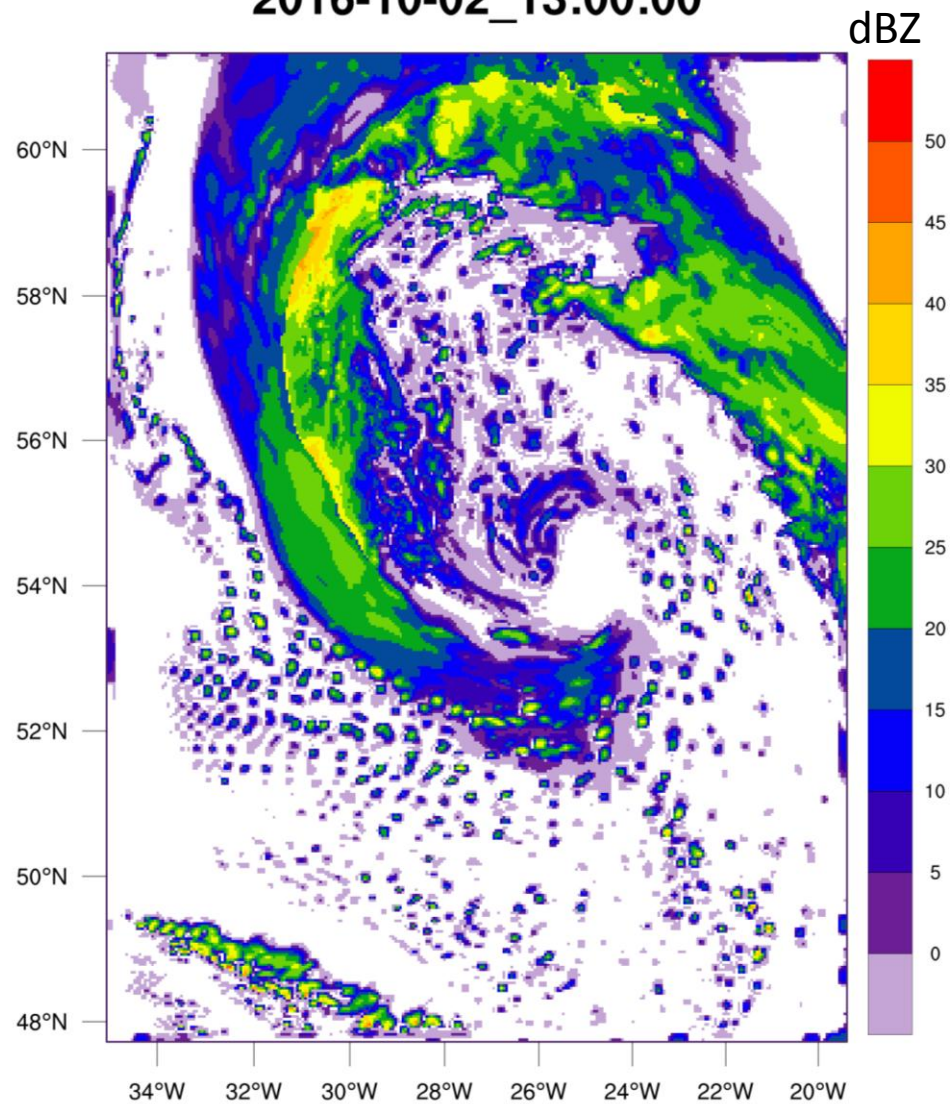


using the Thompson scheme



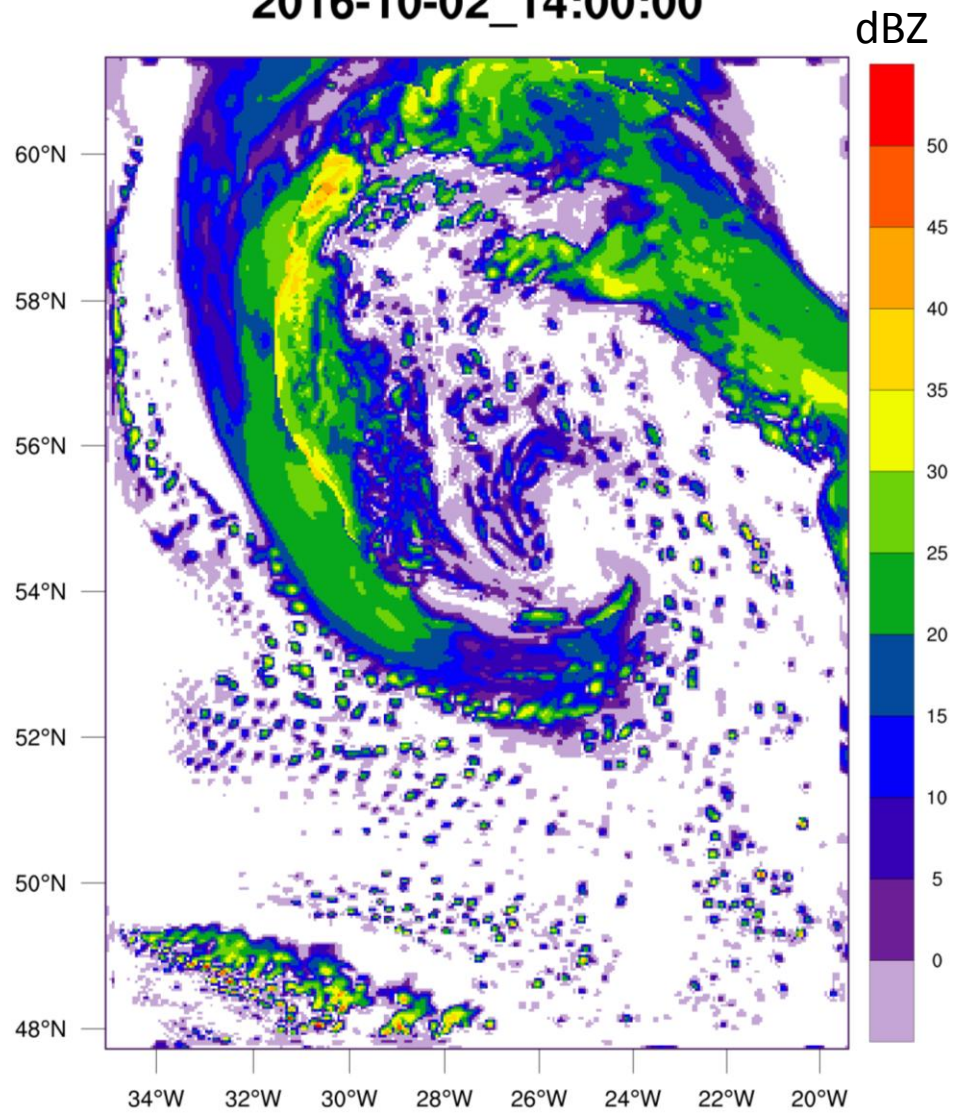
using the Thompson scheme

2016-10-02_13:00:00



using the Thompson scheme

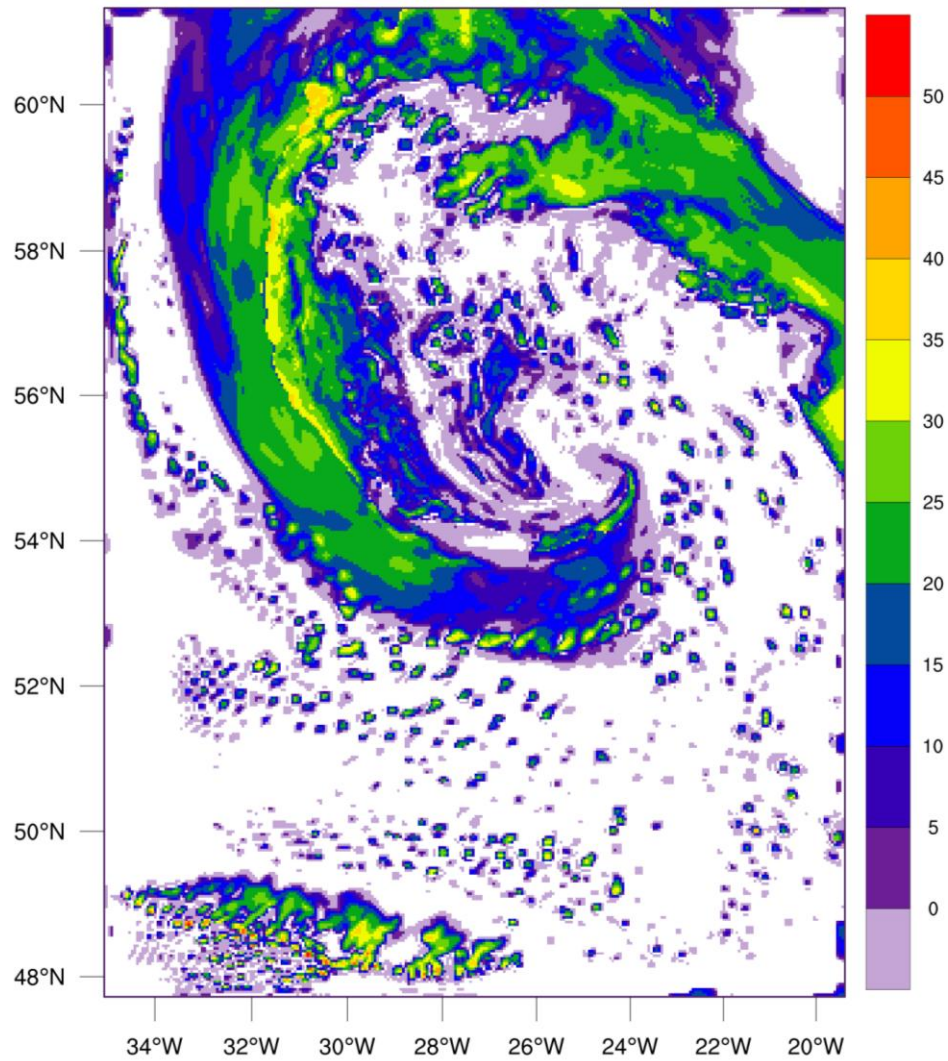
2016-10-02_14:00:00



using the Thompson scheme

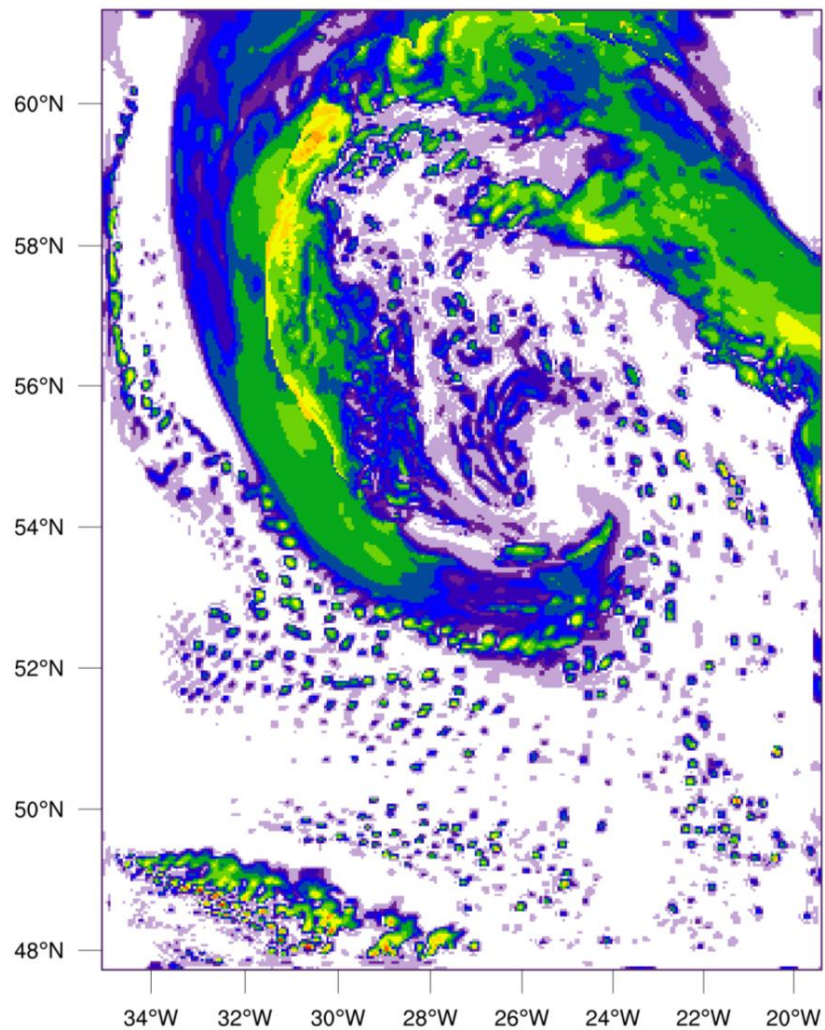
2016-10-02_15:00:00

dBZ



Thompson scheme

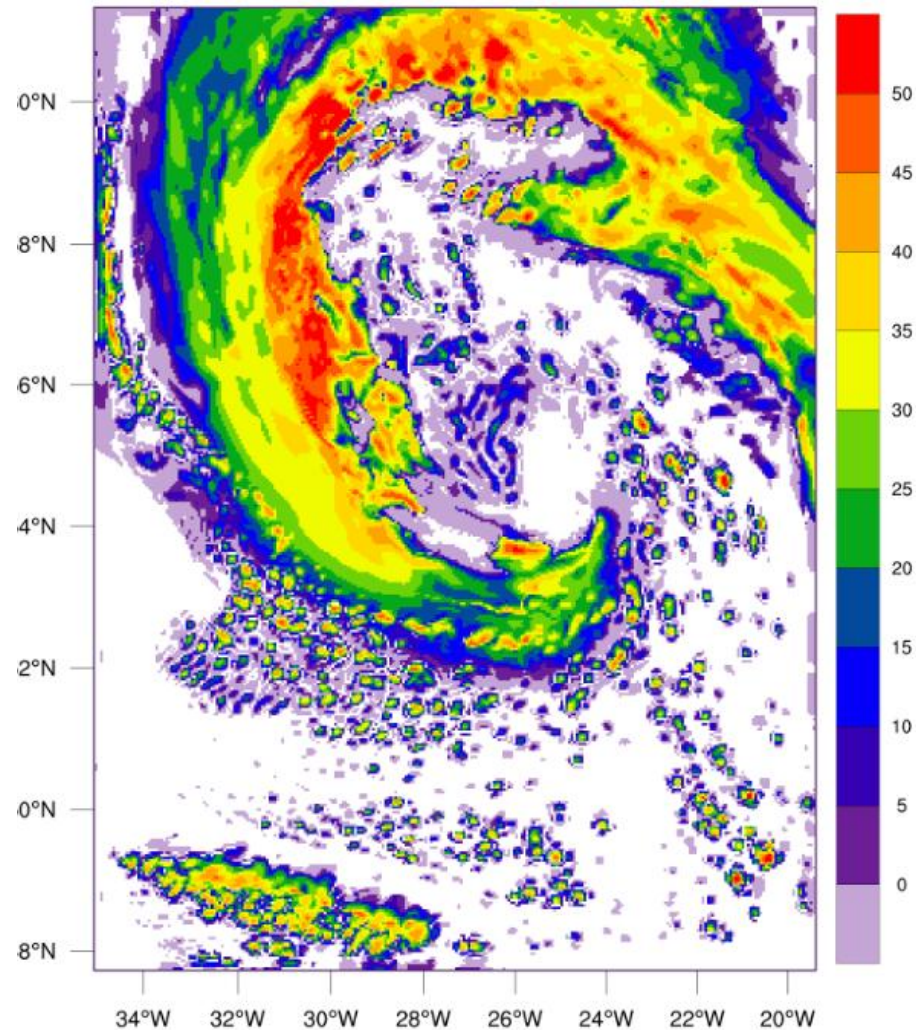
2016-10-02_14:00:00



Morrison scheme

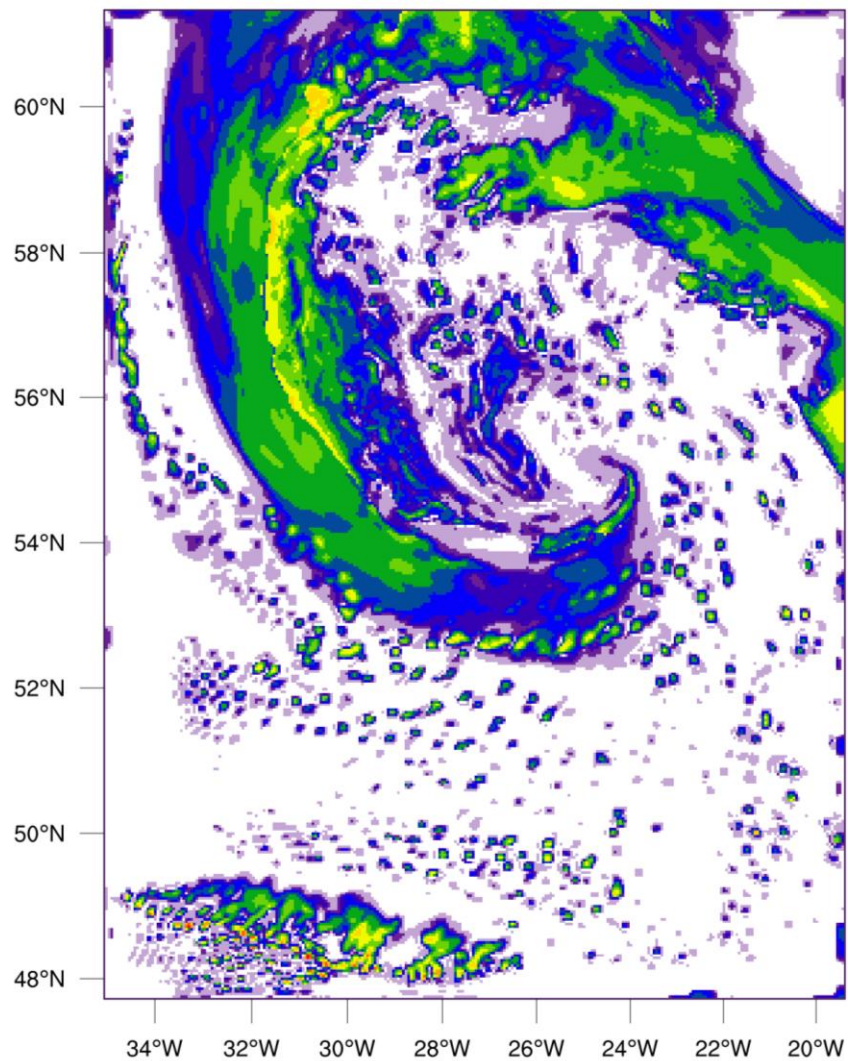
IBZ

2016-10-02_14:00:00



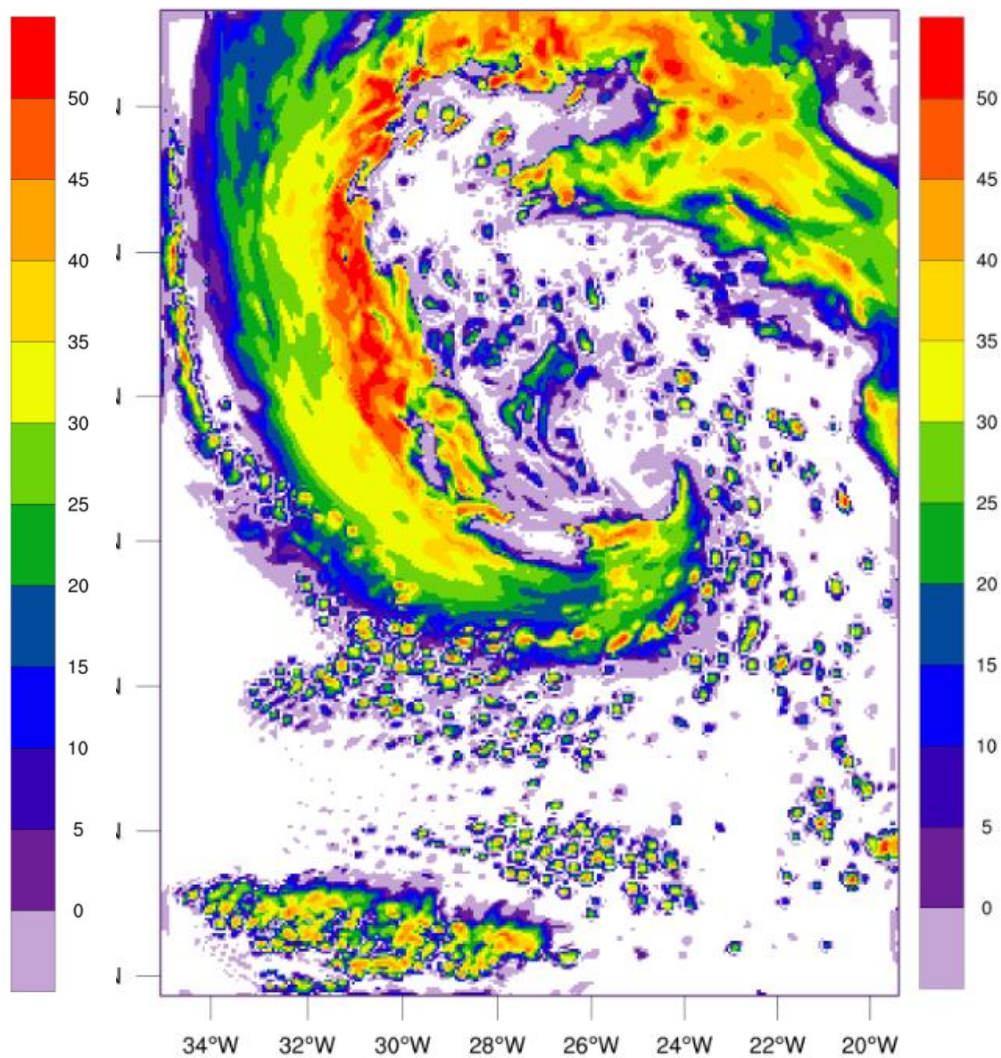
Thompson scheme

2016-10-02_15:00:00



Morrison scheme

dBZ 2016-10-02_15:00:00



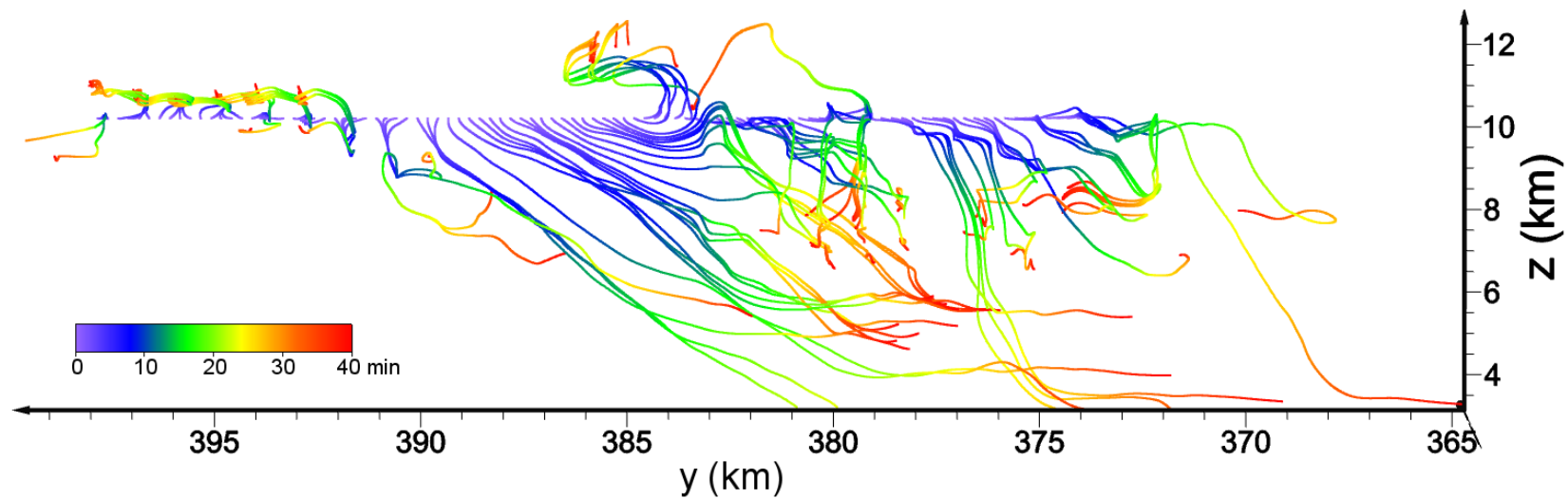
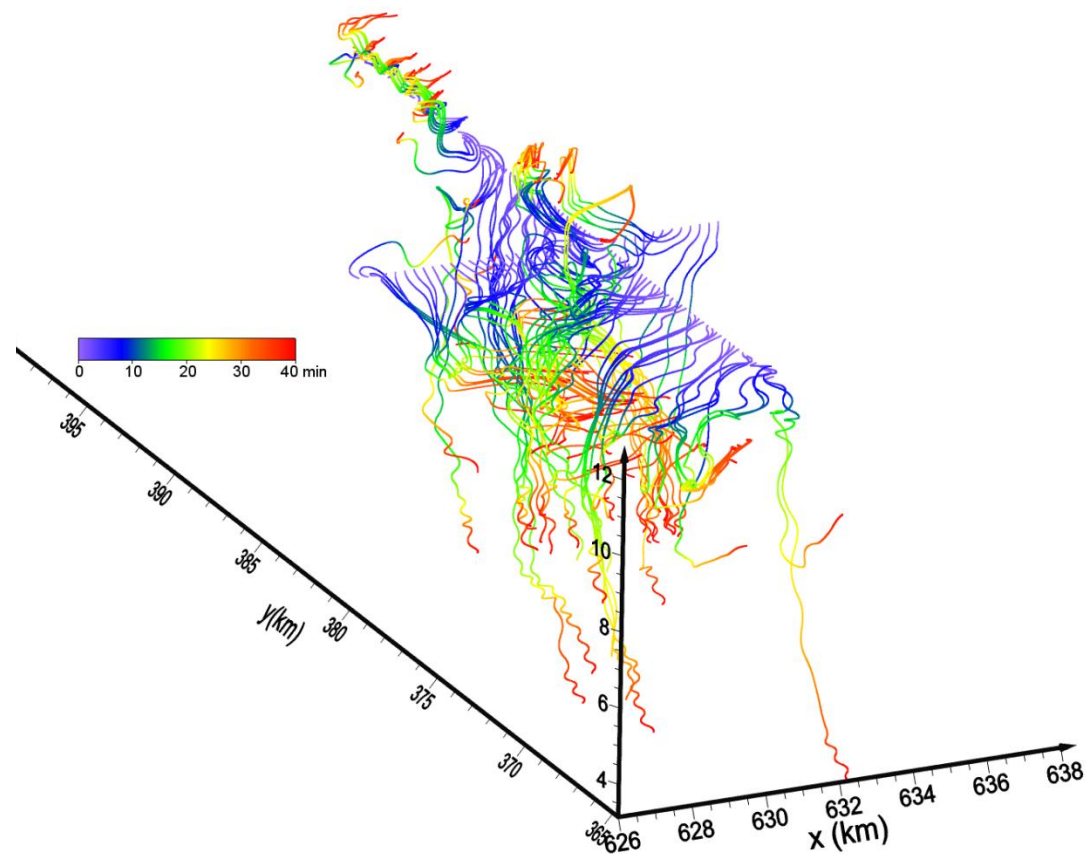
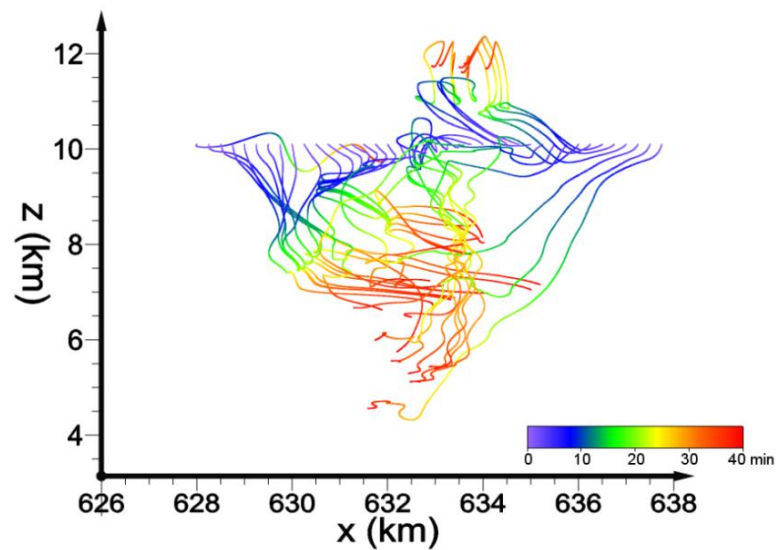
Méthodologie:

- poursuivre l'évolution individuelle des parcelles d'air à l'aide des trajectoires (**backward ou forward**) et
- analyser le taux de réchauffement/refroidissement dû à la condensation/évaporation, déposition/sublimation, givrage et fonte des hydrométéores

Analyse des trajectoires

- 1) méthode lagrangienne: sélection des parcelles individuelles + suivi de T , w , Q_{LWC} , Q_{ice} , taux de condensation, ...
 - 2) sélection d'une scène importante (30-40 min) avec tous les paramètres d'intérêt (u , v , w , T , RH , Q_{LWC} , ...) en 3D sur un domaine réduit.
- ➔ Calcul des trajectoires **backward ou forward** pour chaque points du domaine sélectionné

Darwin 2014 (HAIC)



- Quelques questions techniques
 - Le 2 octobre = IOP6 ou IOP7 car nomination différente sur Wiki page et dans le BAMS
 - Le Falcon FR trajectoire du 2 octobre = RF06 ou RF07 car dénomination différente sur Wiki page et dans le BAMS
 - Base de données – accès ?
- Quelle(s) IOP(s) pour le meilleur cas d'étude possible ?
2 octobre est ok?