

# ***Micro Squall Line in Belém Region***

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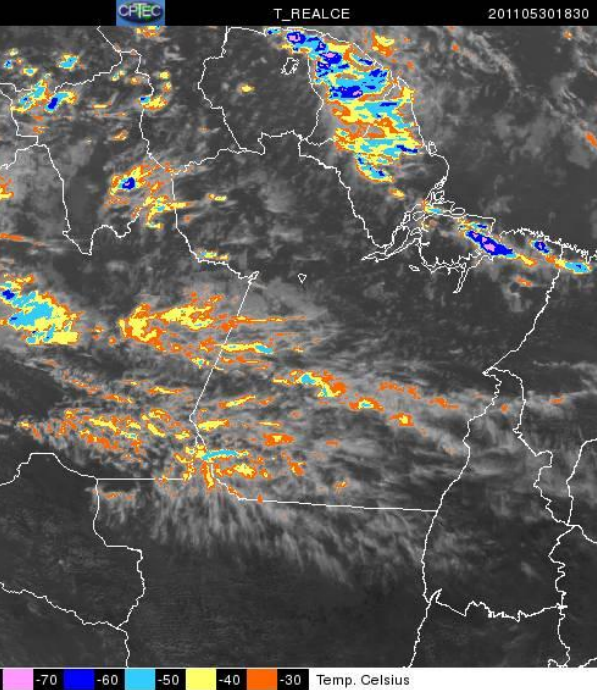
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(2) Centro de Previsão de Tempo e Estudos Climáticos, Cachoeira Paulista, São Paulo, Brasil.

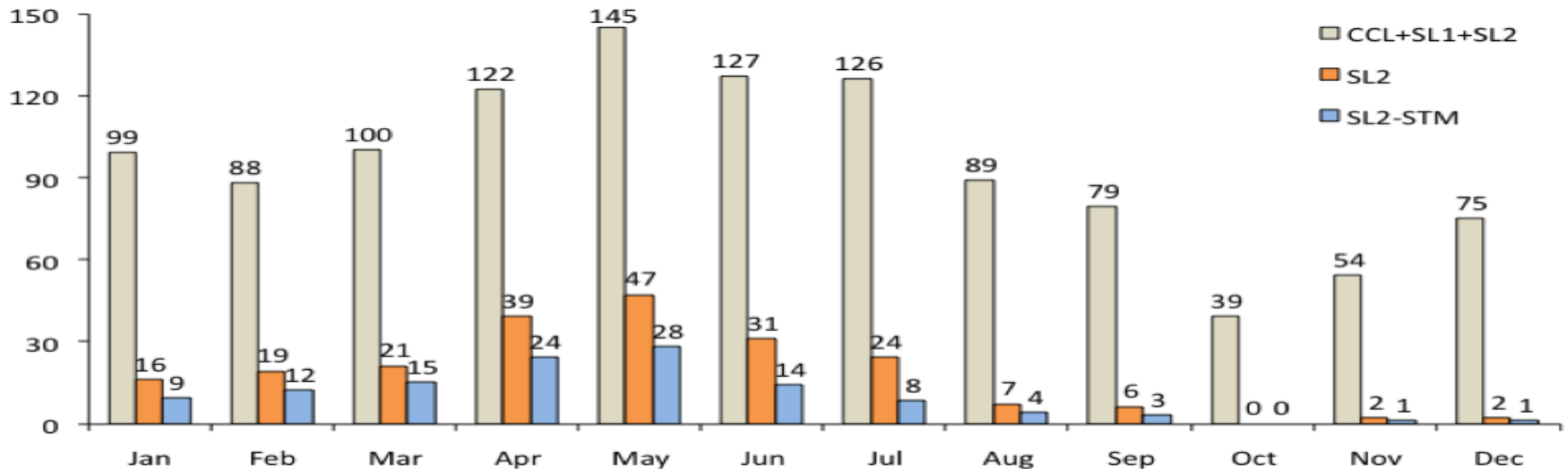




# Squall Lines : 2000 to 2006

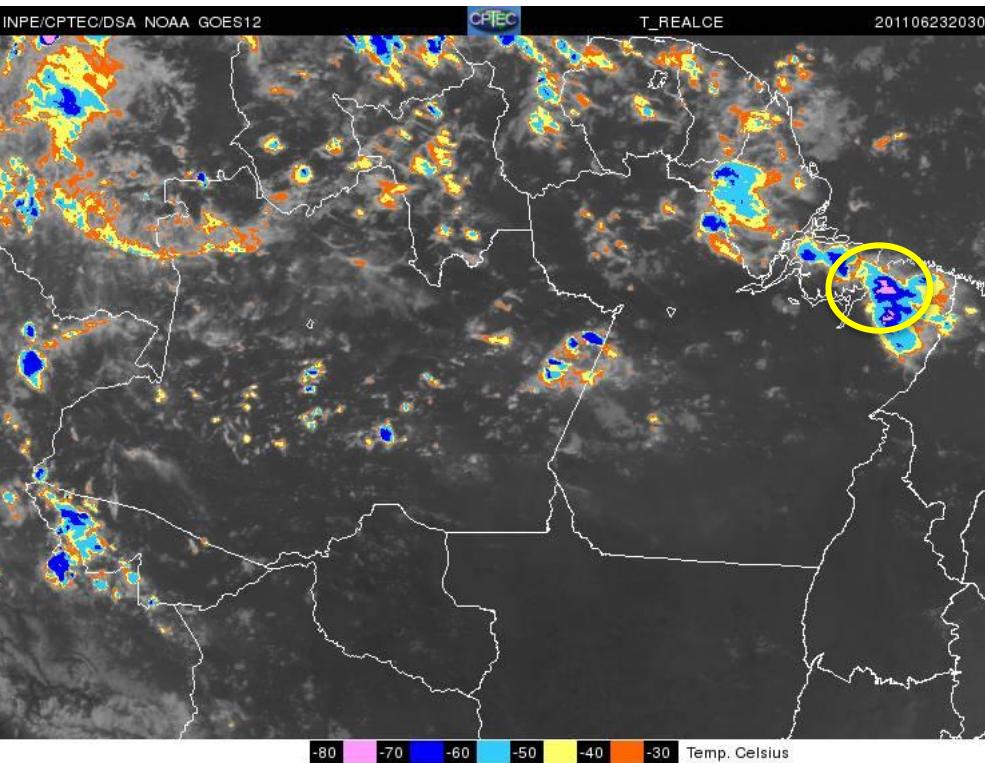
According to Kousky (1980), when the cumulonimbus develops from sea breeze in the coast it organize as a line of convective clouds, it can propagate inside the land as a squall line.

These squall lines have large dimensions of about thousands kilometers and therefore is easily viewed in satellite image and it can be classified having a space scale like a system of the synoptic scale.

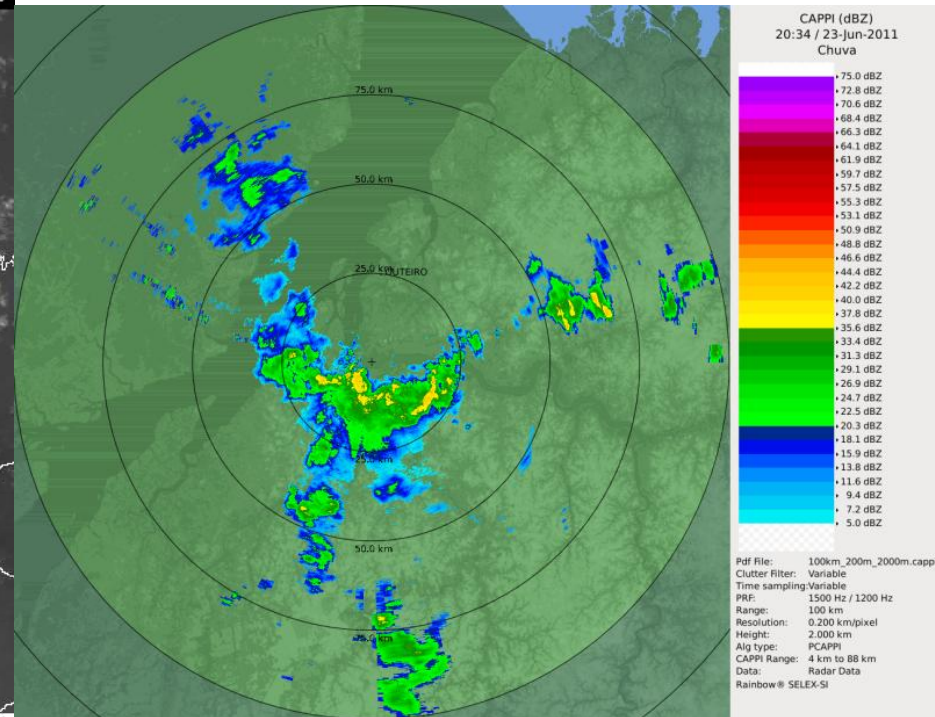


# Target in Belem: Squall Lines

June, 23 2011 20:30 UTC



June, 23 2011 20:34 UTC

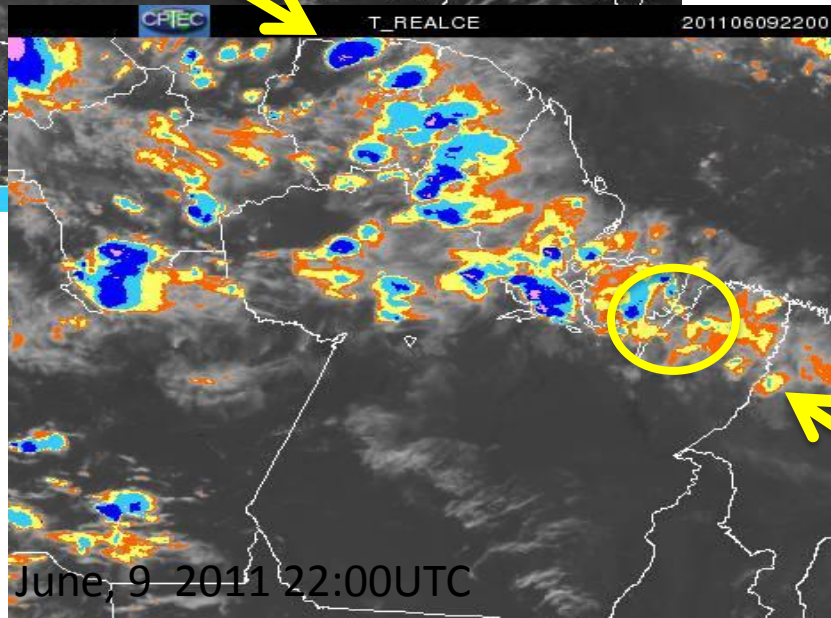
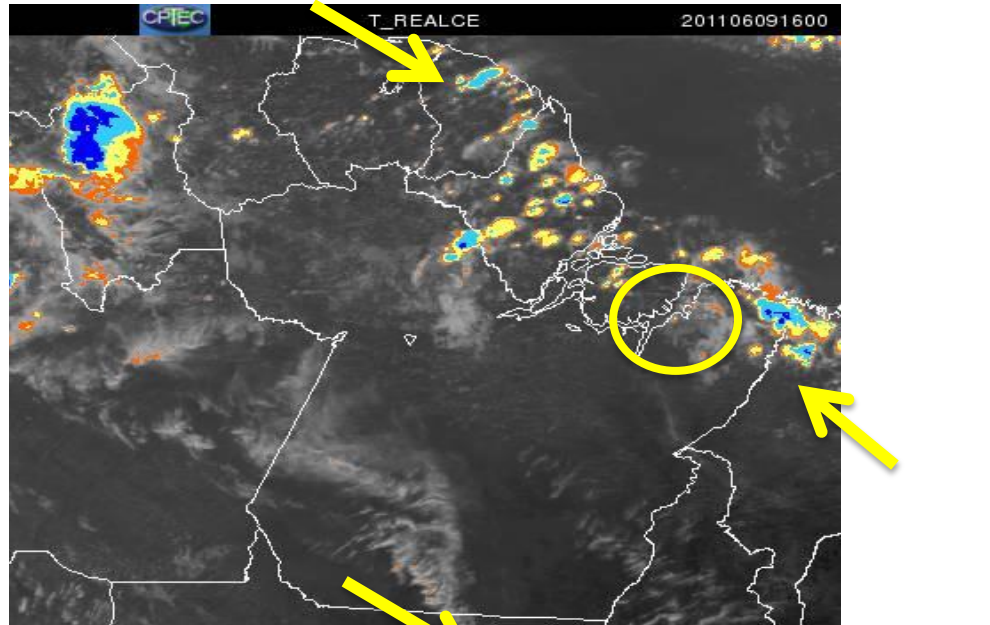


Number of cases observed during the Chuva campaign  
**20 Squall Lines – June, 7 to 30 2011.**



# 1 Squall Line and 2 Micro Squall Lines

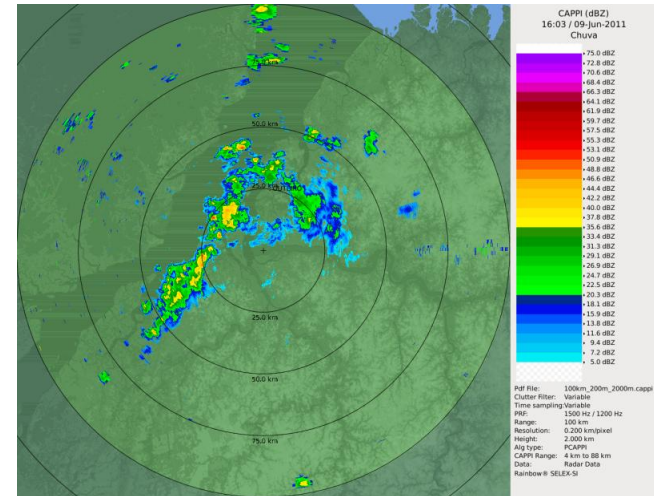
June, 9 2011 16:00UTC



June, 9 2011 22:00UTC

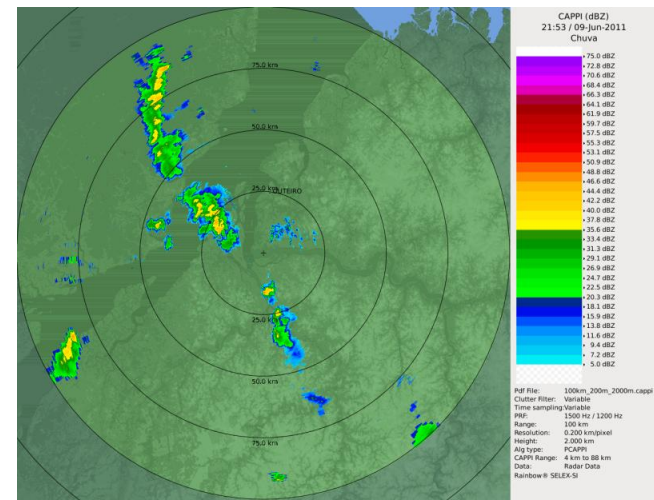
## Parallel to Marajo Bay (MSLP)

June, 9 2011 16:03UTC



## Transversal to Marajo Bay (MSLT)

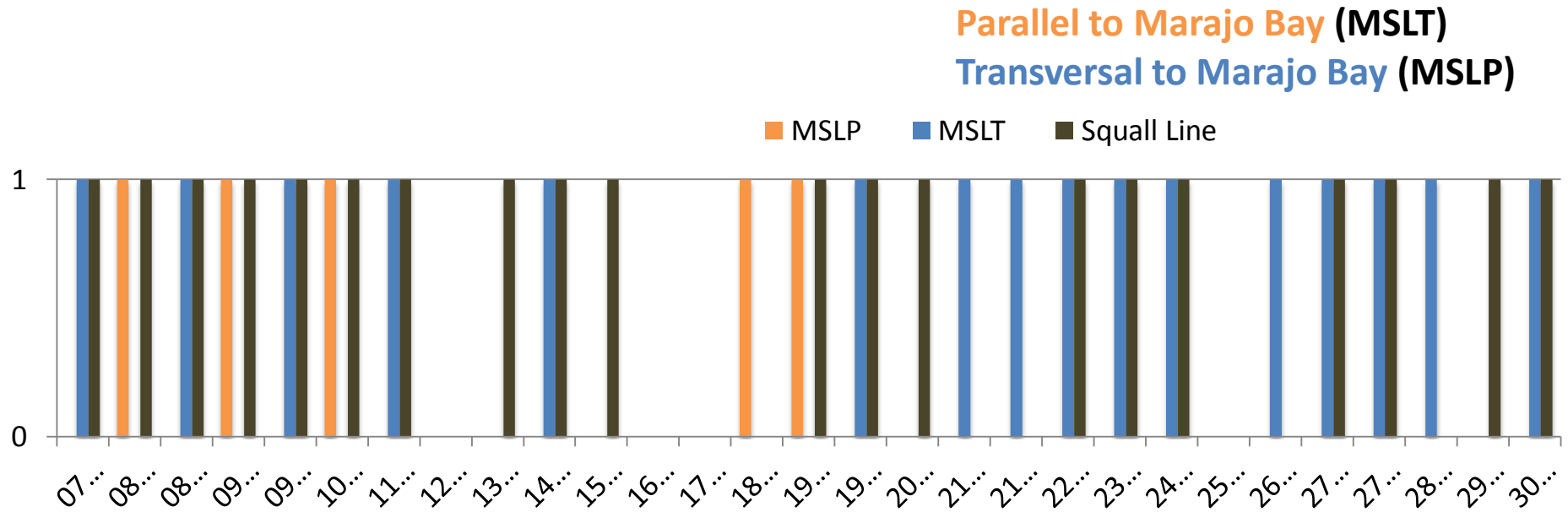
June, 9 2011 21:53UTC



The aim of this paper is to study this new type of squall Line, trying to find its morphology and to understand the relationship of such convective band with the classic Squall Line.

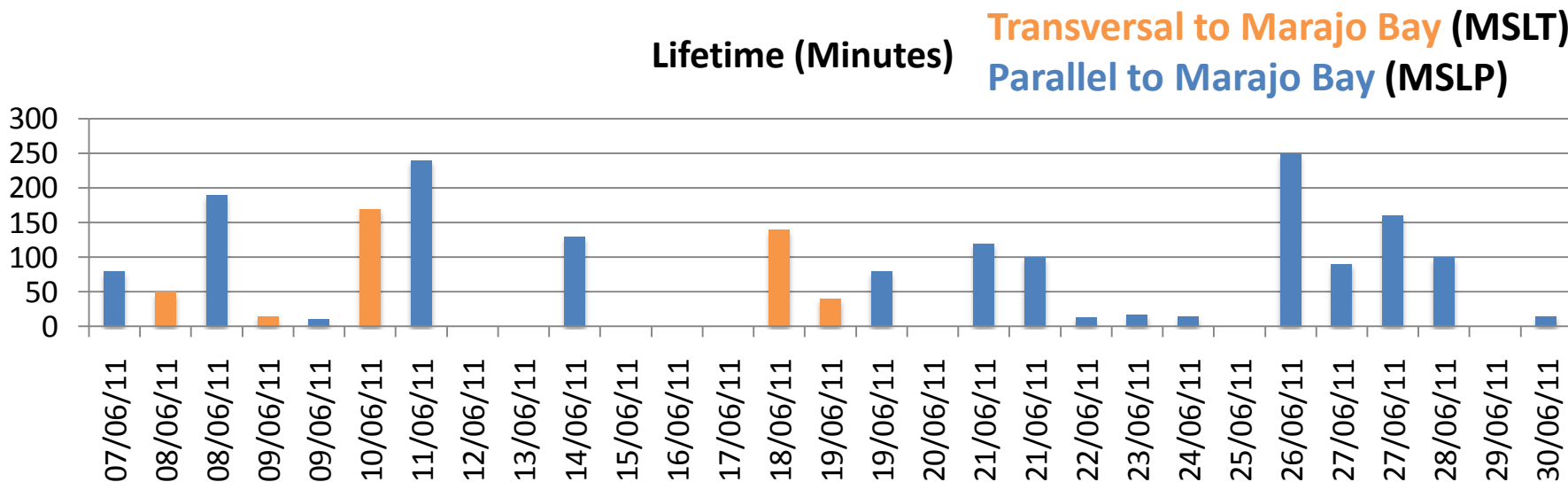
- Average characteristics of the micro lines (FORTRACC).
- Understand the relationship with the classic Squall Line.
- Possible mechanisms of formation (modeling).

# Distribution of Micro-Squall Lines in Belem



- **20 Squall Lines (9 CSL, 4 SL1 and 4 SL2)**
- **21 cases of MSL (5 MSLP and 16 MSLT)**
- **16 MSL was observed in day with Squall Line**
- **5 MSL occurred in absence of Squall Line**
- **Two cases MSL same day ( June, 8, 9, 19, 21 and 27)**

# Lifetime (minutes) of the Micro-Squall Lines



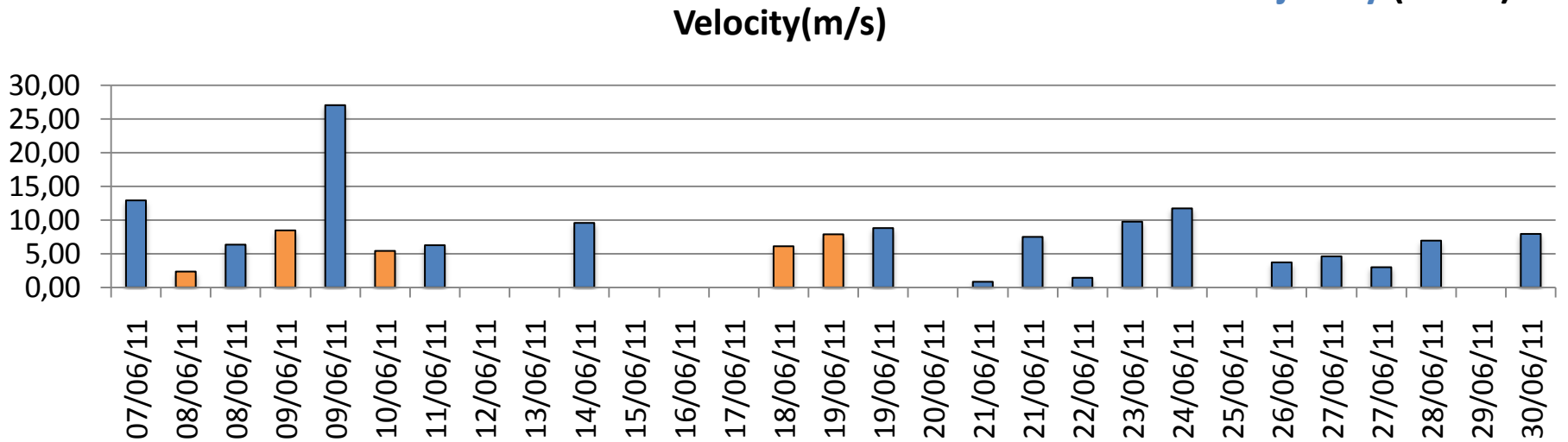
- **Average lifetime for MSL = 1h:50min**
  - **MSLP = 50 min**
  - **MSLT = 2h:20min**
- **MSLP had its formation earlier (from 15 to 19:30 UTC)**
- **MSLT (between 17:30 and 23UTC)**
- **a case of the MSLT overnight (04UTC).**

CSL = 9 hours  
SL1 = 12 hours  
SL2 = 16 hours

# Propagation velocity (m/s) of the Micro-Squall Lines

Transversal to Marajo Bay (MSLT)

Parallel to Marajo Bay (MSLP)



Average speed = 7 m/s

MSLP = 6 m/s

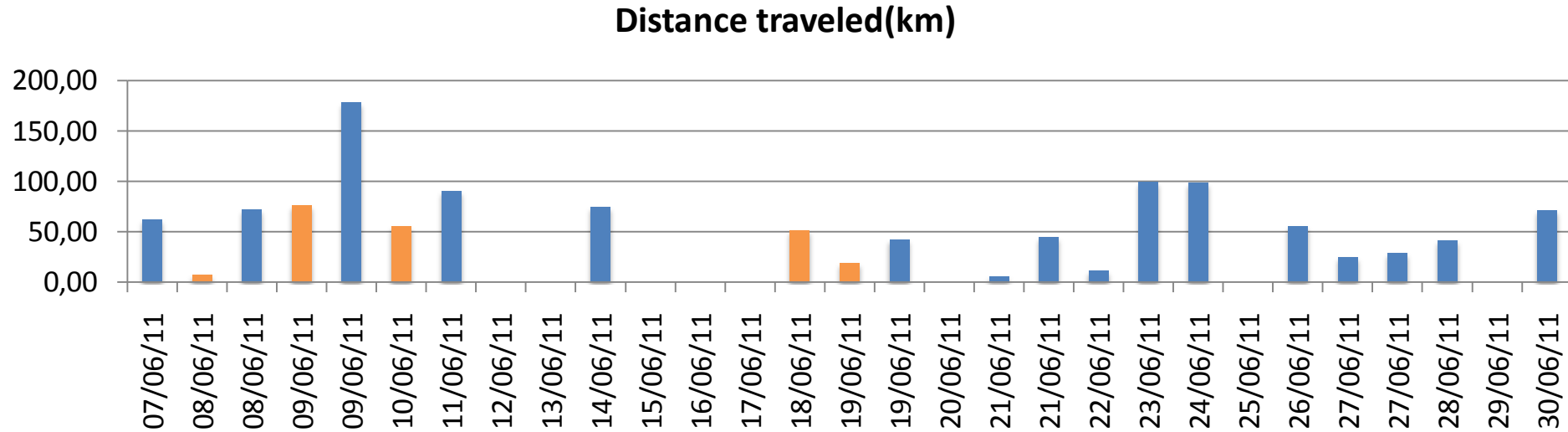
MSLT = 8m/s

SL1 = 12 m/s

SL2 = 16 m/s



# Distance (km) traveled by the Micro-Squall Lines



Mean distance traveled = 57.63km

MSLP = 42km

MLST = 62 km

Maximum for SL2 = 2000 km

# *Some differences*

## **Micro Squall Line (MSL)**

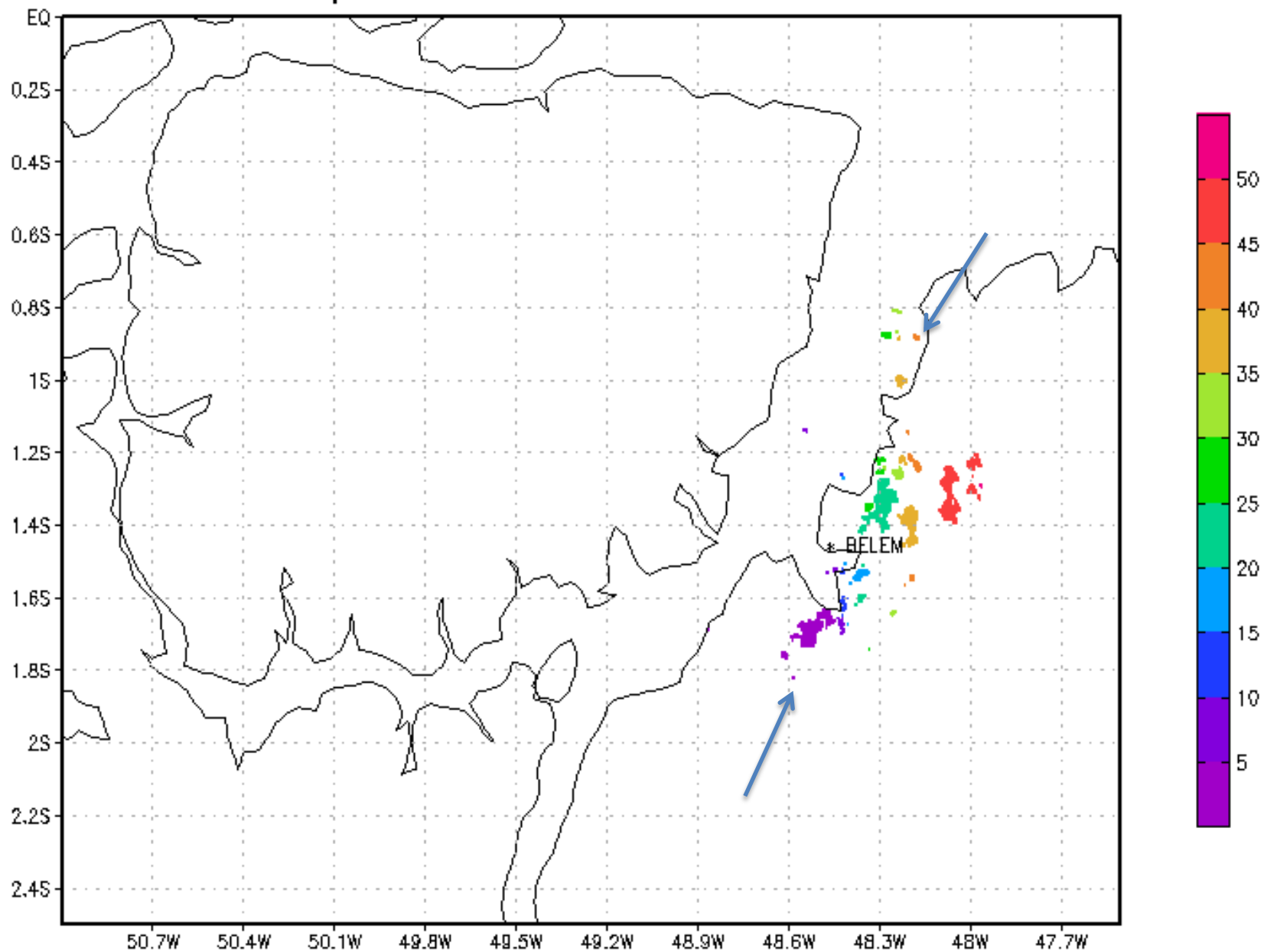
- Length = 150km
  - Average lifetime = 1h:50min
- 

## **Classical Squall Line (SL)**

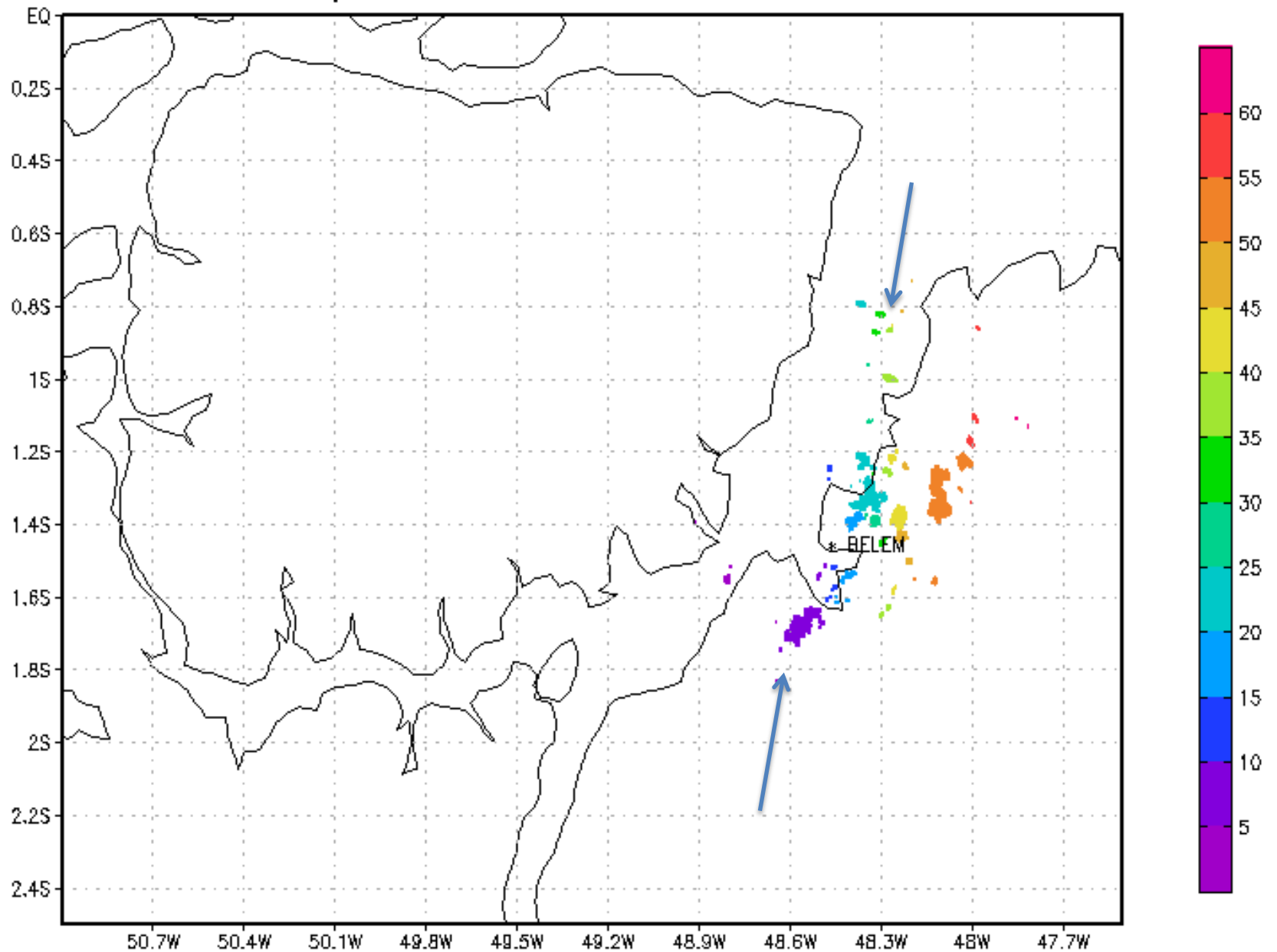
- Length = 1500km
  - Average lifetime = 9, 12 e 16 hours for CSL, SL1 and SL2, respectively.
- 

- MSL is Meso  $\beta$  scale
- SL is meso  $\alpha$  scale

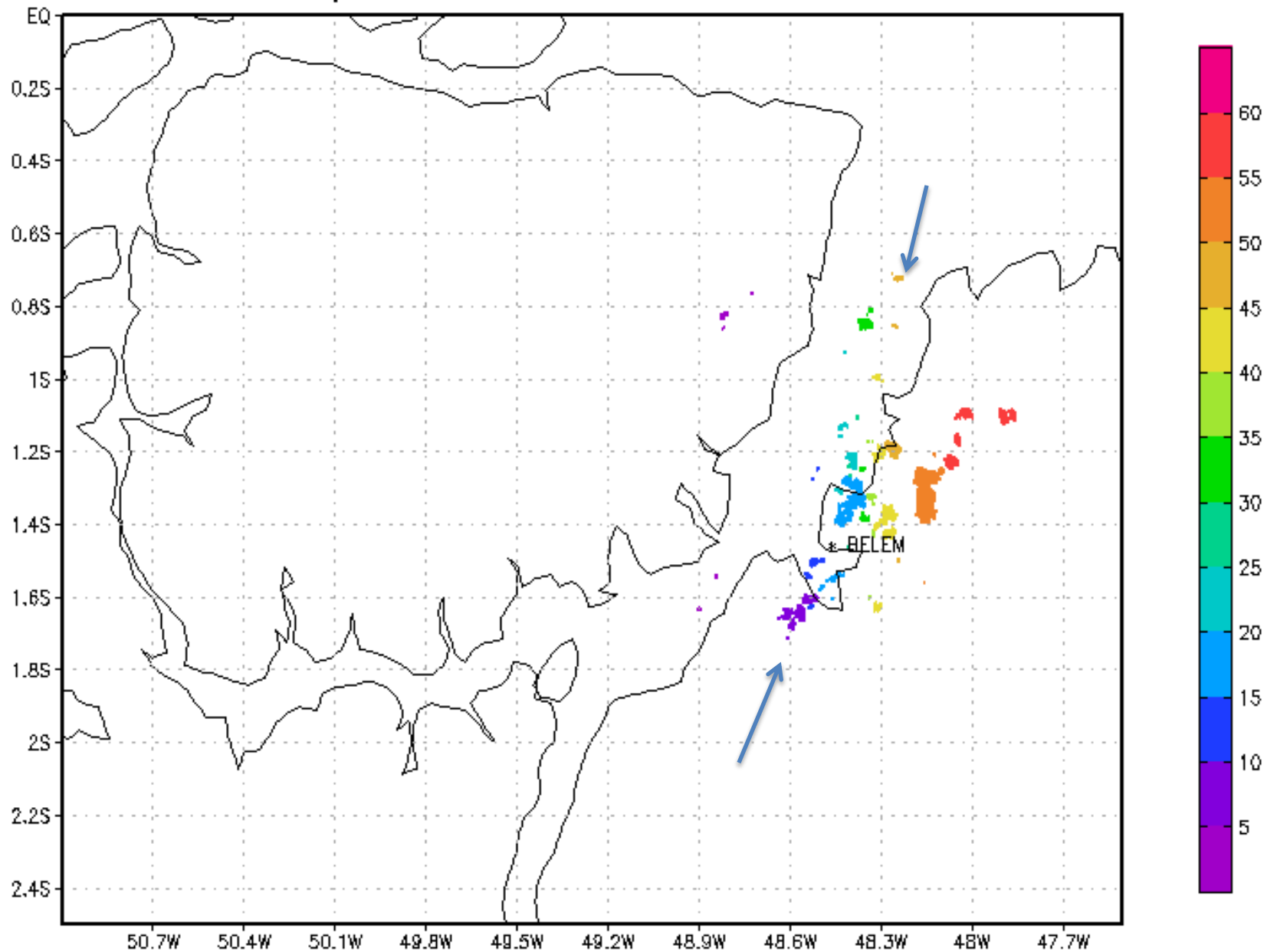
# micro-squall-line 2011-06-09 1504 UTC



# micro-squall-line 2011-06-09 1514 UTC

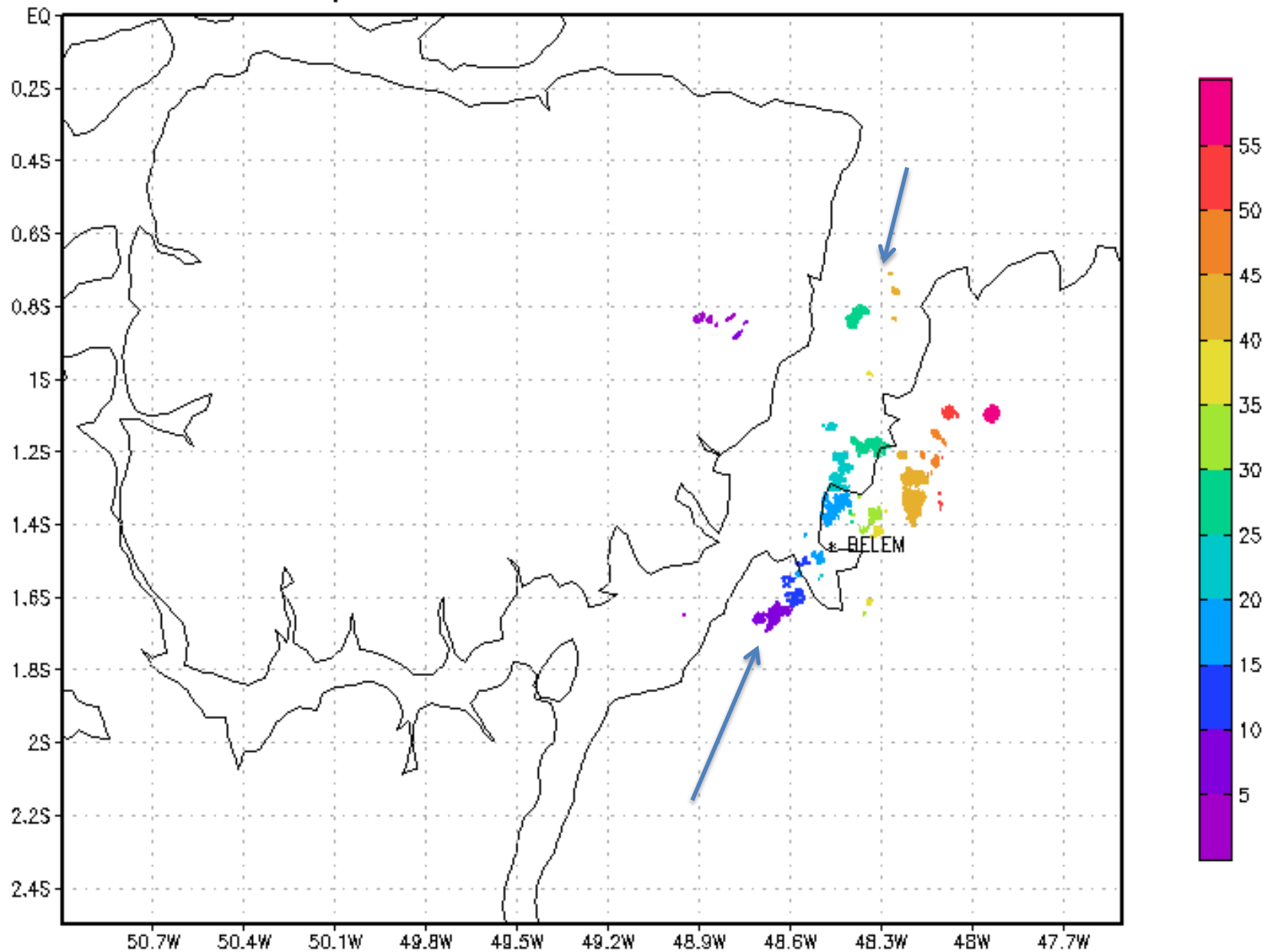


# micro-squall-line 2011-06-09 1524 UTC

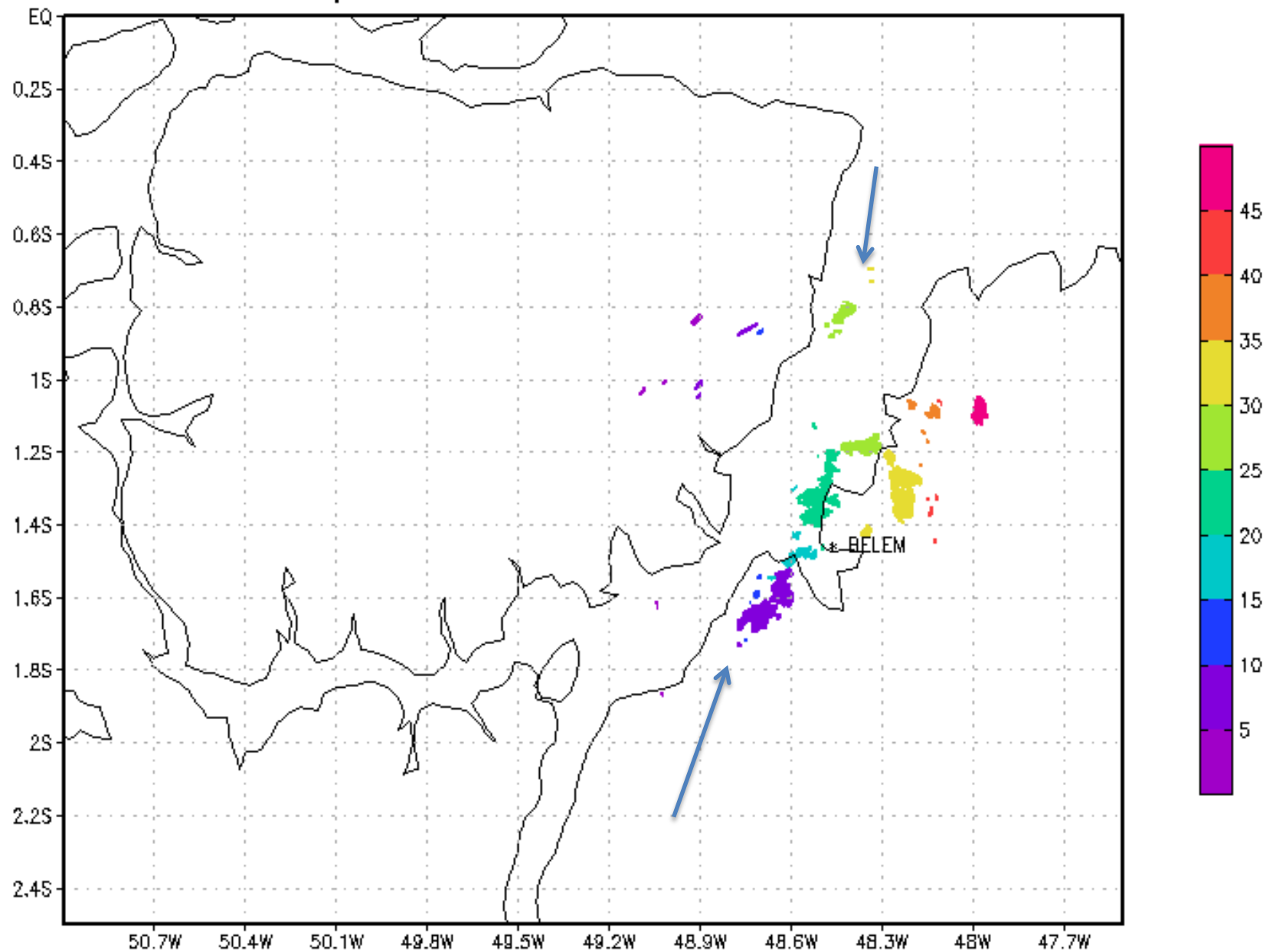




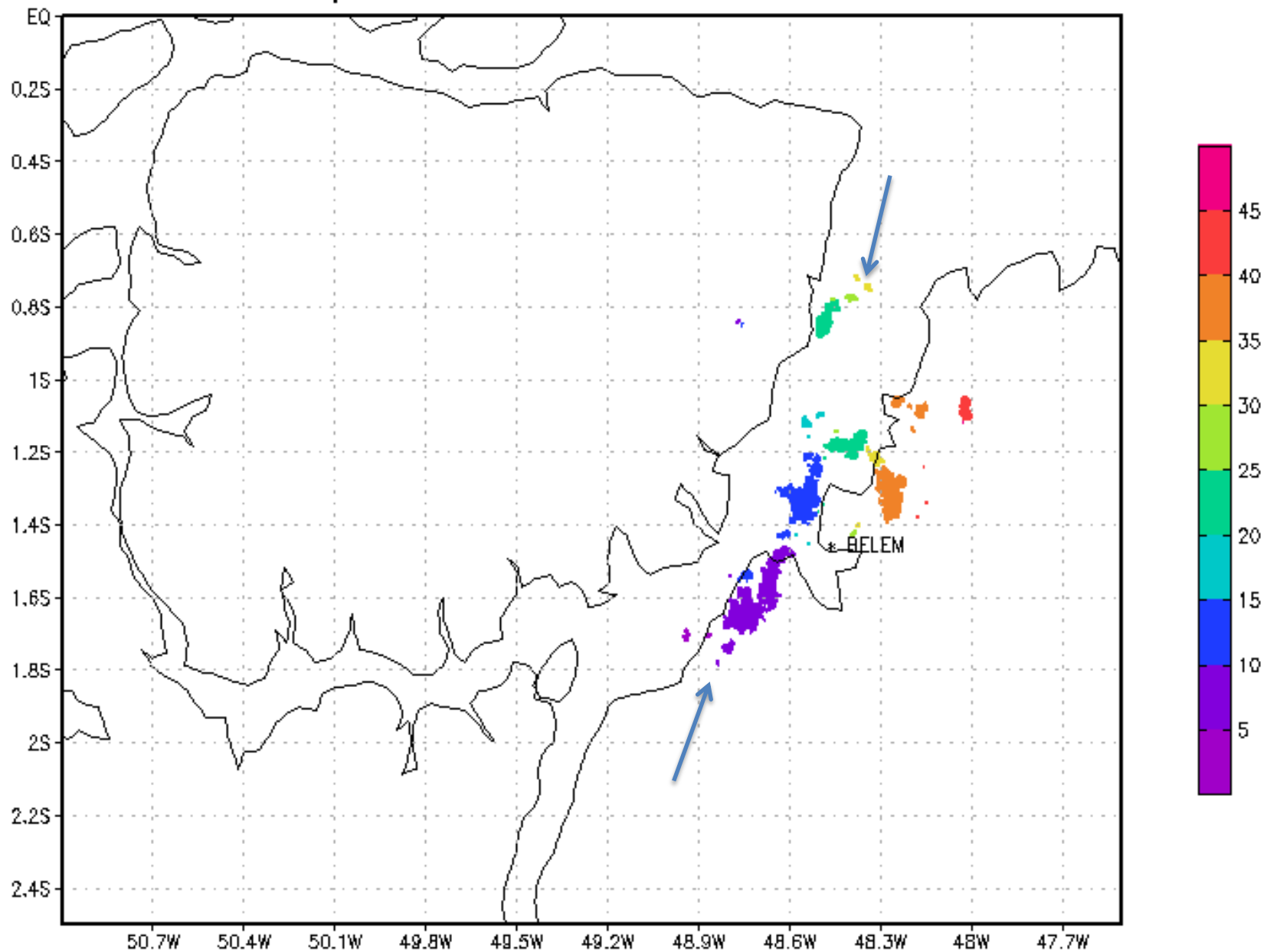
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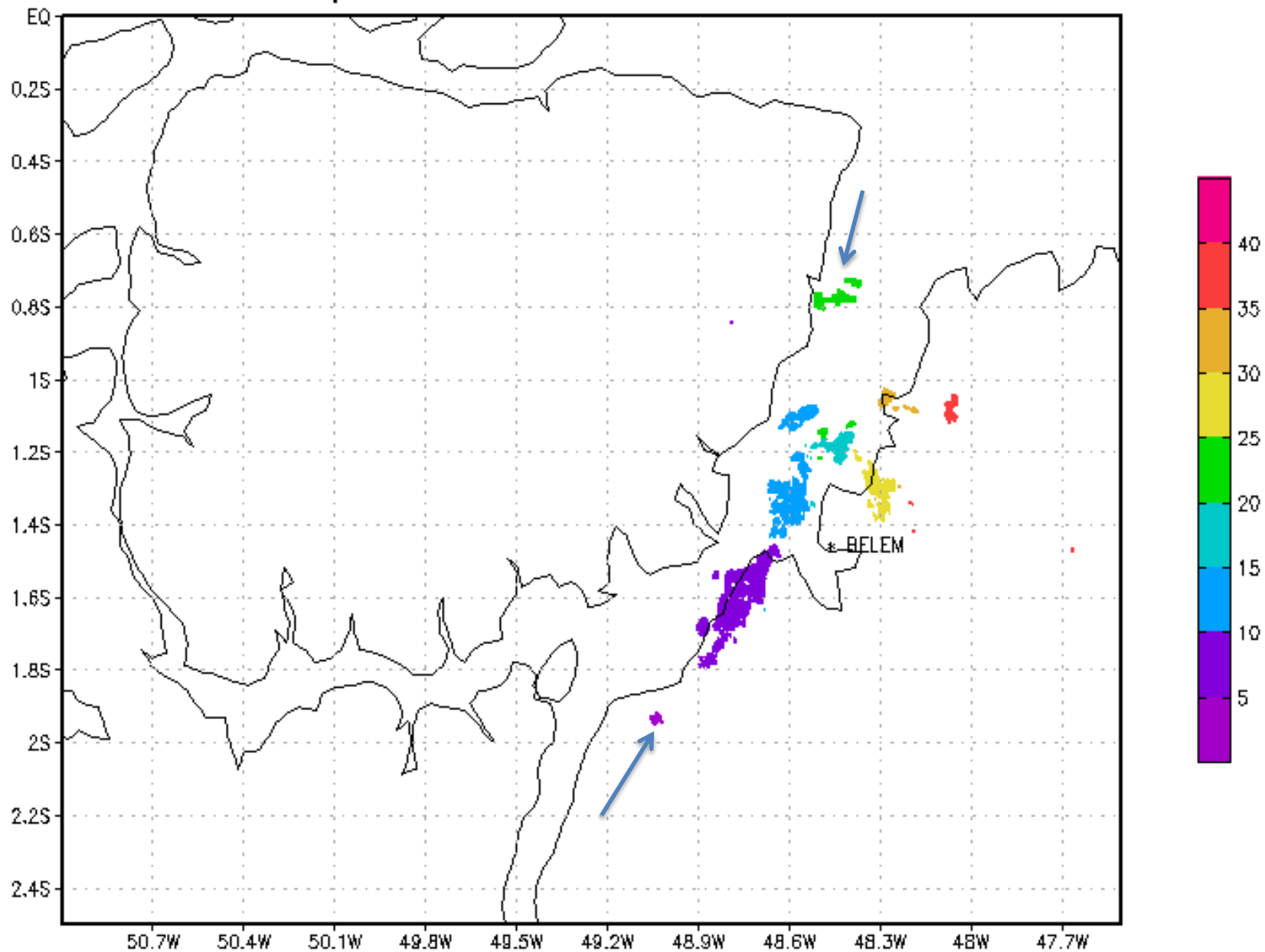
# micro-squall-line 2011-06-09 1544 UTC



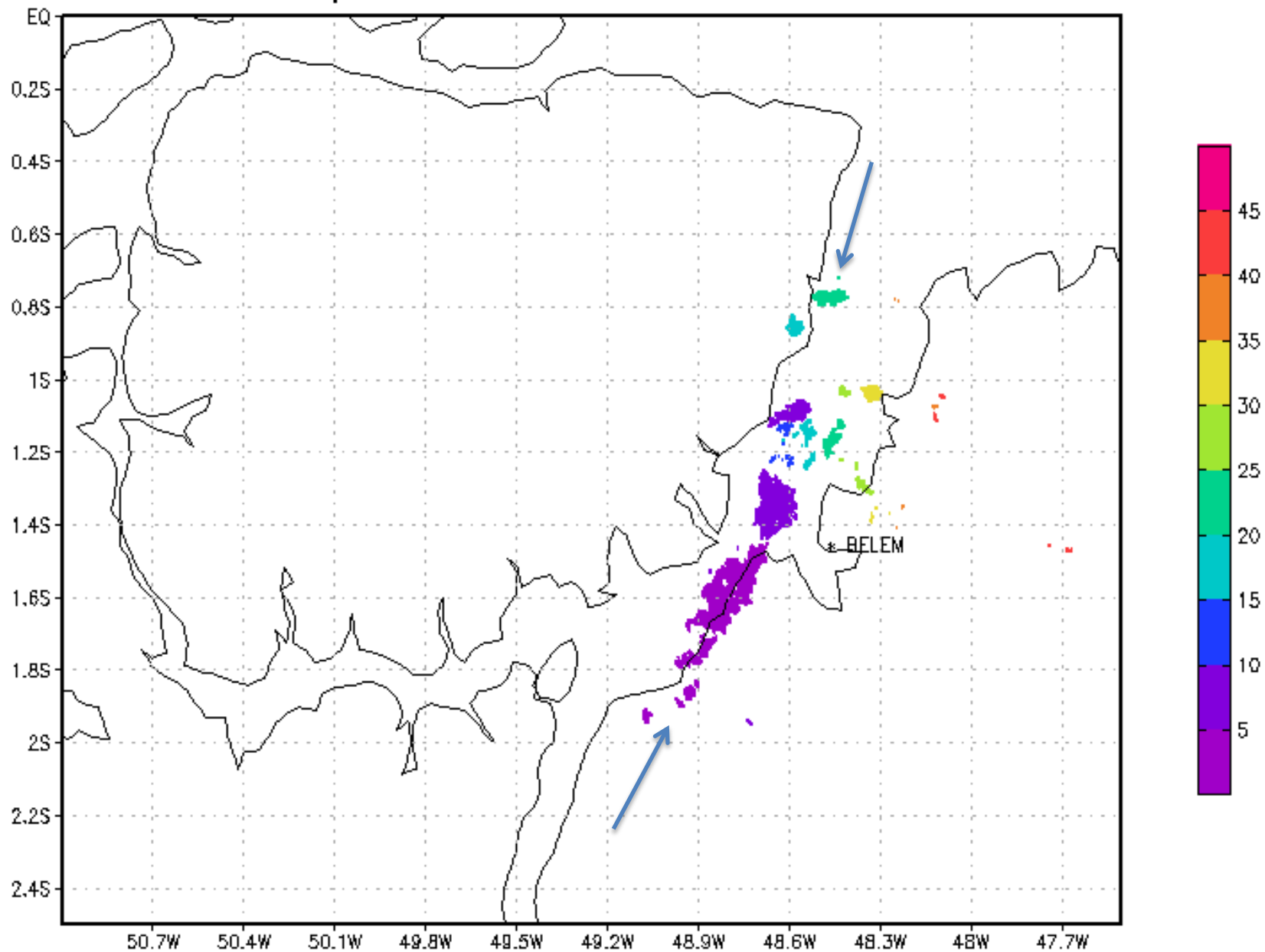
# micro-squall-line 2011-06-09 1554 UTC



# micro-squall-line 2011-06-09 1604 UTC

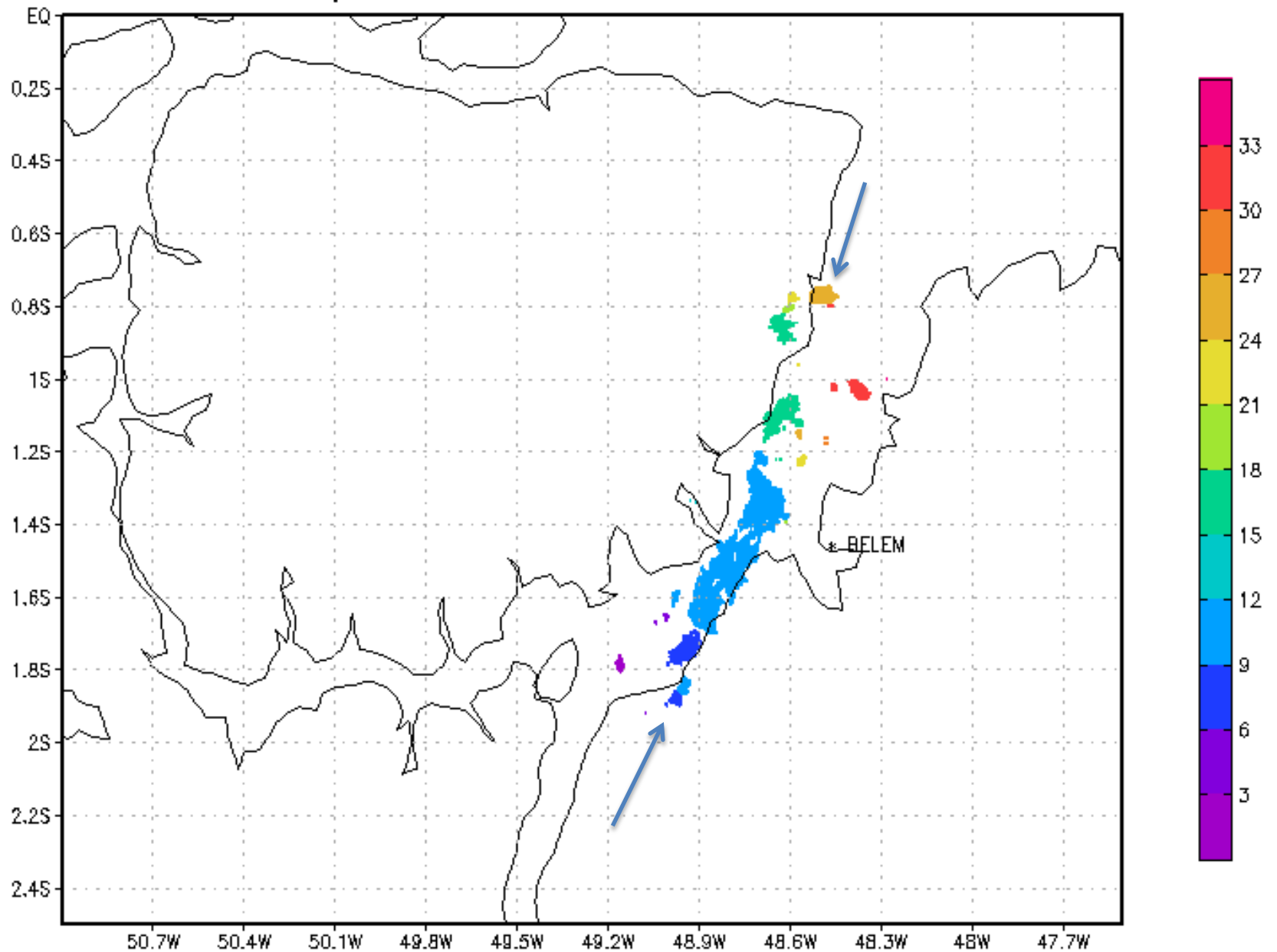


# micro-squall-line 2011-06-09 1614 UTC

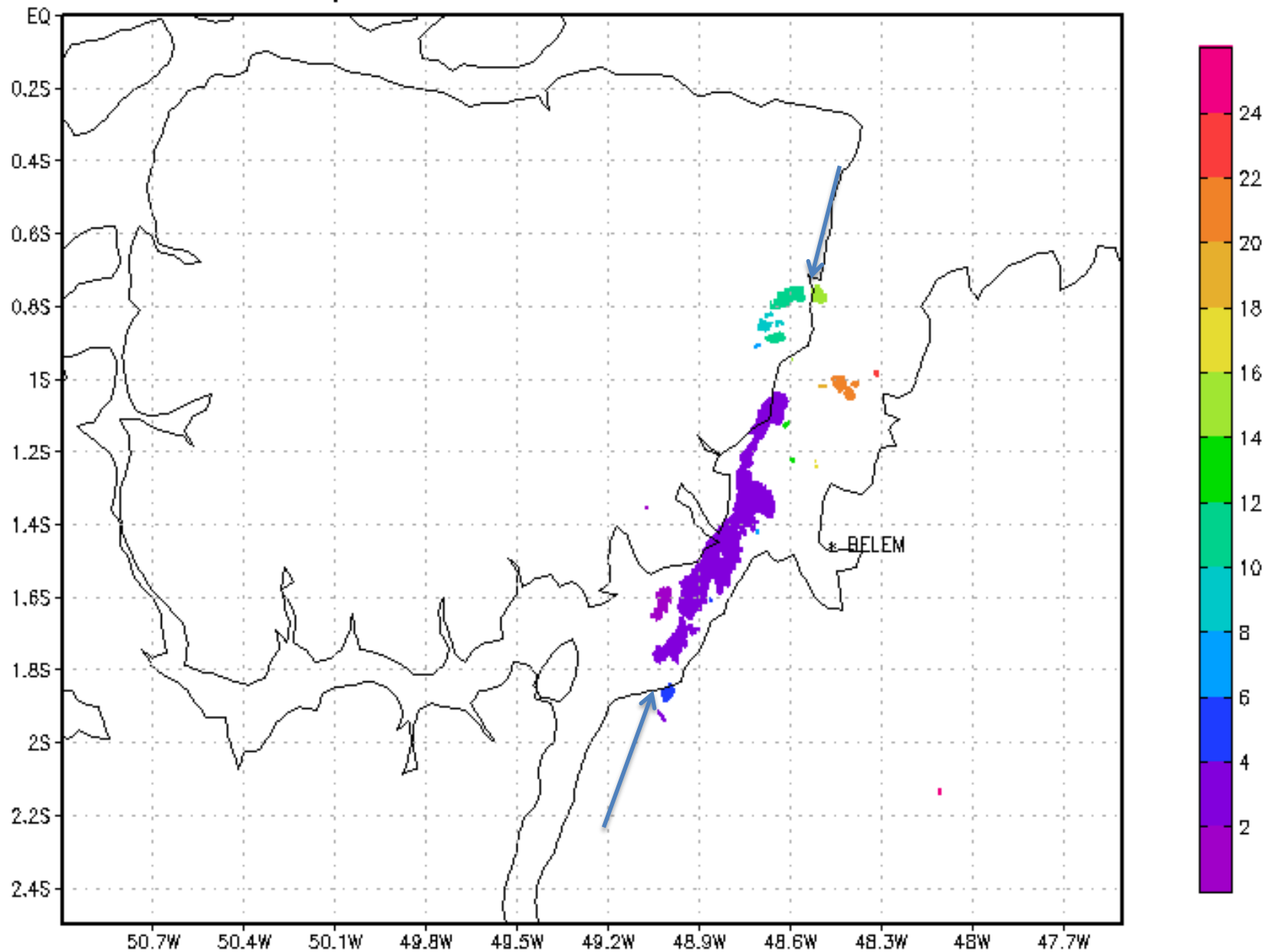




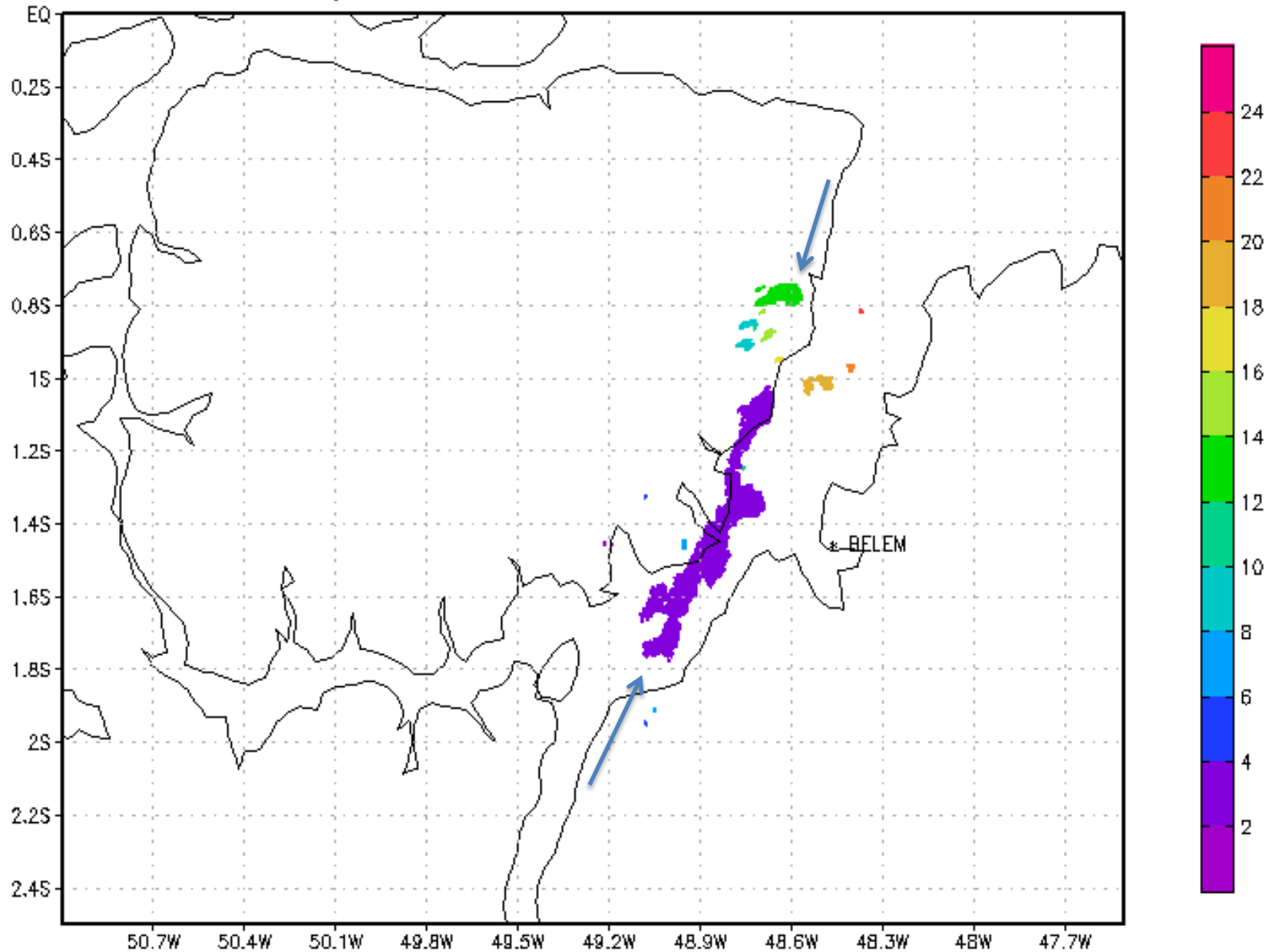
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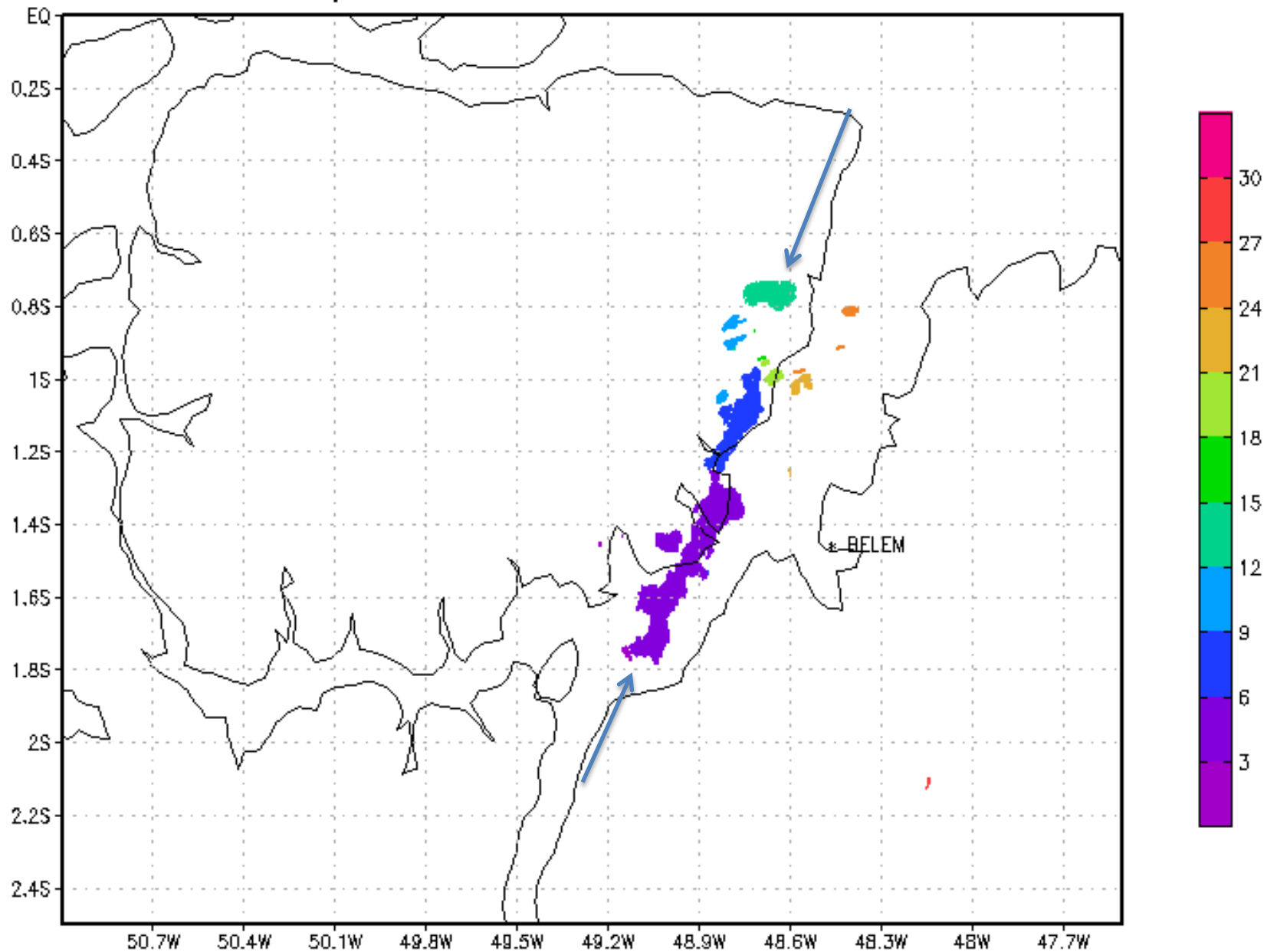
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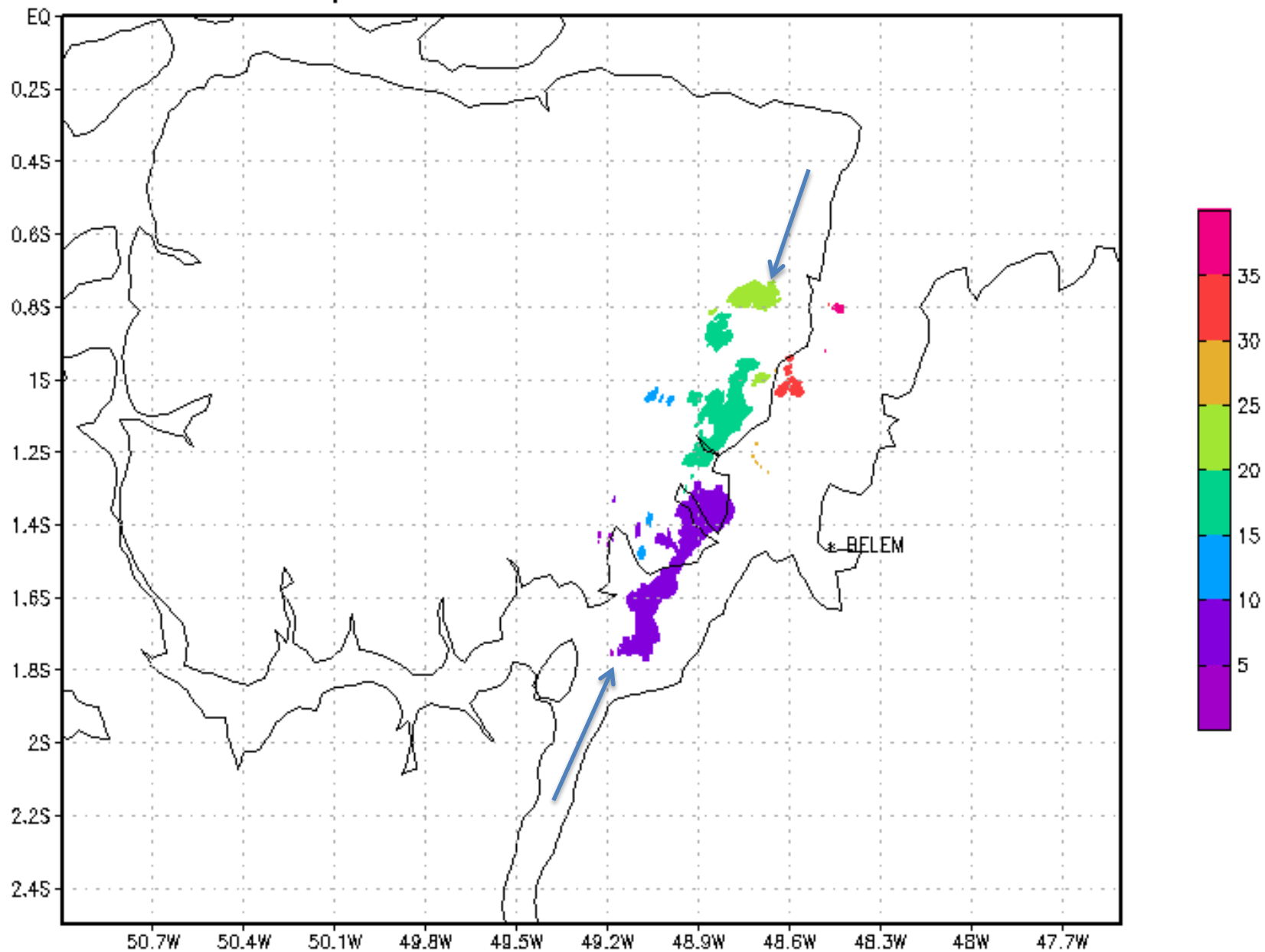
# micro-squall-line 2011-06-09 1644 UTC



# micro-squall-line 2011-06-09 1654 UTC

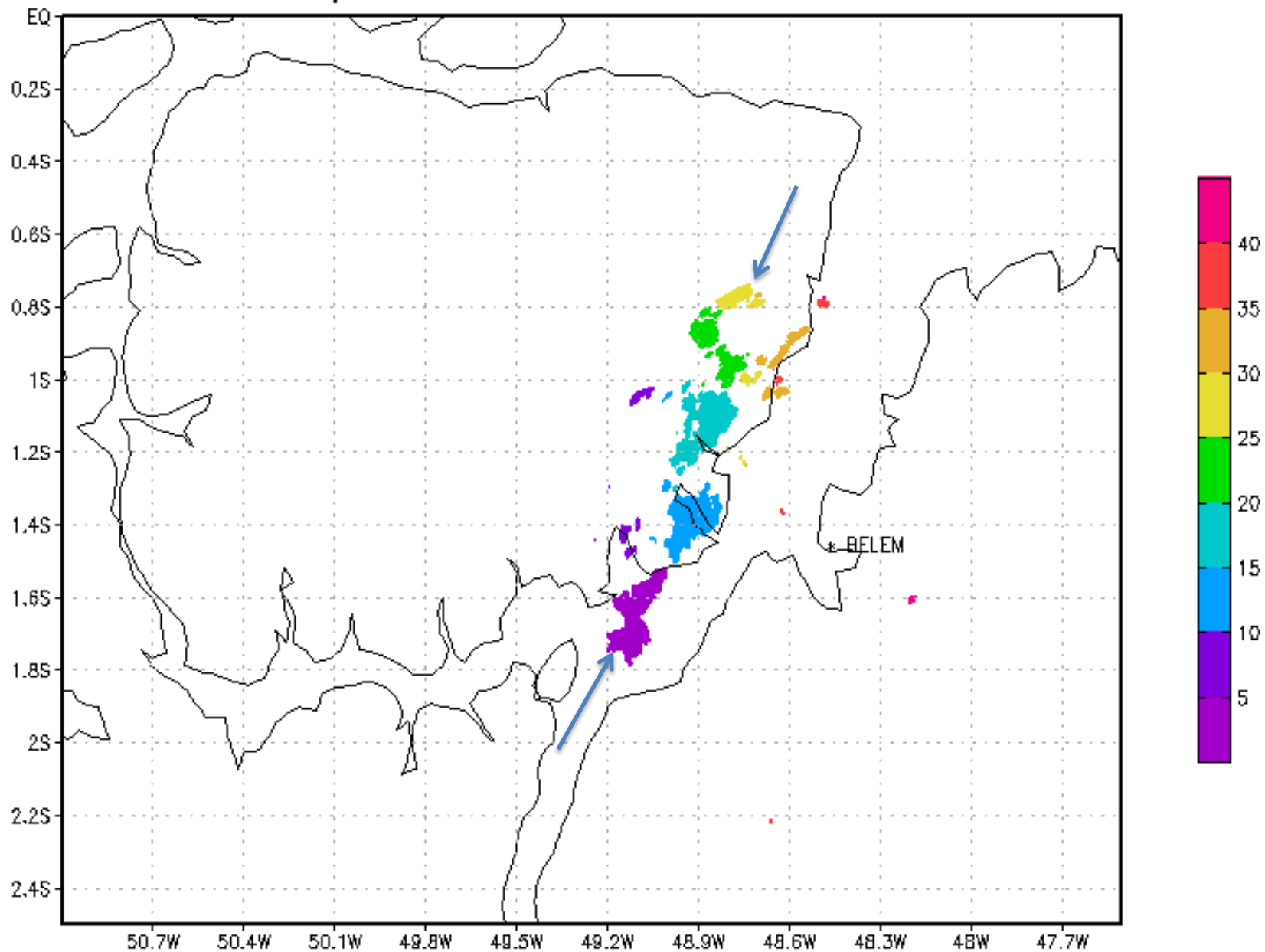


# micro-squall-line 2011-06-09 1704 UTC

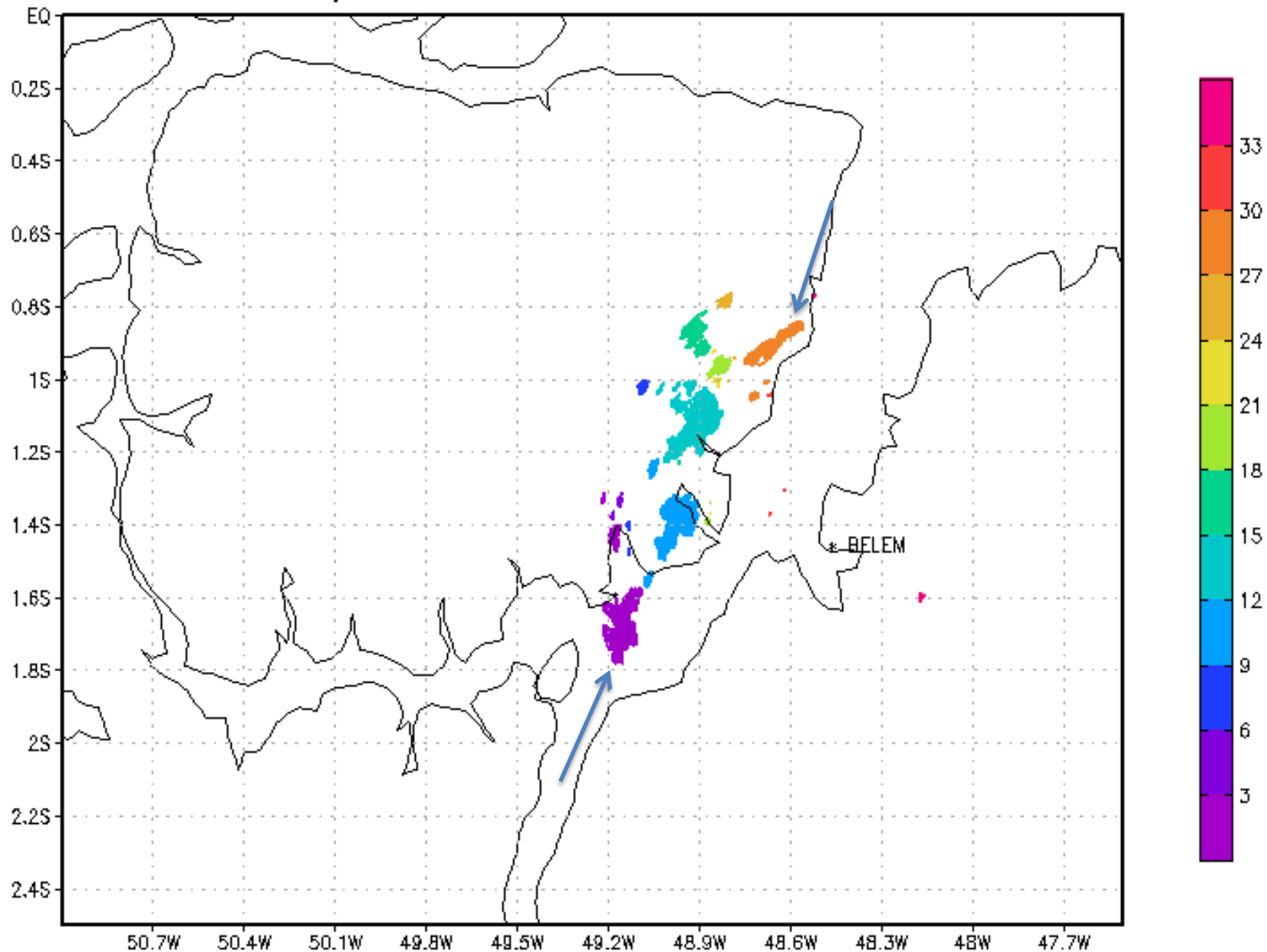




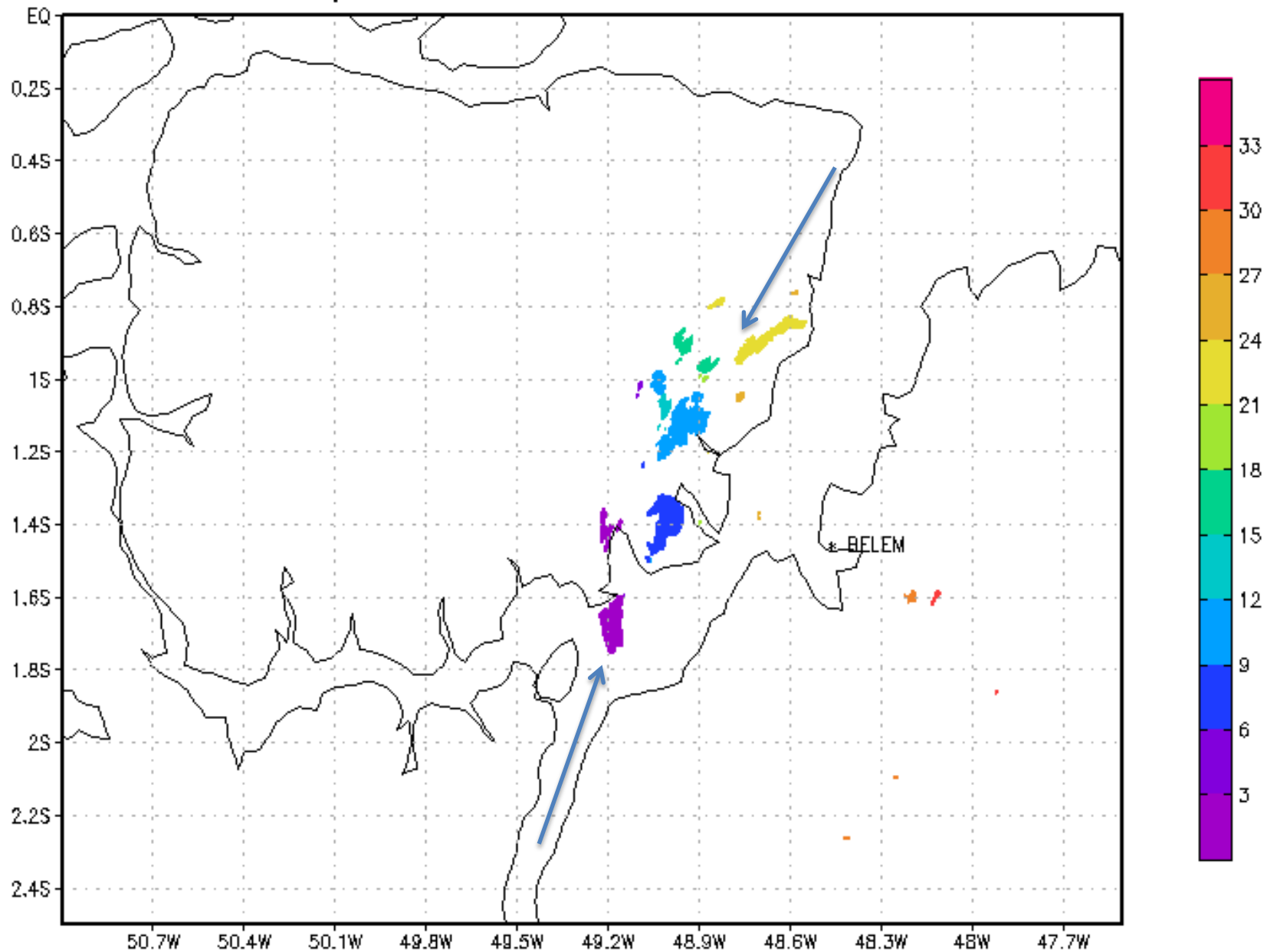
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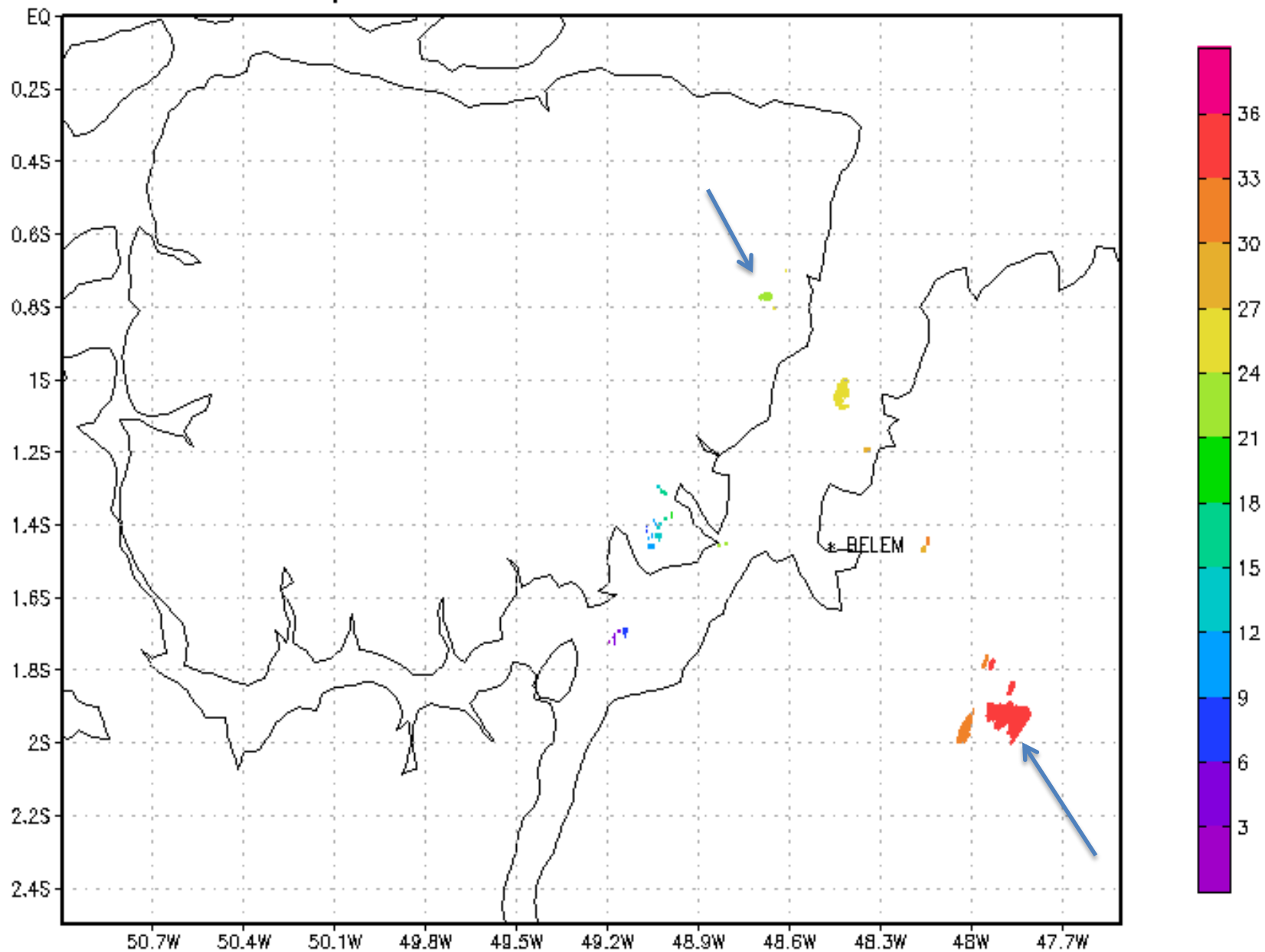
# micro-squall-line 2011-06-09 1724 UTC



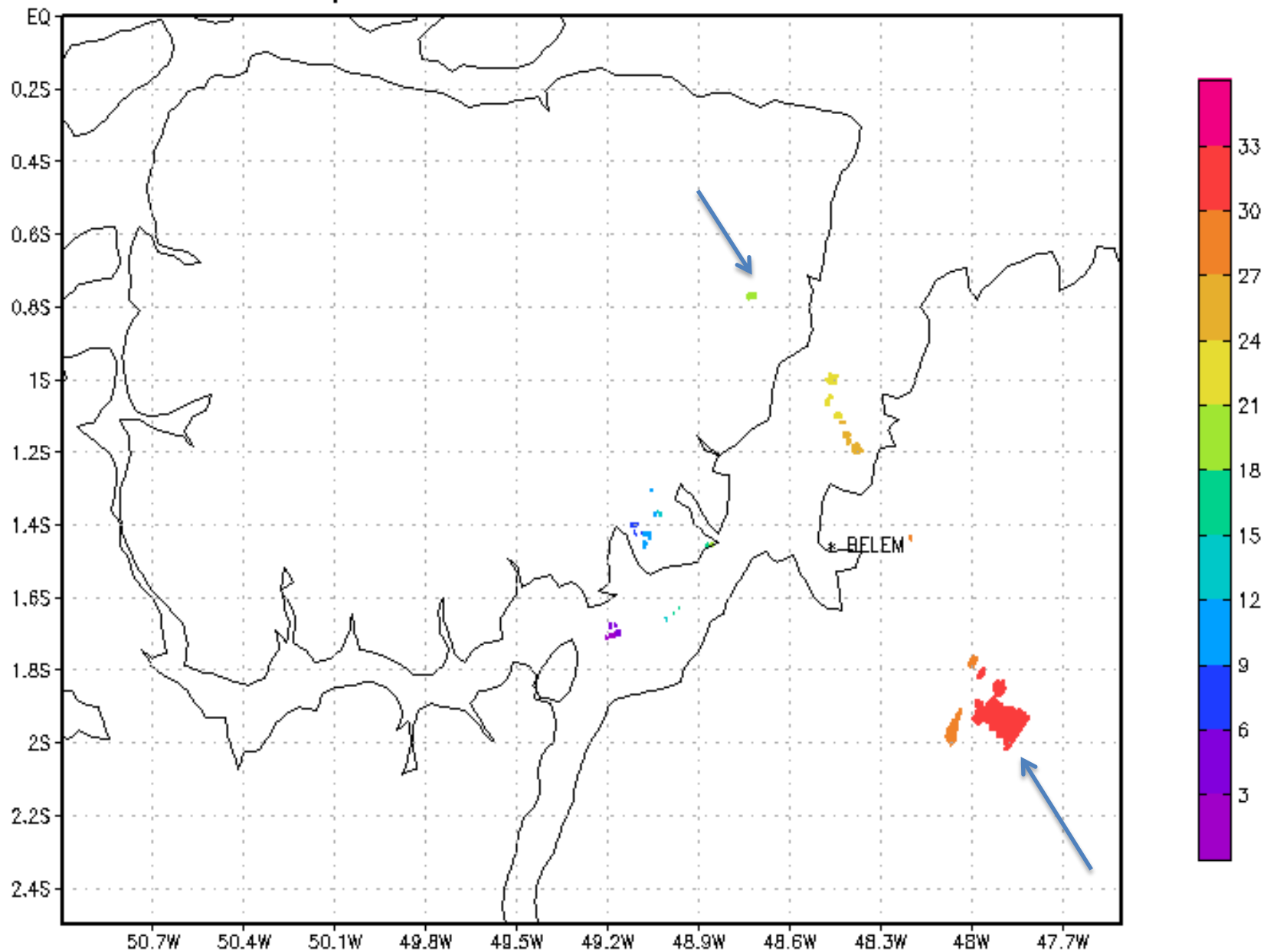
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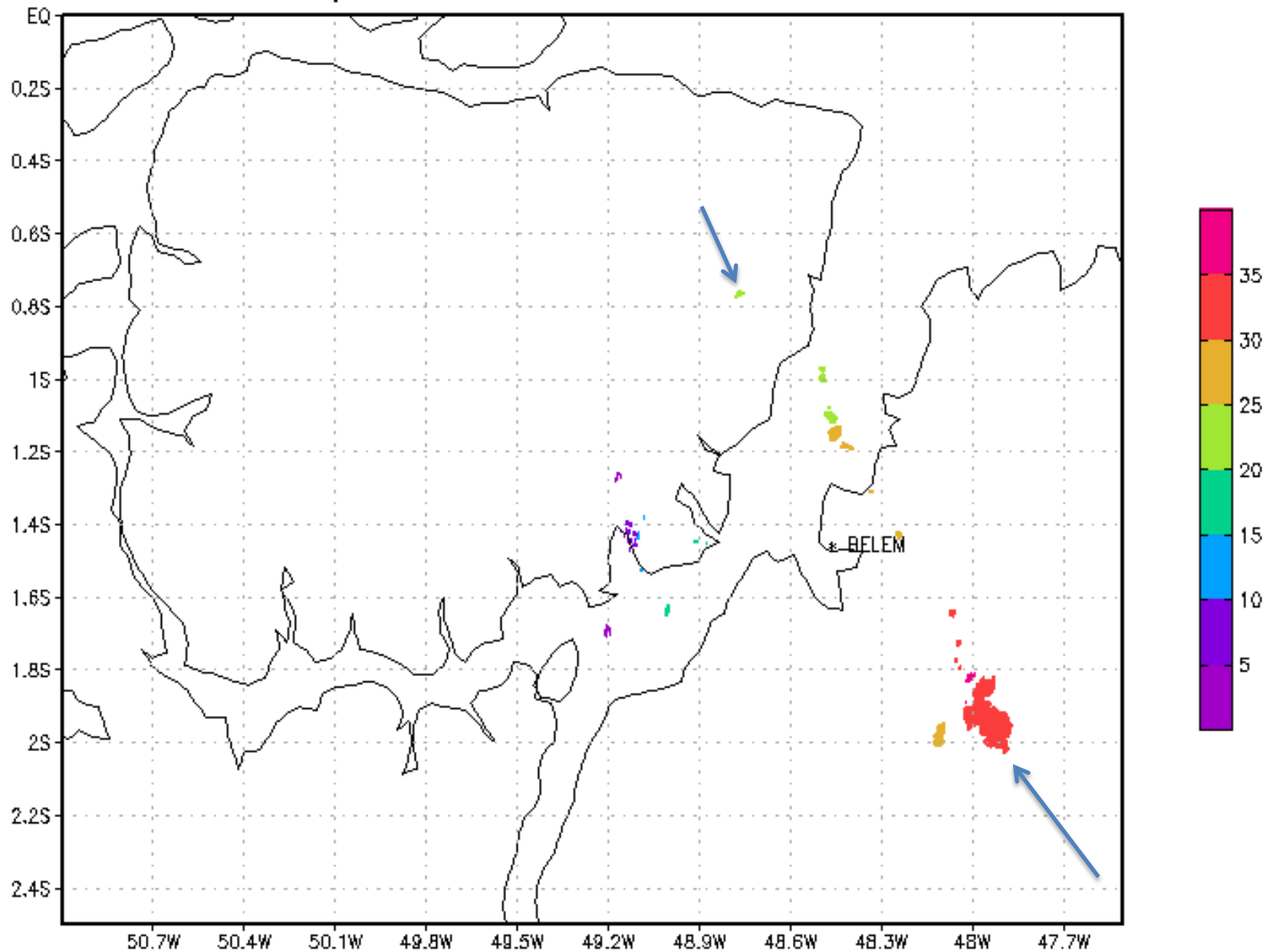
# micro-squall-line 2011-06-09 2014 UTC



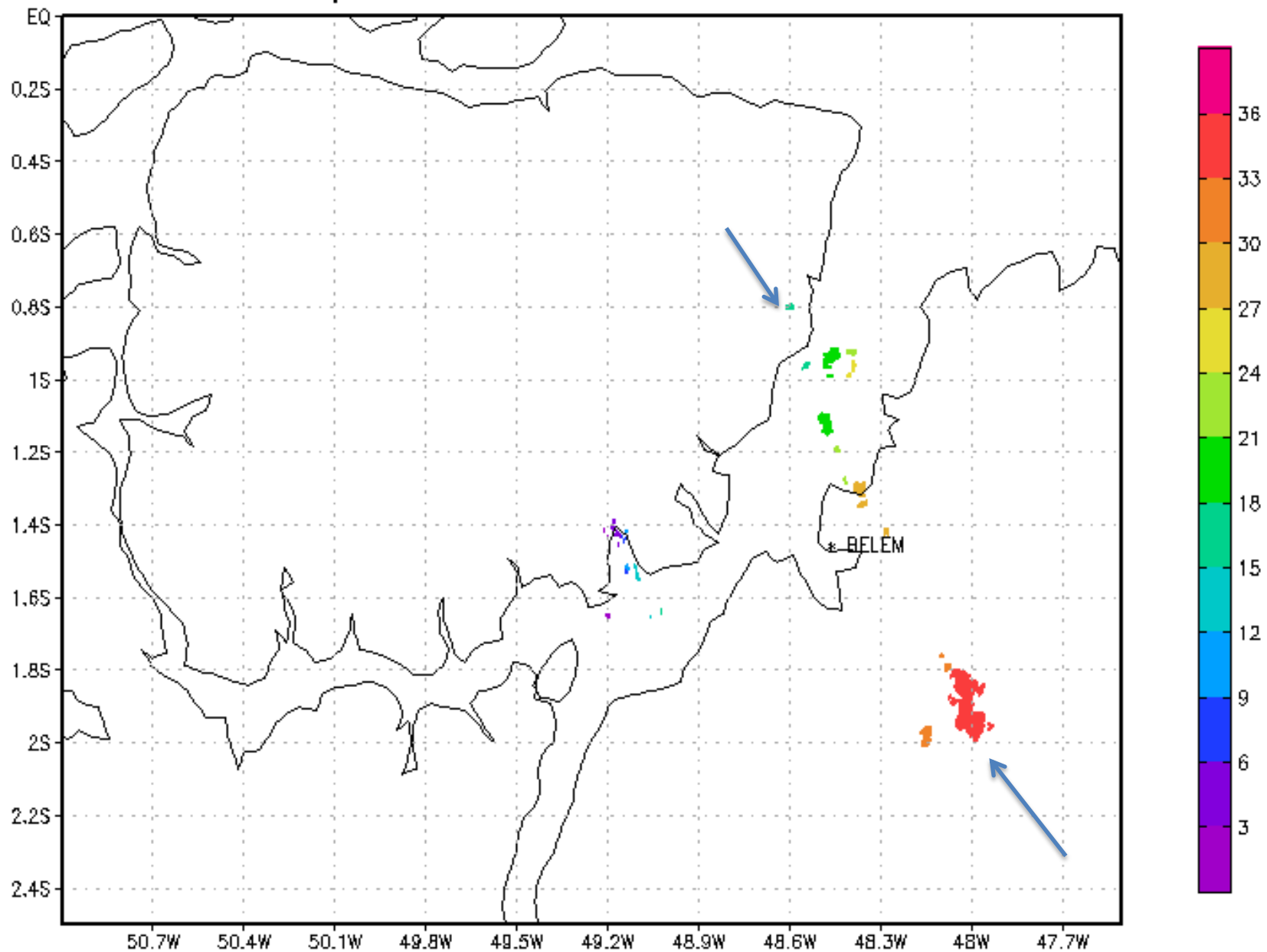
# micro-squall-line 2011-06-09 2024 UTC



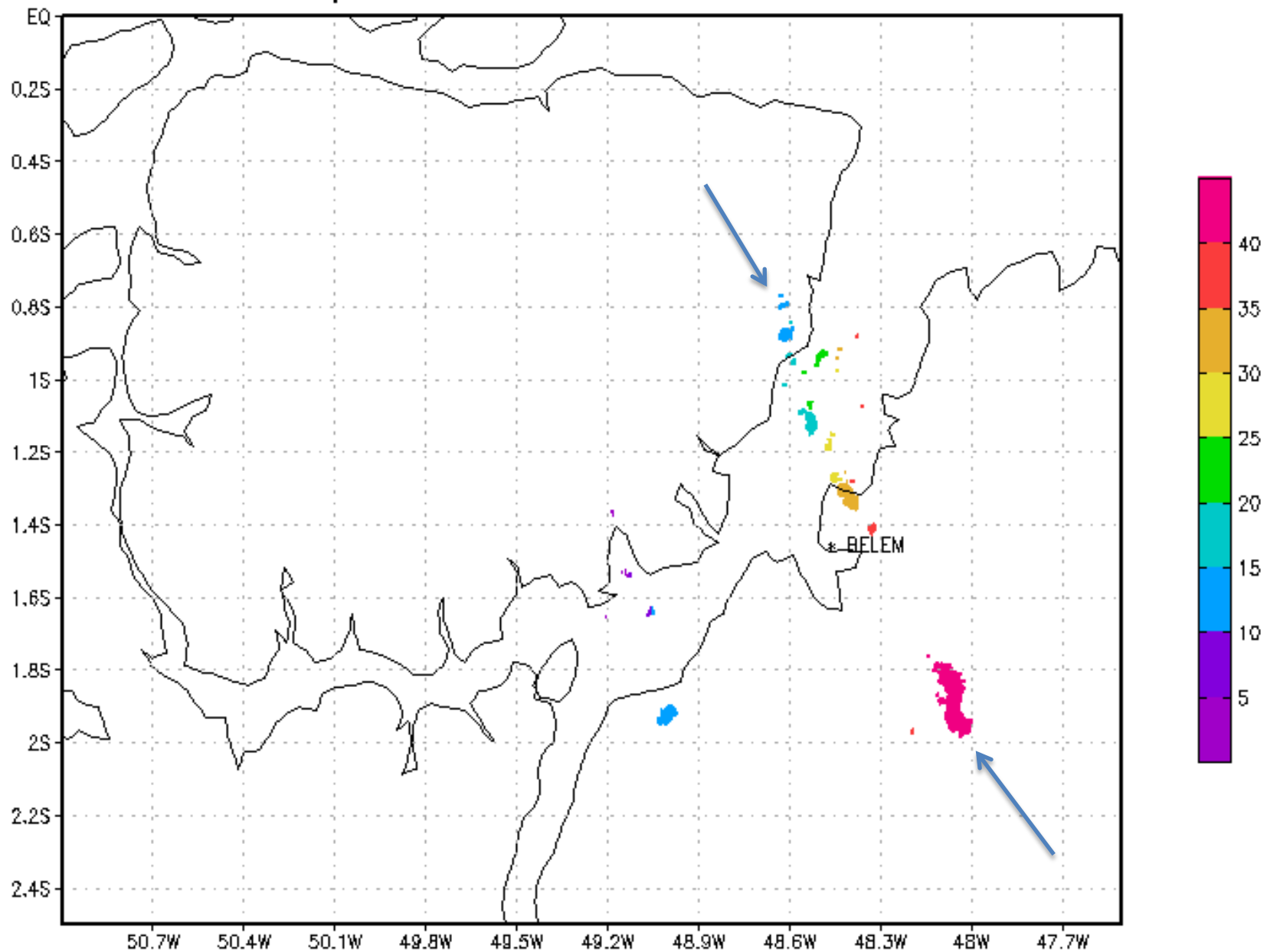
# micro-squall-line 2011-06-09 2034 UTC



# micro-squall-line 2011-06-09 2044 UTC

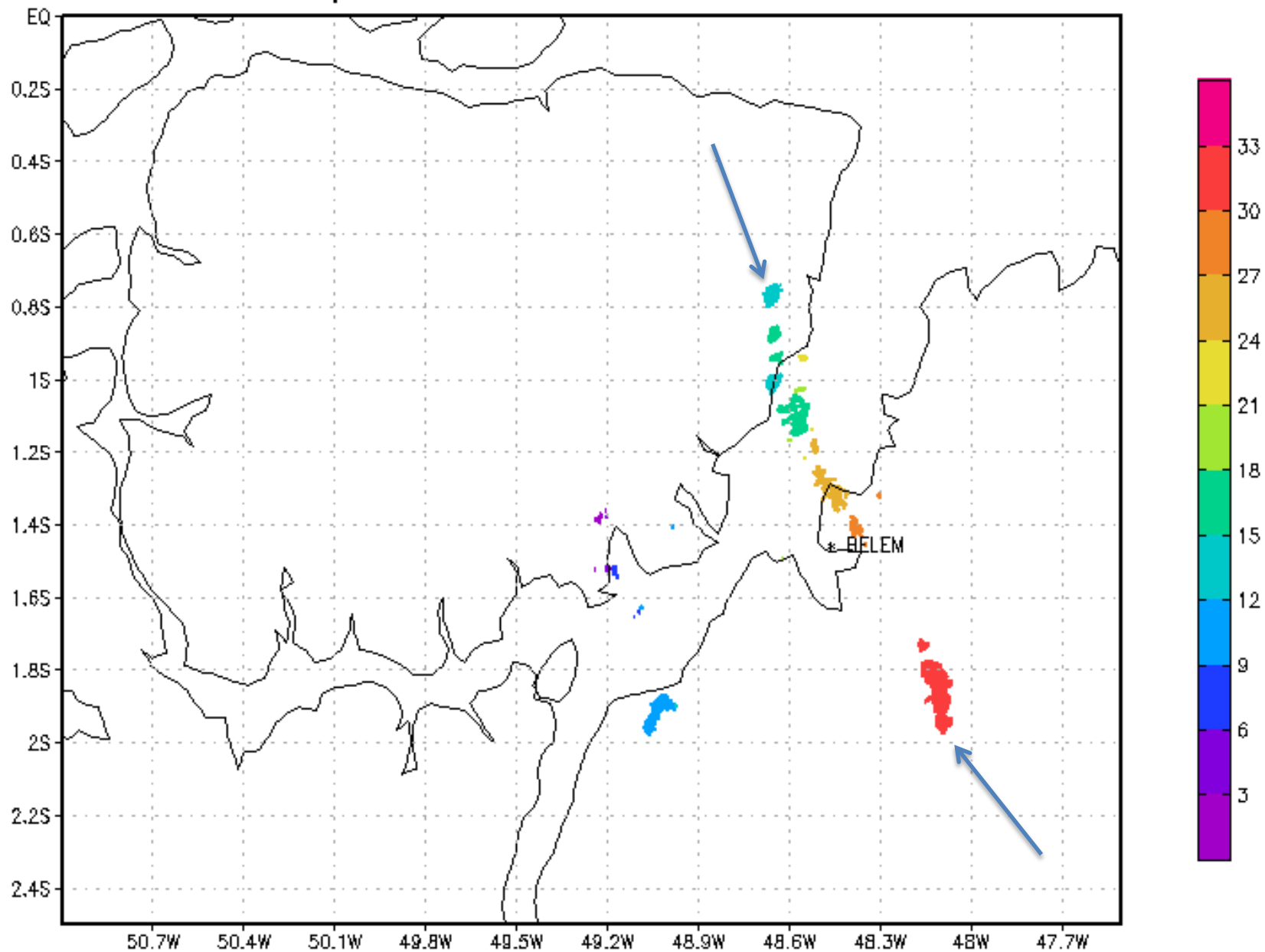


# micro-squall-line 2011-06-09 2054 UTC

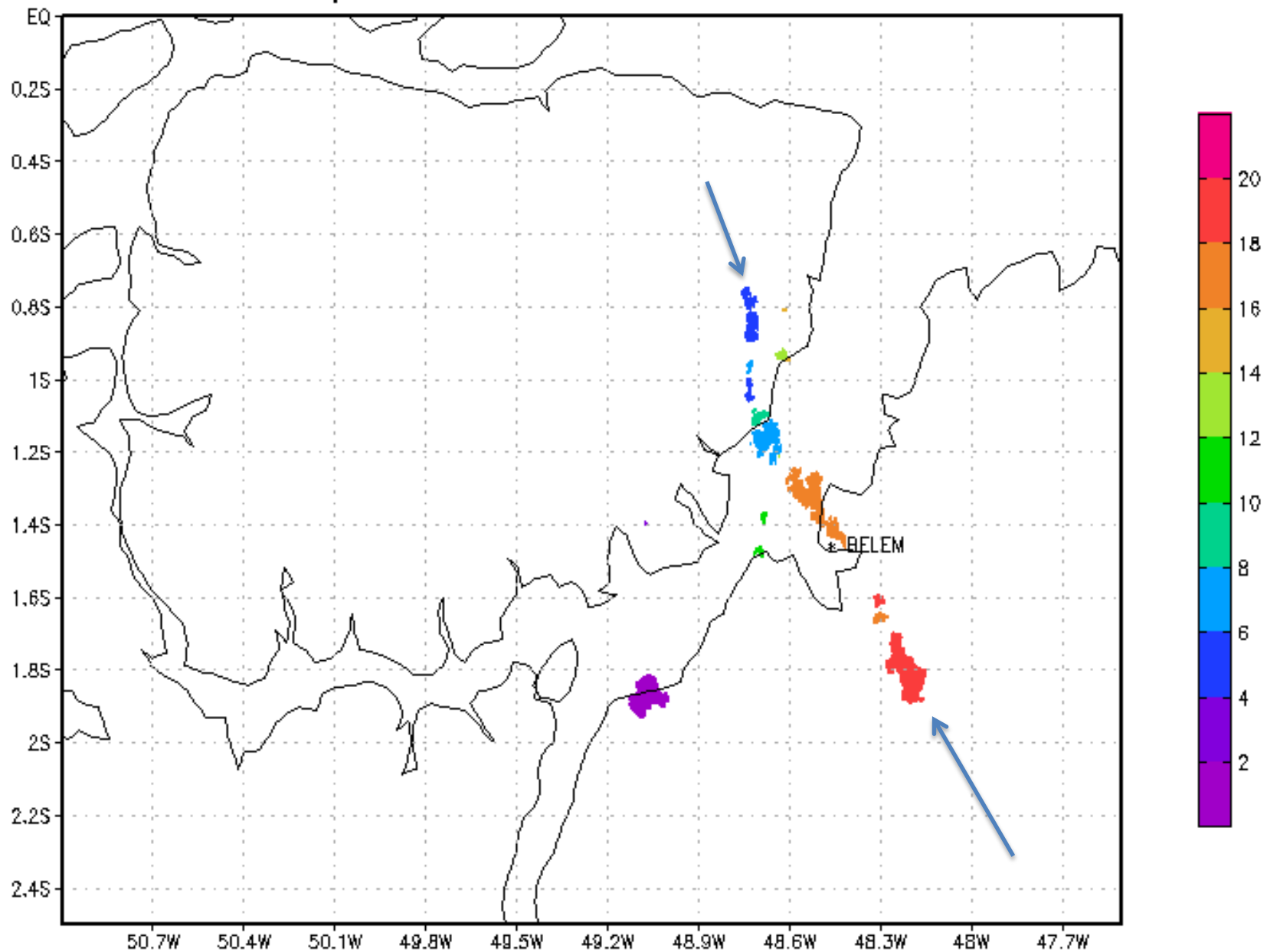




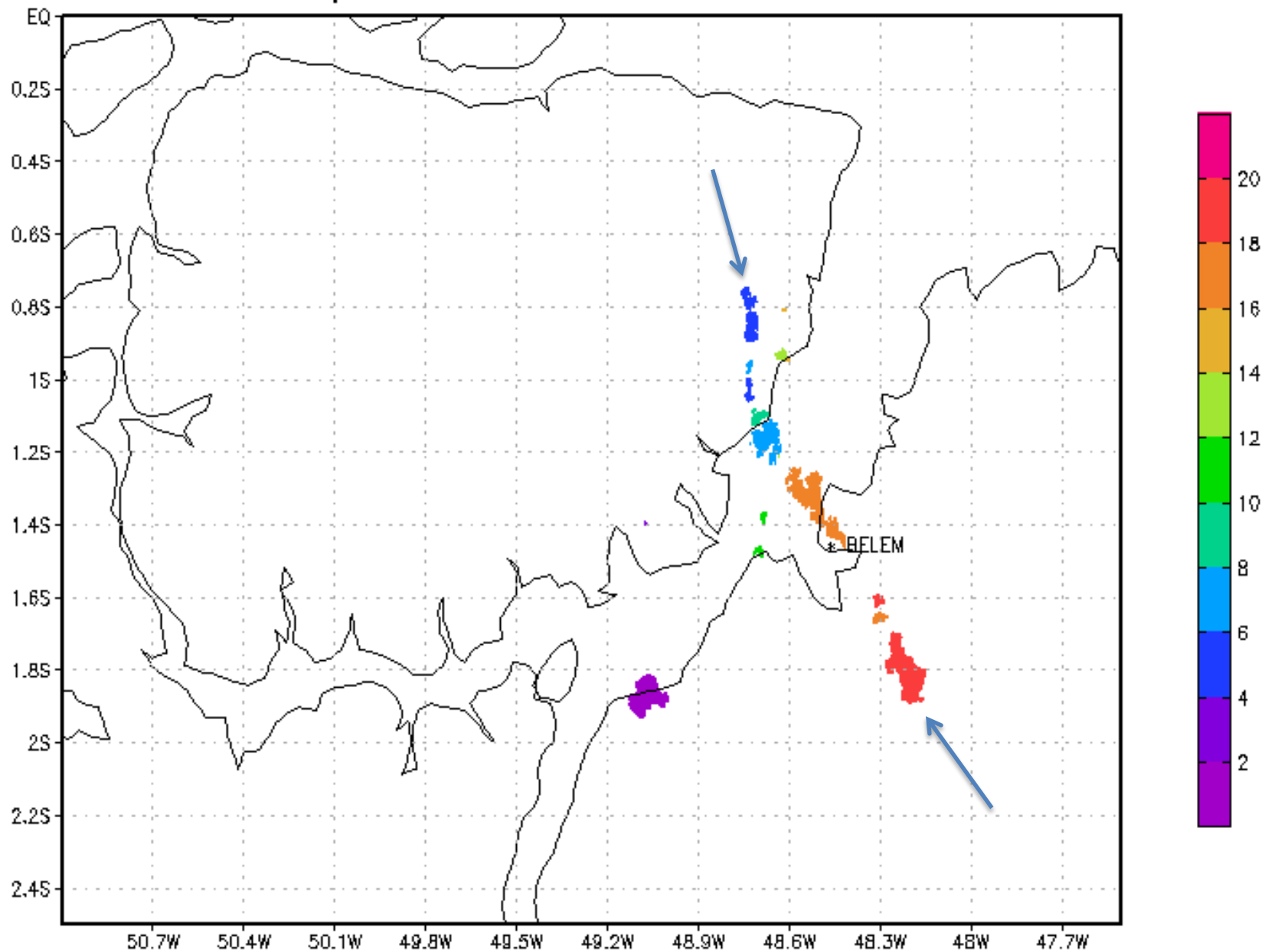
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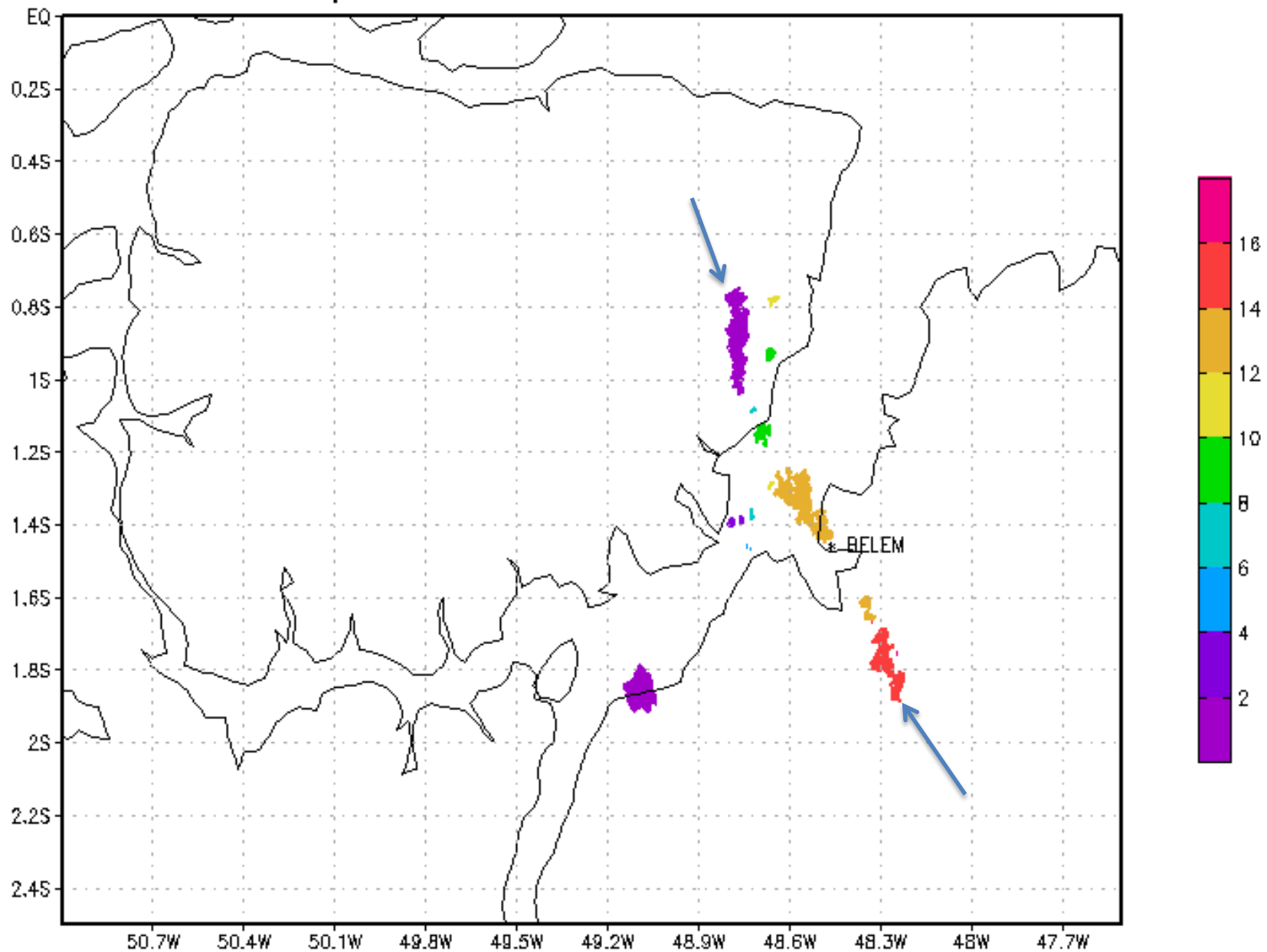
# micro-squall-line 2011-06-09 2124 UTC



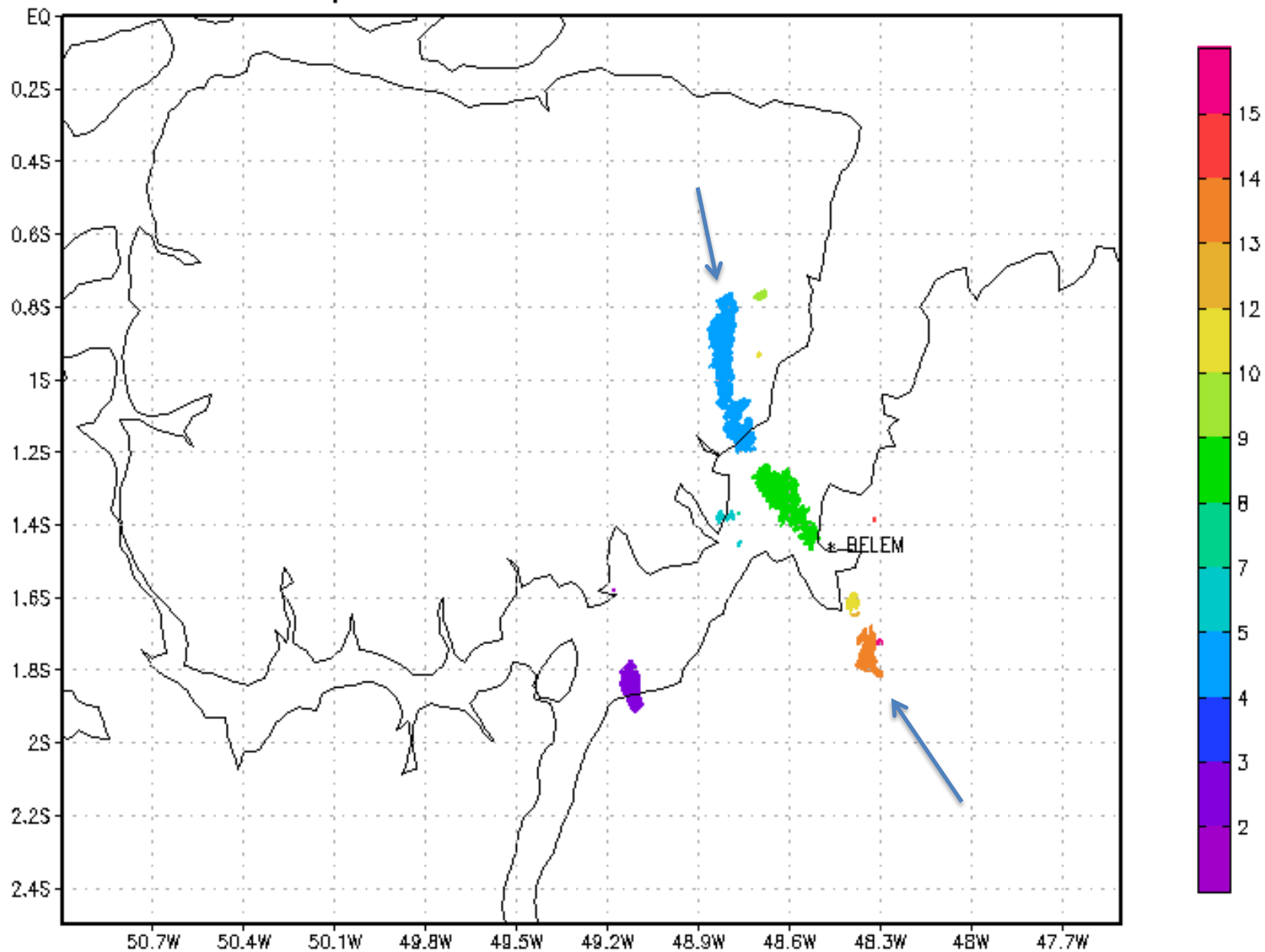
# micro-squall-line 2011-06-09 2124 UTC



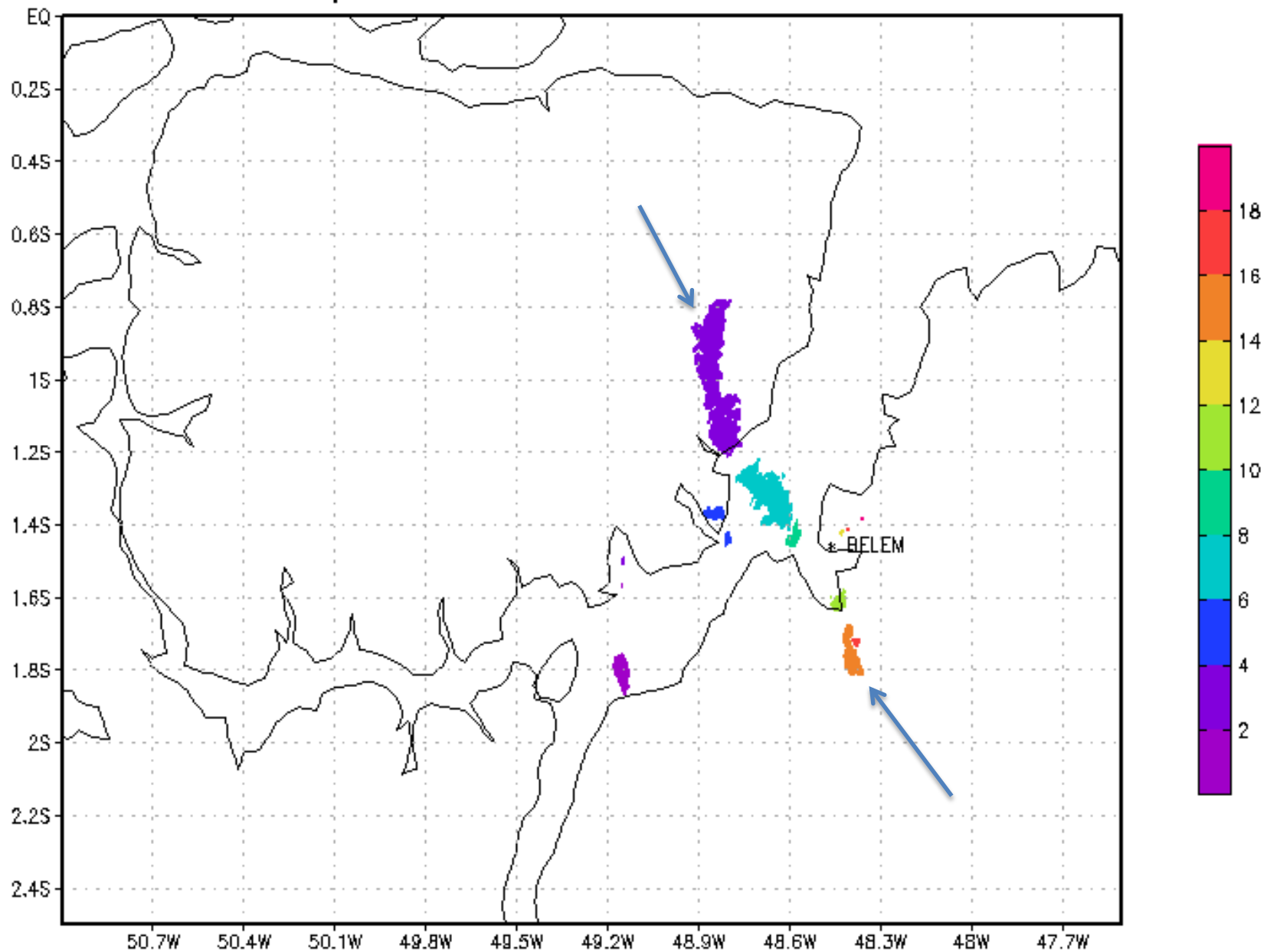
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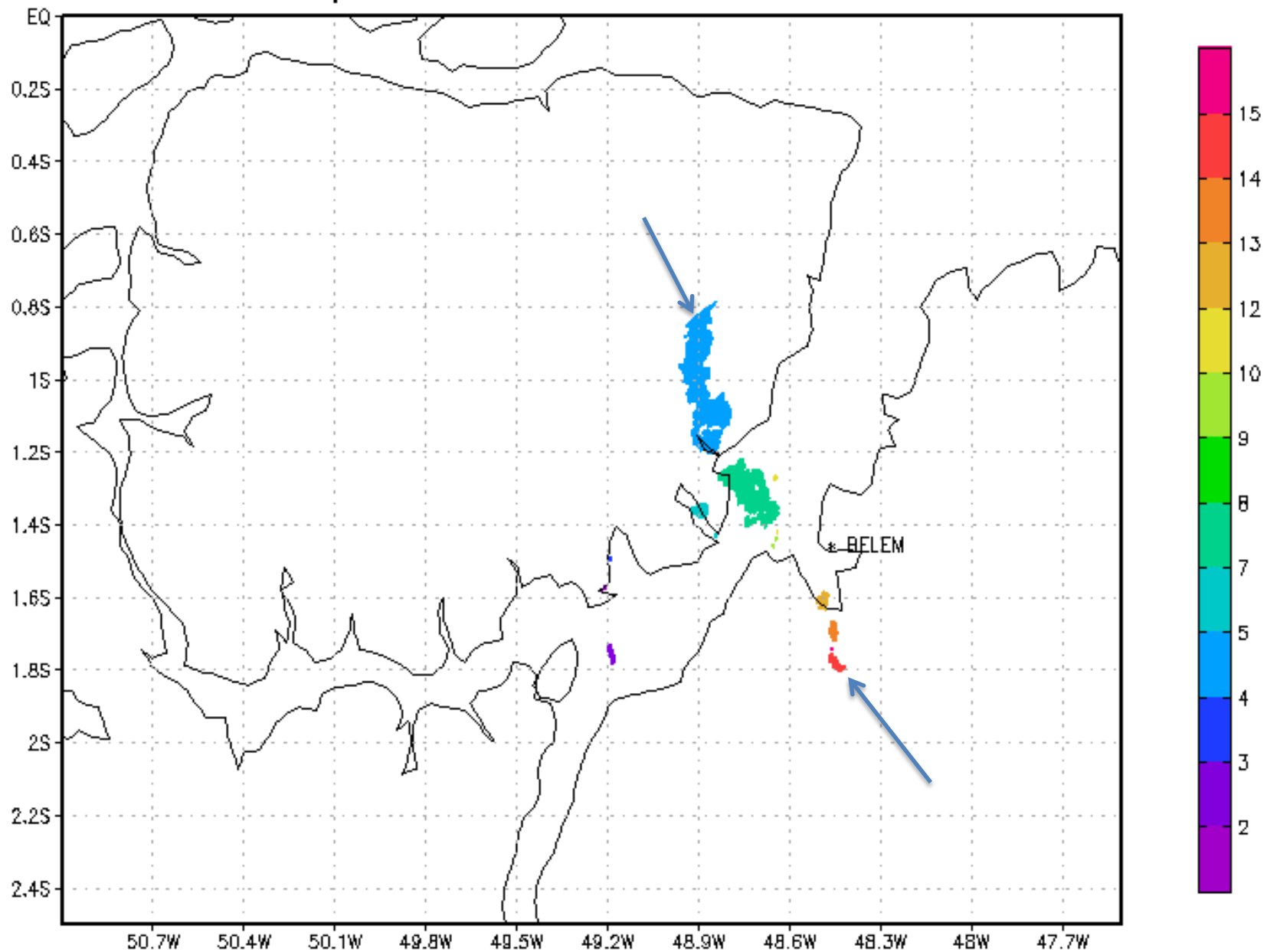
# micro-squall-line 2011-06-09 2144 UTC



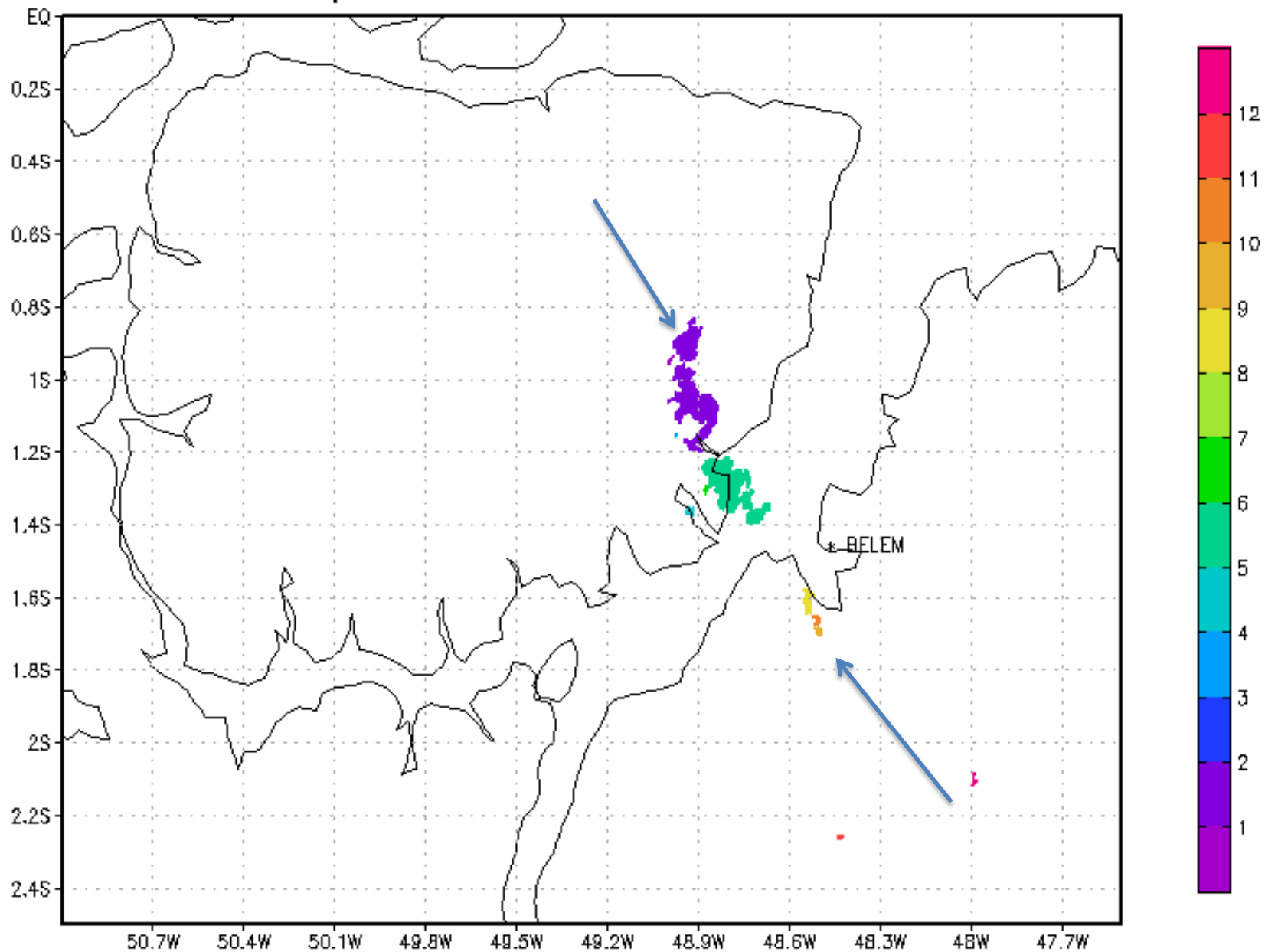
# micro-squall-line 2011-06-09 2154 UTC



# micro-squall-line 2011-06-09 2204 UTC

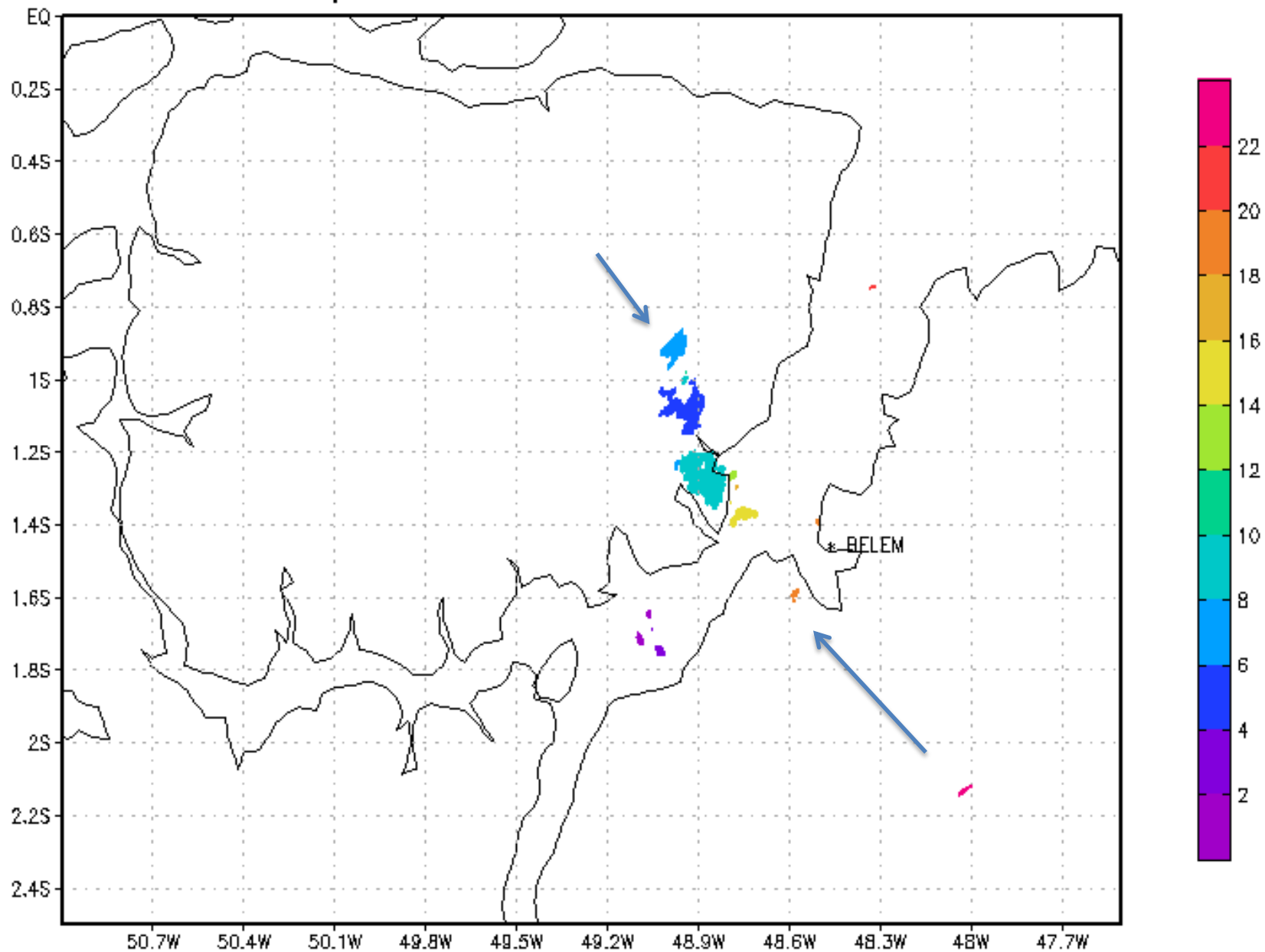


# micro-squall-line 2011-06-09 2214 UTC



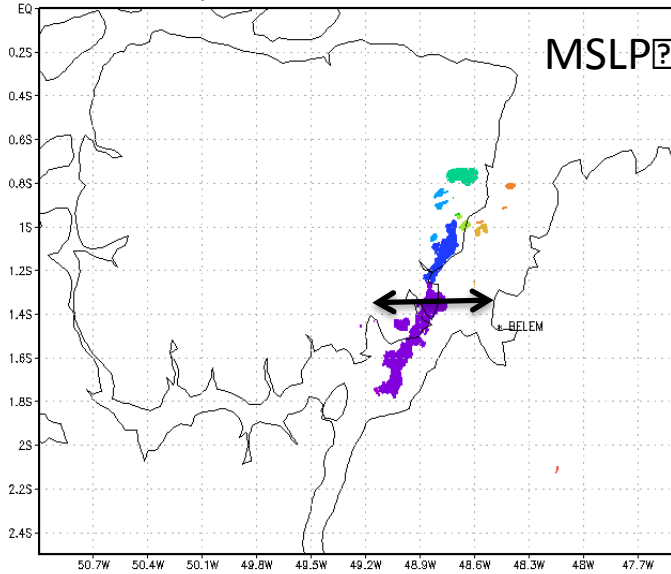


# micro-squall-line 2011-06-09 2224 UTC

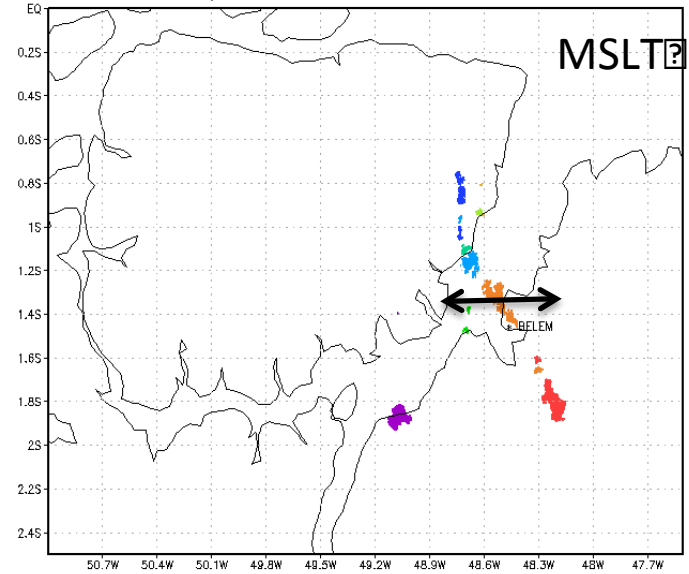


# 1 Squall Line and 2 Micro Squall Lines

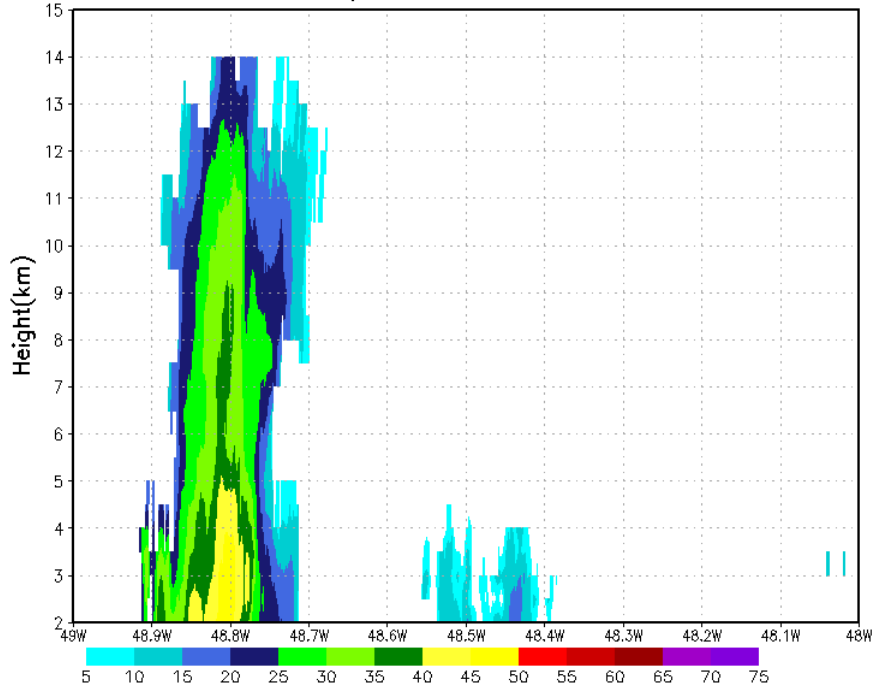
micro-squall-line 2011-06-09 1654 UTC



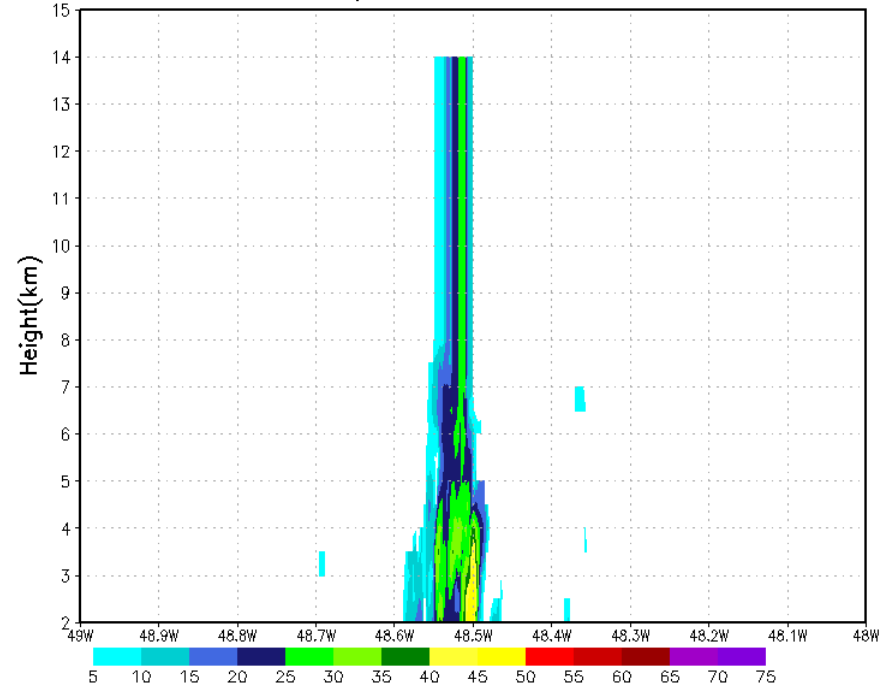
micro-squall-line 2011-06-09 2124 UTC



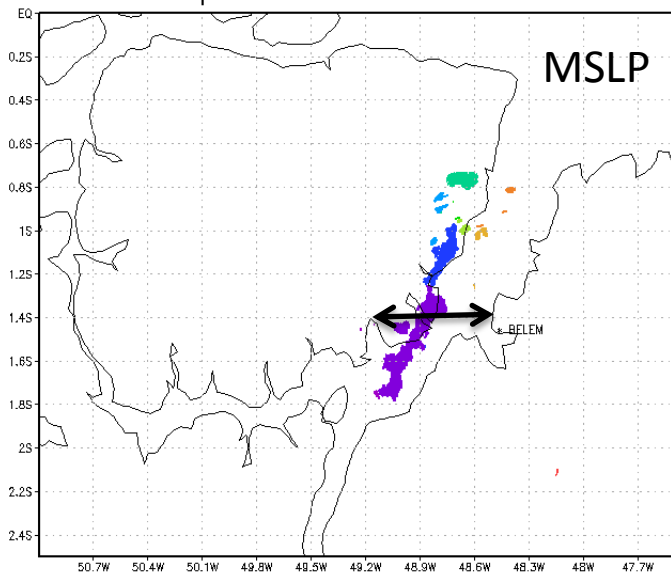
MSLP reftivity 1.35oS 20110609 16:53UTC



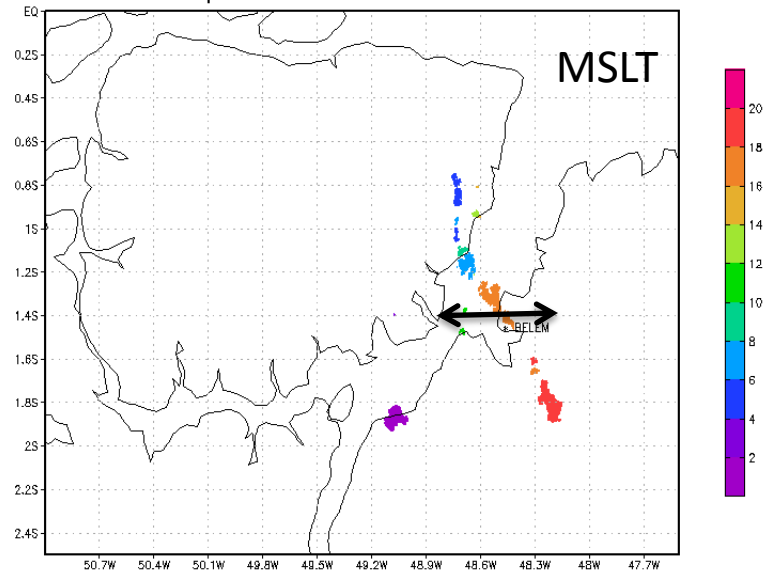
MSLT reftivity 1.35oS 20110609 21:24UTC



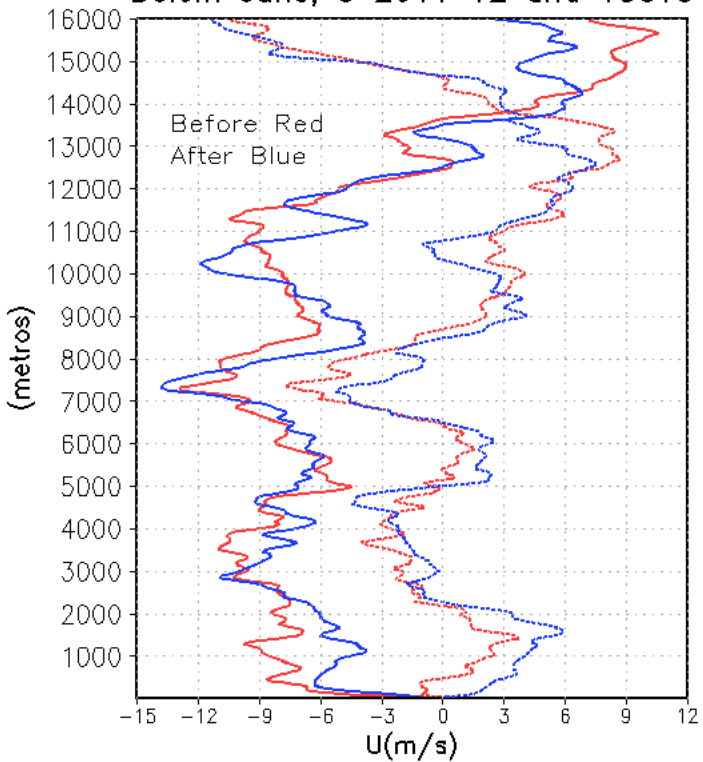
micro-squall-line 2011-06-09 1654 UTC



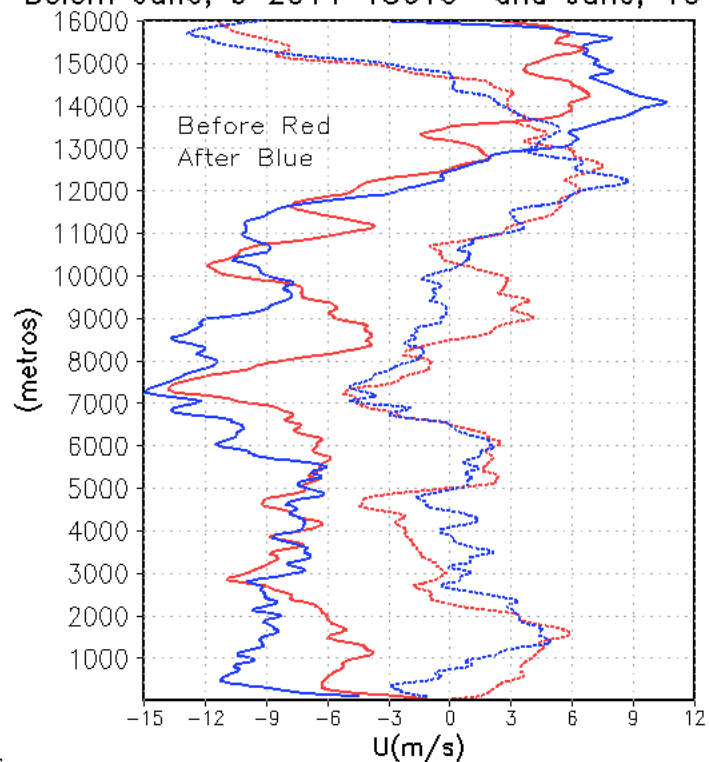
micro-squall-line 2011-06-09 2124 UTC



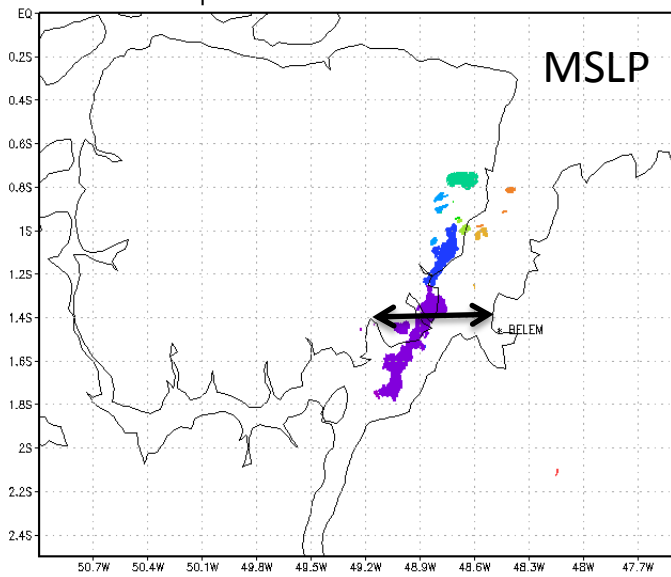
Belem June, 9 2011 12 and 18UTC



Belem June, 9 2011 18UTC and June, 10 00UTC



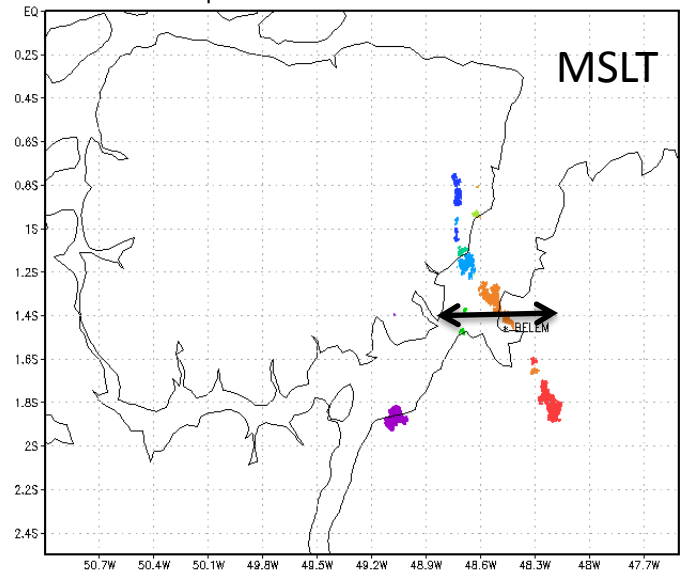
micro-squall-line 2011-06-09 1654 UTC



GRADS: COLA/IGES

2012-09-21-11:34

micro-squall-line 2011-06-09 2124 UTC



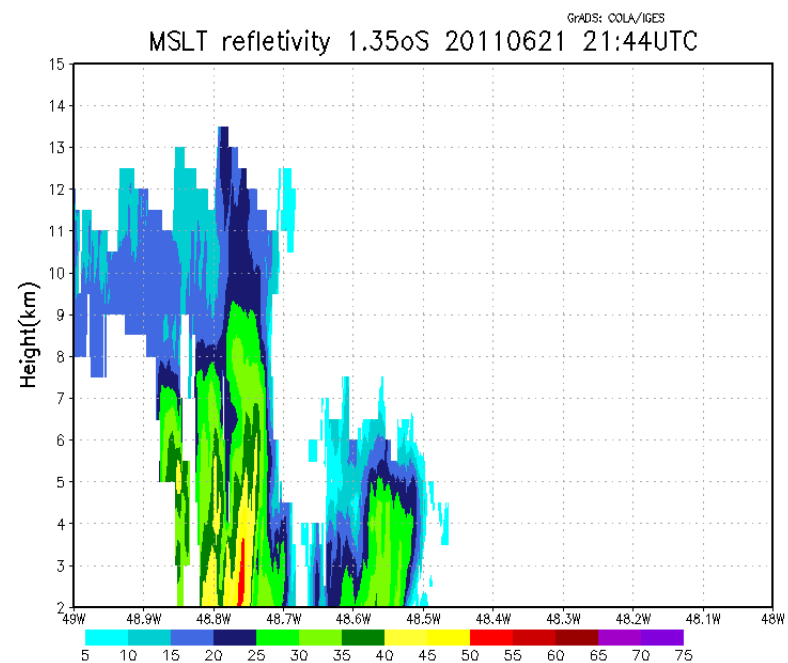
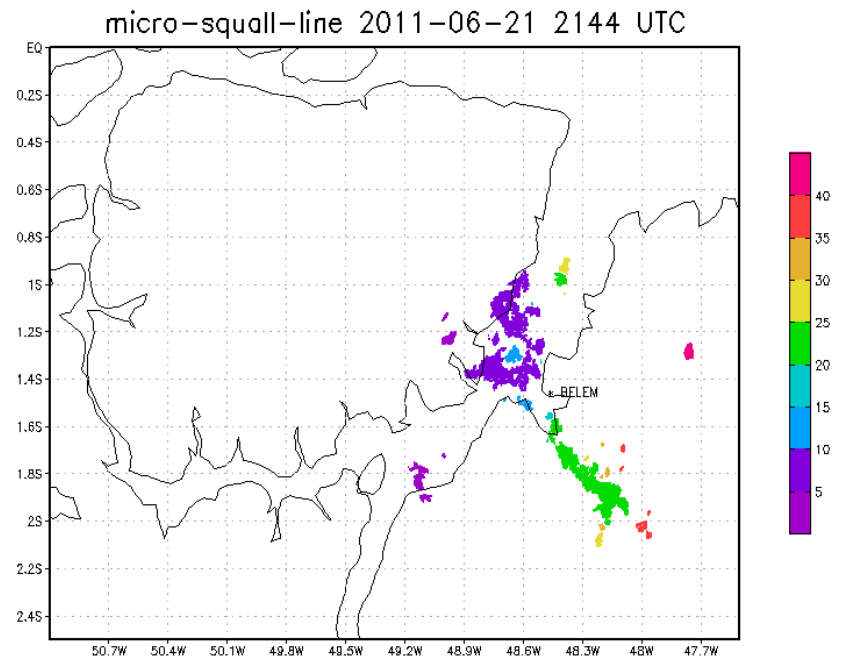
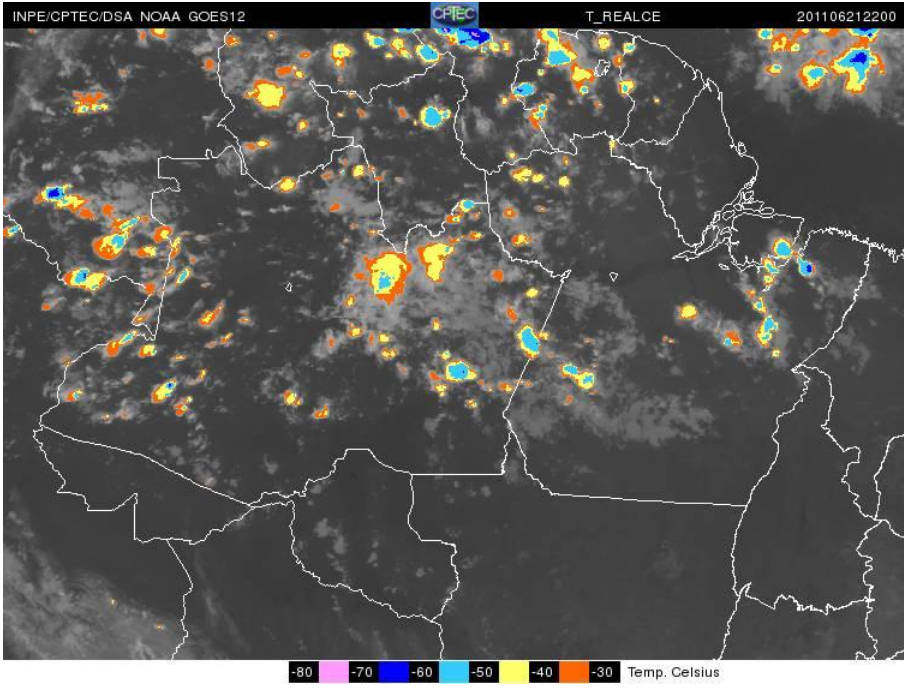
GRADS: COLA/IGES

2012-09-21-11:34

# Rainfall(mm)

	Benevides	Outeiro	DTCEA	INMET
MLSP	8.636	1.778	0.762	0
MSLT	0	0	1.524	9.144





# ***Preliminary Conclusions***

- Generally, these systems are embedded in clouds that belong to classical Squall Lines which are observed on satellite image as a single convective organization.
- Moreover, it seem to have a series of pulses of precipitation, giving an idea of existence of another scale internal of the organization.