



# Comma clouds

*Mesoscale cloud features in the cold air*

Barbara Zeiner



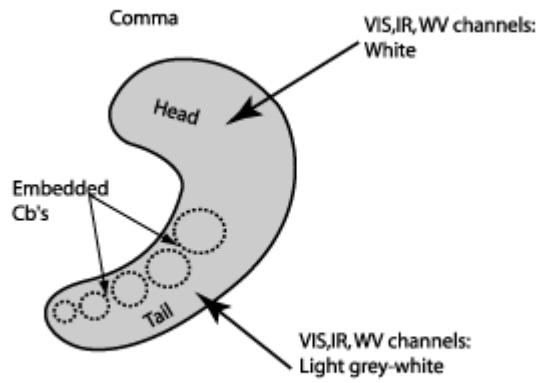
**ZAMG**  
Zentralanstalt für  
Meteorologie und  
Geodynamik

# What is a comma?



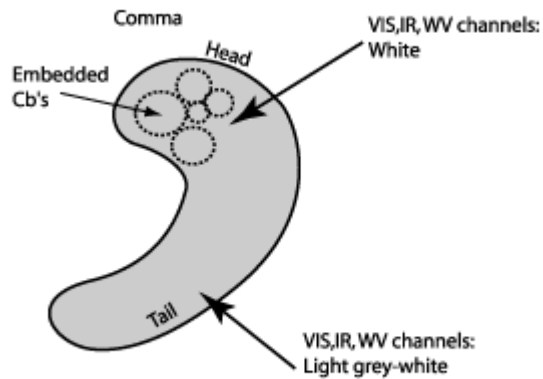
- A comma shaped (small to) mesoscale cloud feature within the cold air mass
  - Typical dimension: 200 to 1000 km
- Location: often behind a frontal system
- Characteristic regions of development: Atlantic, sometimes Mediterranean Sea; less frequent above continent
- Important for Western European countries: British Isles experiences severe weather situation due to commas
- Climatology: more often during winter than during summer

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Comma head: thick cloudiness:  
therefore bright in VIS, IR, WV

Comma tail: cloud tops tend to be warmer  
than at comma head; light grey

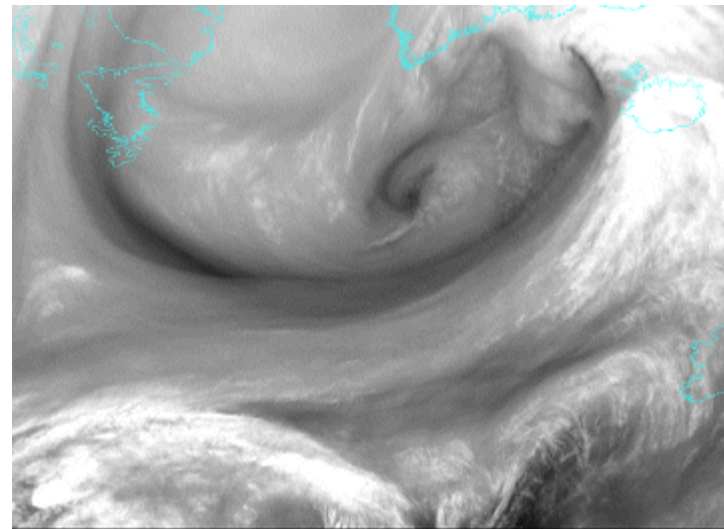
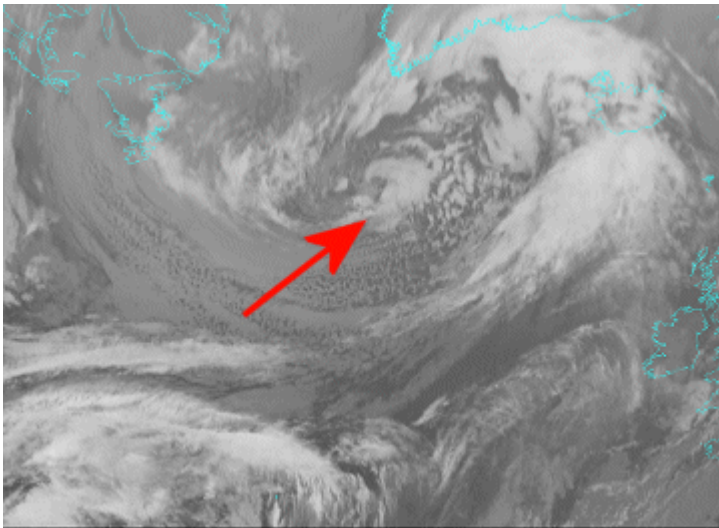


Embedded Cbs

# Appearance in satellite imagery



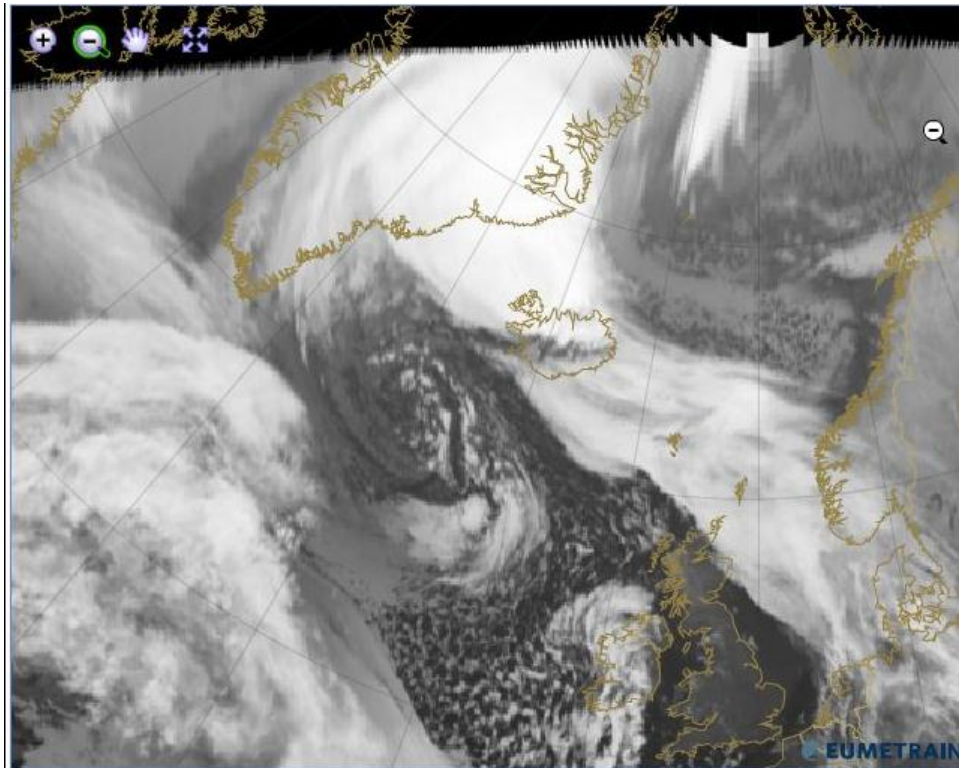
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# Appearance in satellite imagery



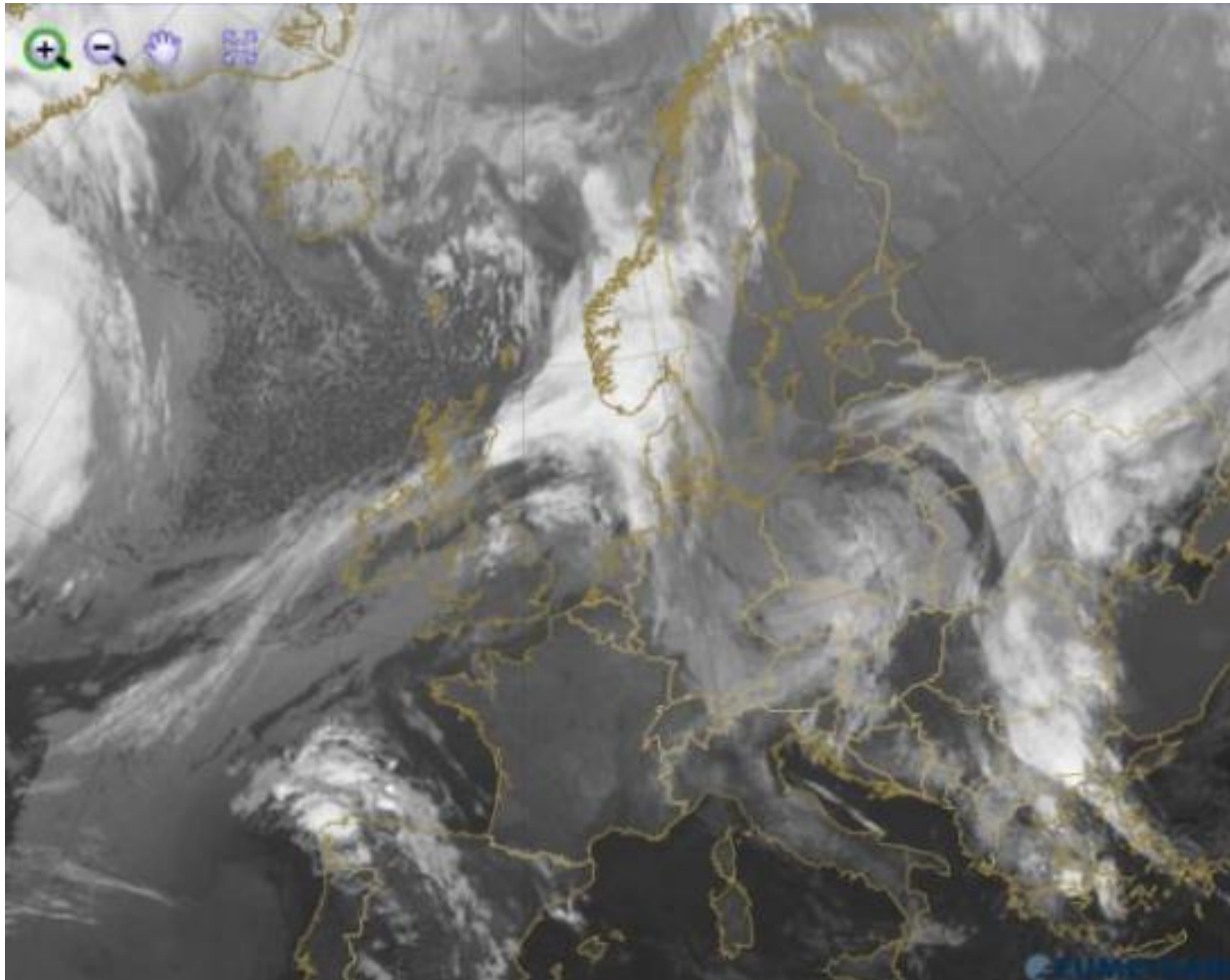
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# Appearance in satellite imagery



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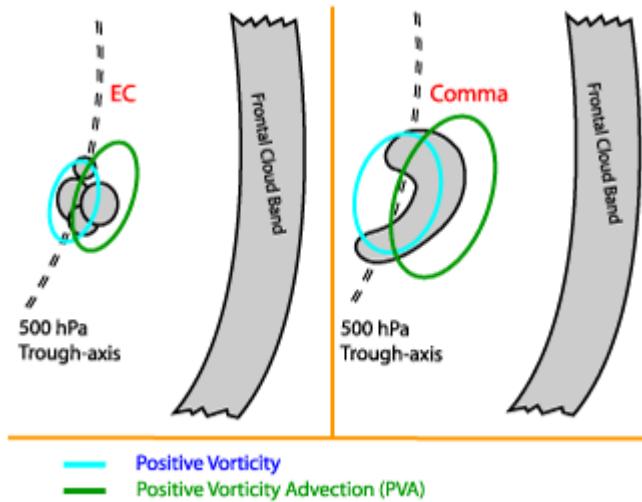


# Genesis and Development



- EC are developing into a comma

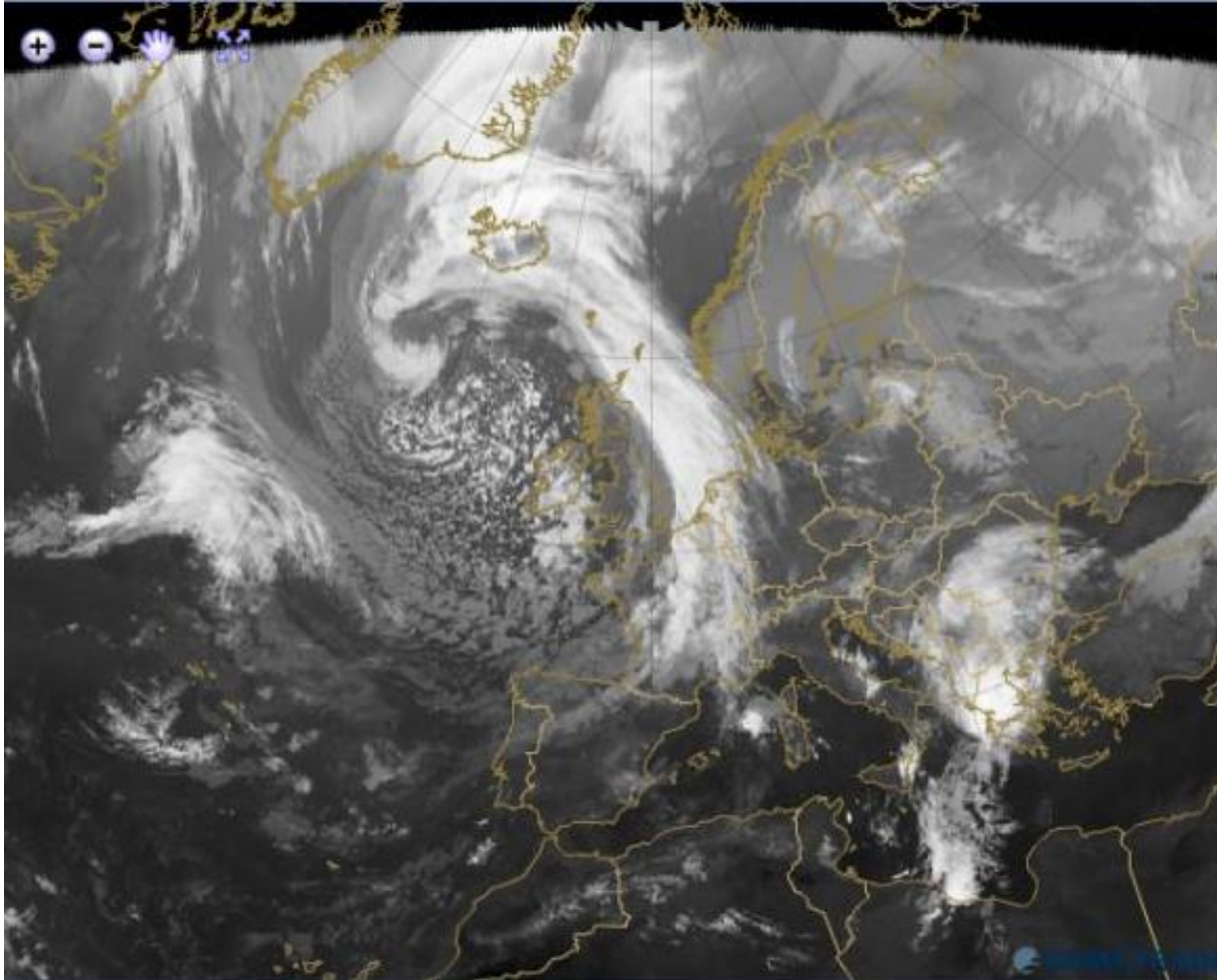
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# Genesis and Development



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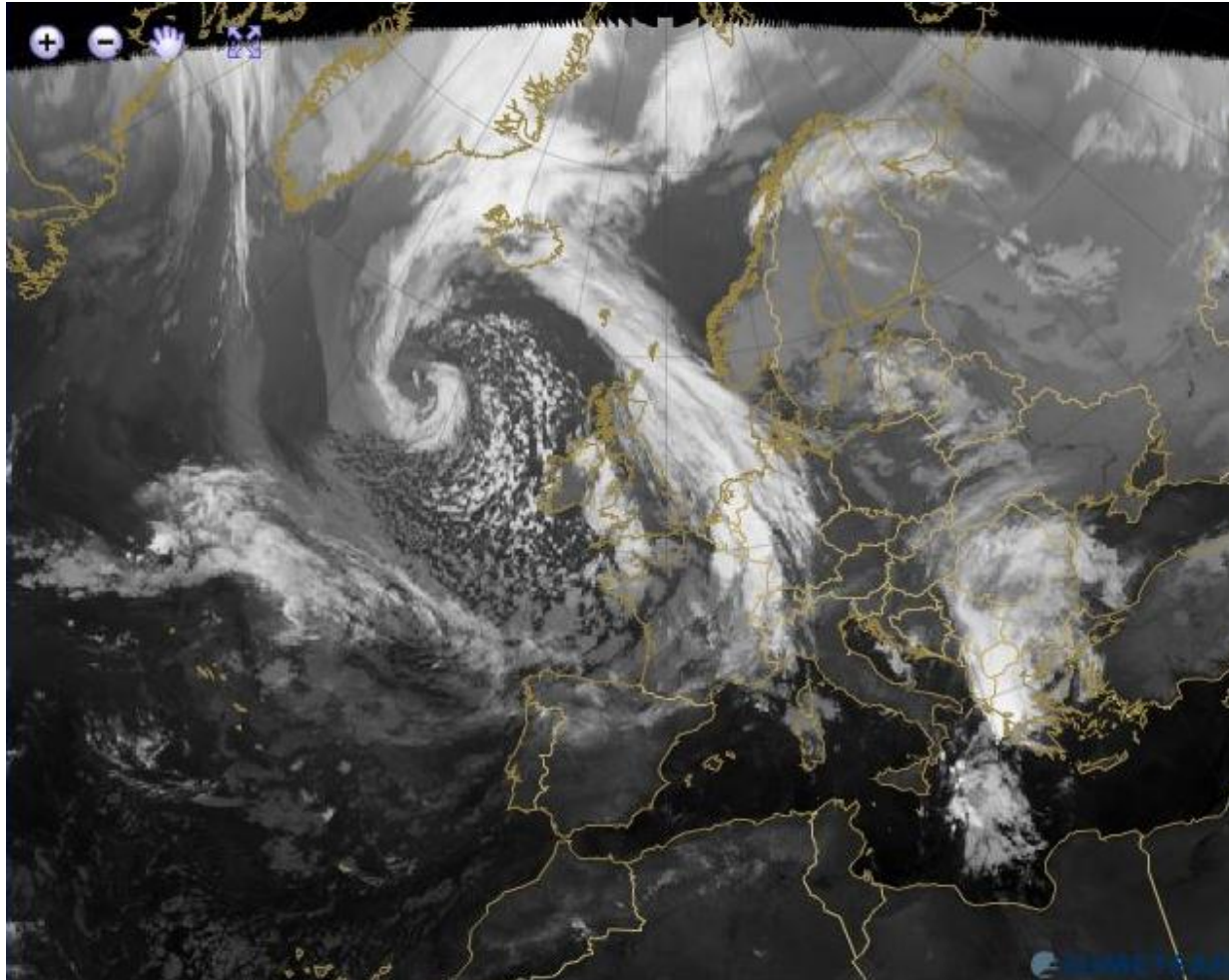




# Genesis and Development



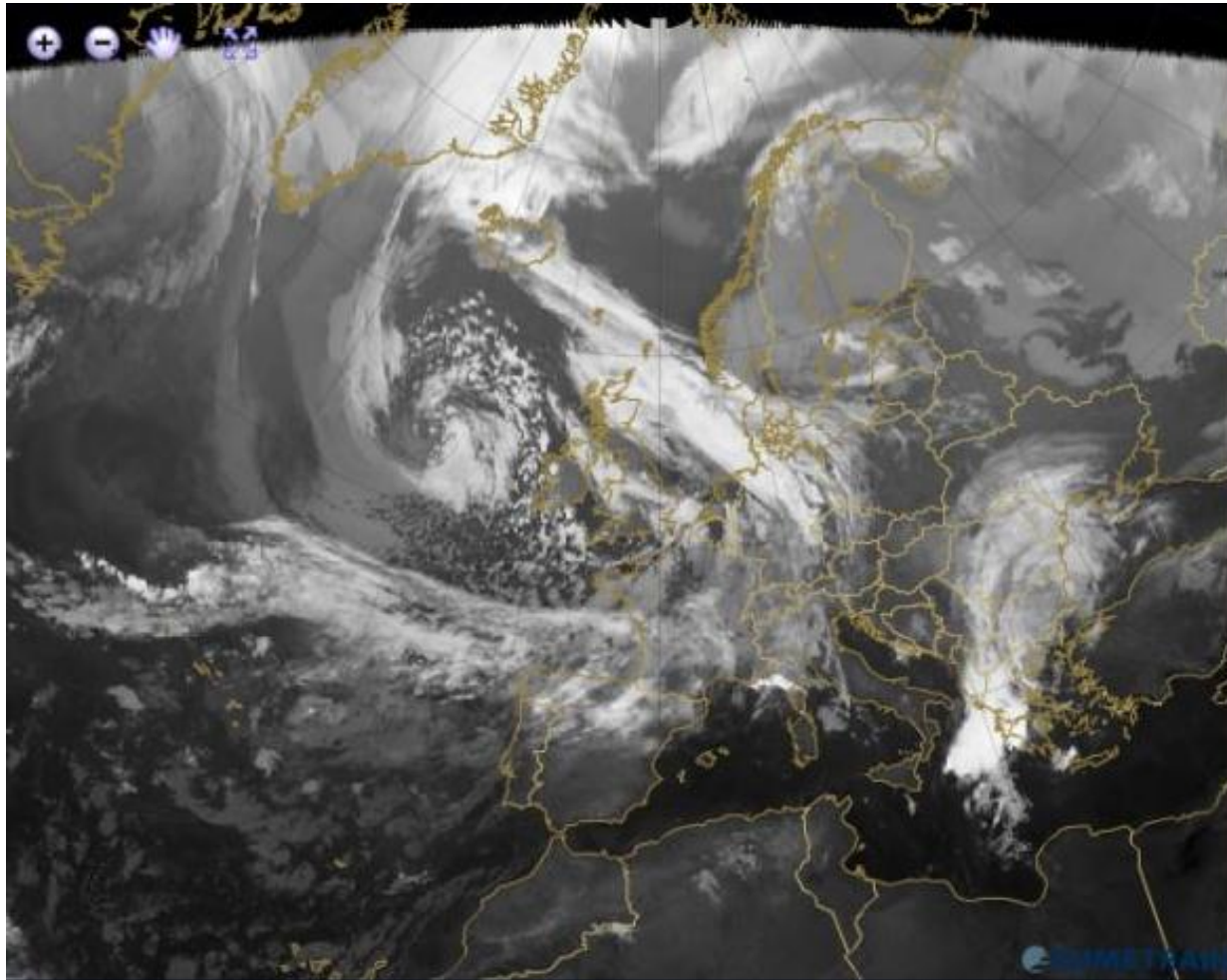
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# Genesis and Development



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# Genesis and Development



Mechanism which are involved in the development of commas:

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- Baroclinic instability
- Barotropic instability
- CISK
- Potential vorticity

# Genesis and Development



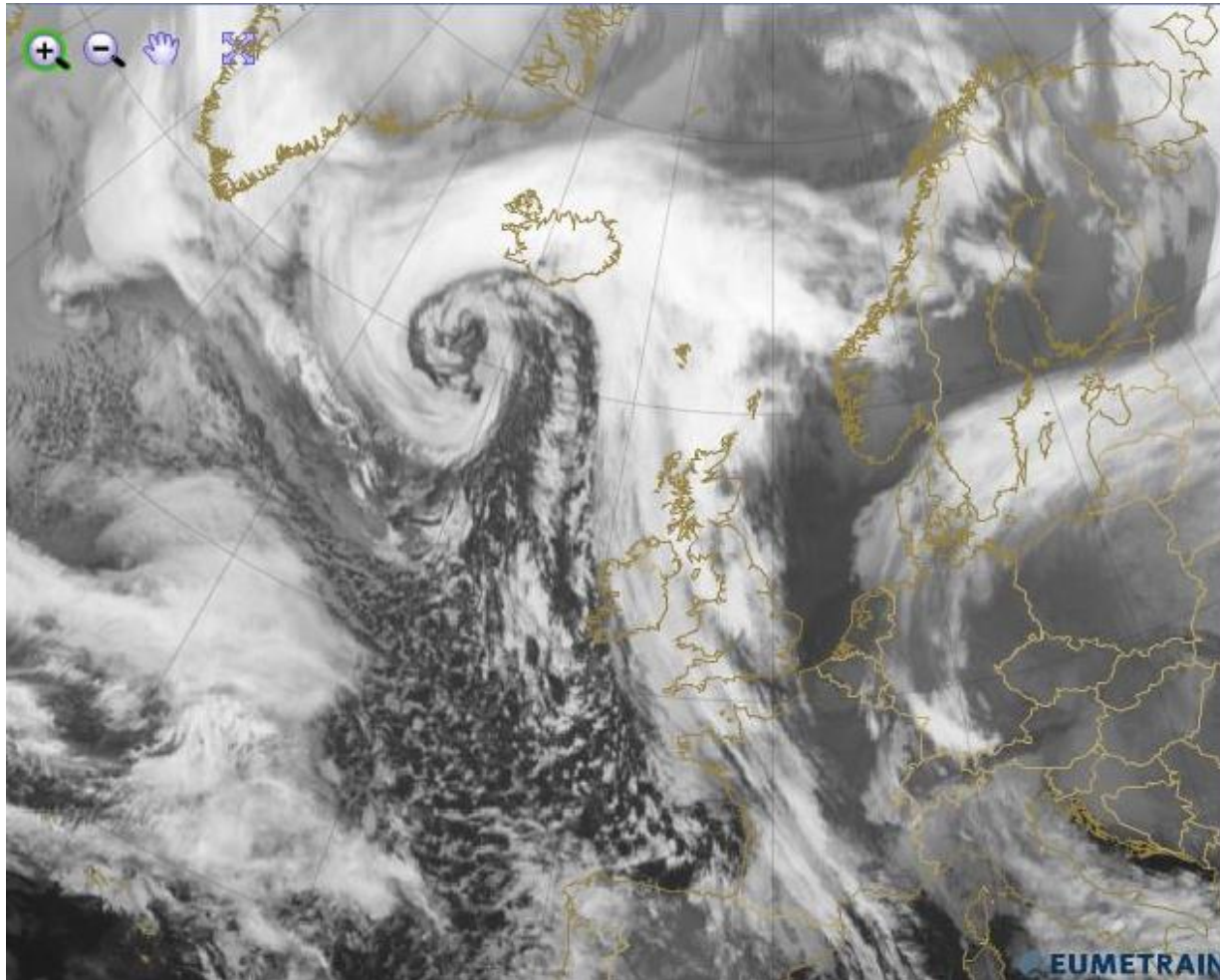
- Cut off from occlusion spirals
- Innermost part of cloud spiral becomes separated
- Within upper level trough
- Cloud free area between occlusion and new comma
- Area of comma within positive vorticity advection and convergence
- Cloud free area under negative vorticity advection and convergence

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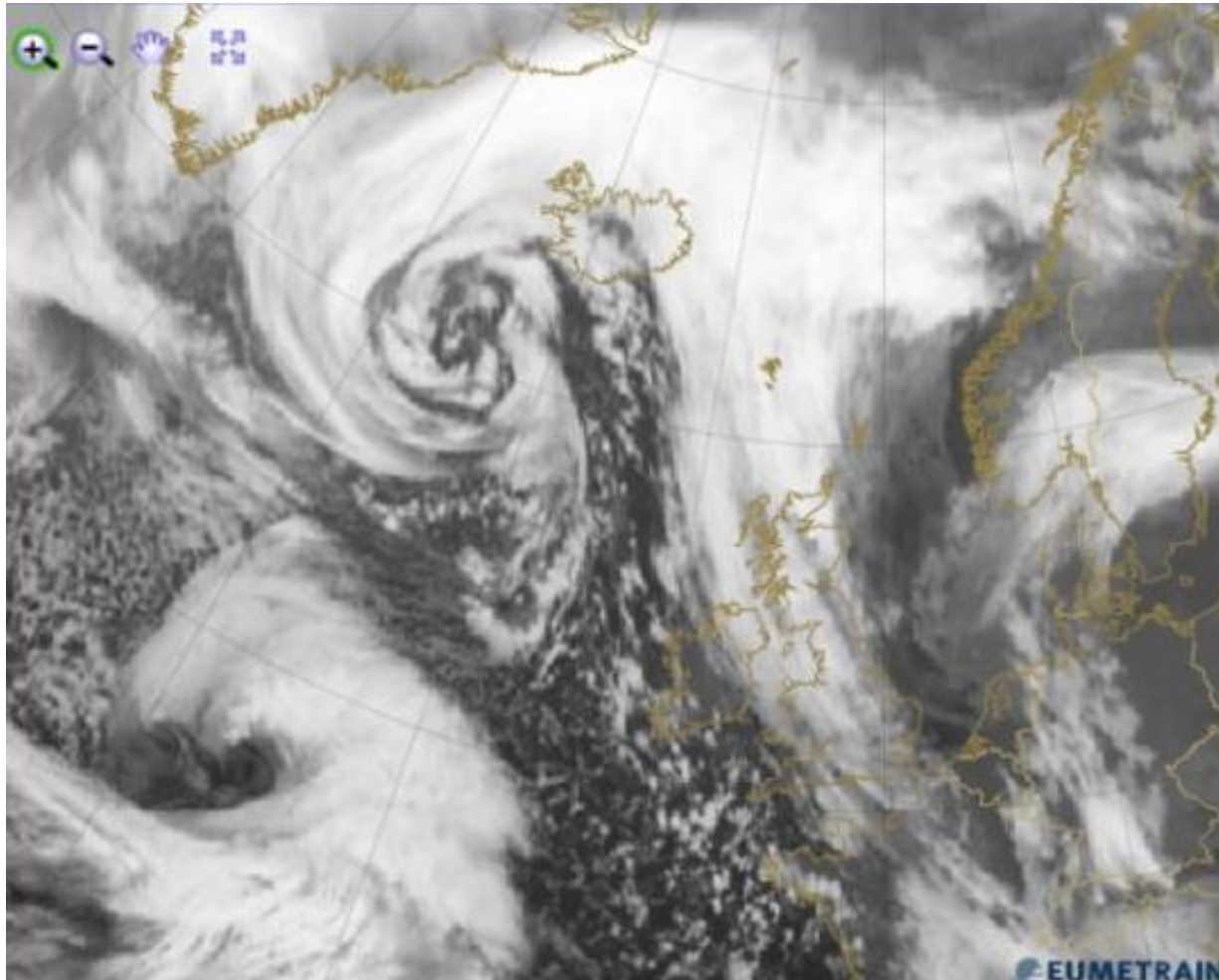
# Genesis and Development



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# Genesis and Development

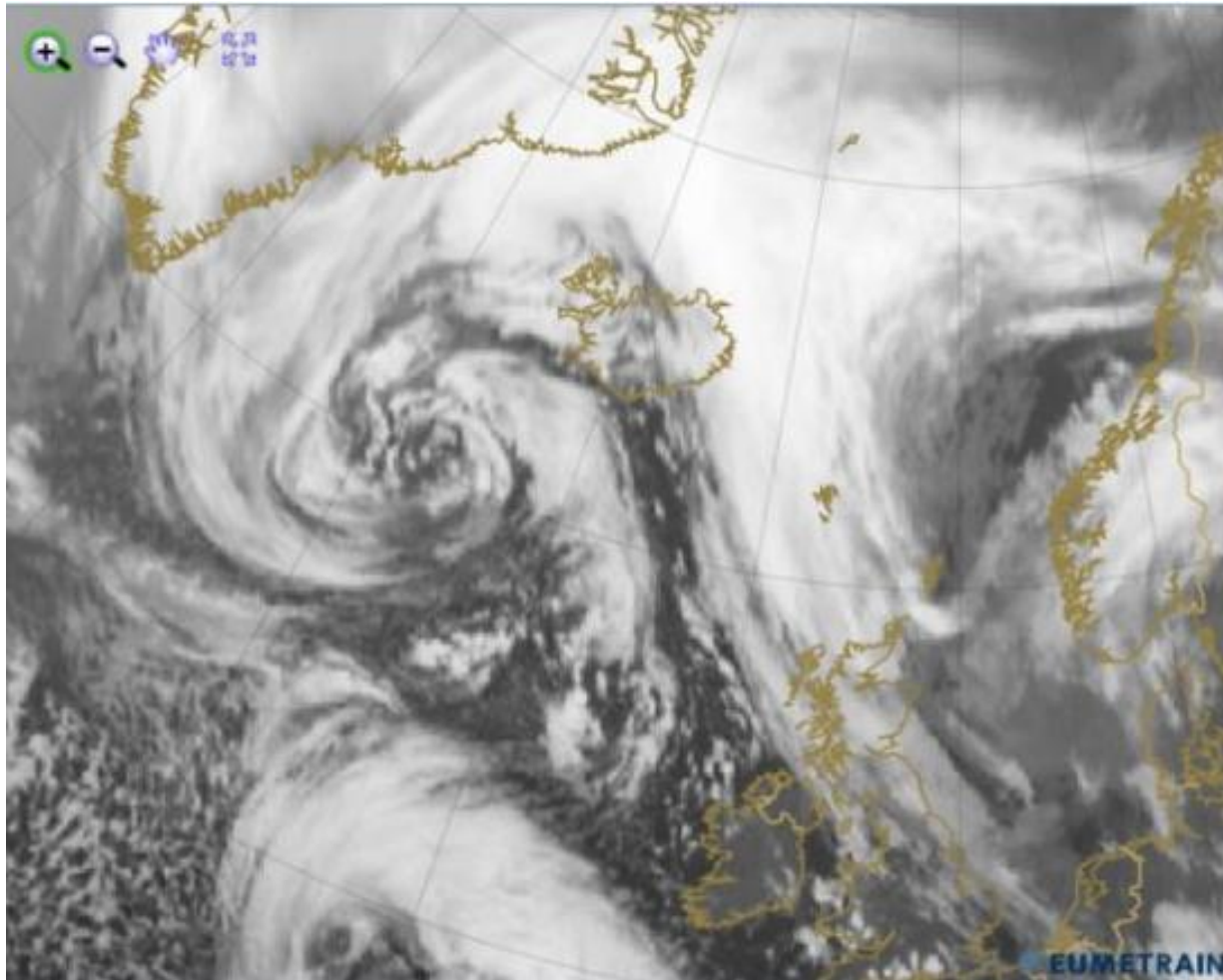


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# Genesis and Development



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# Genesis and Development



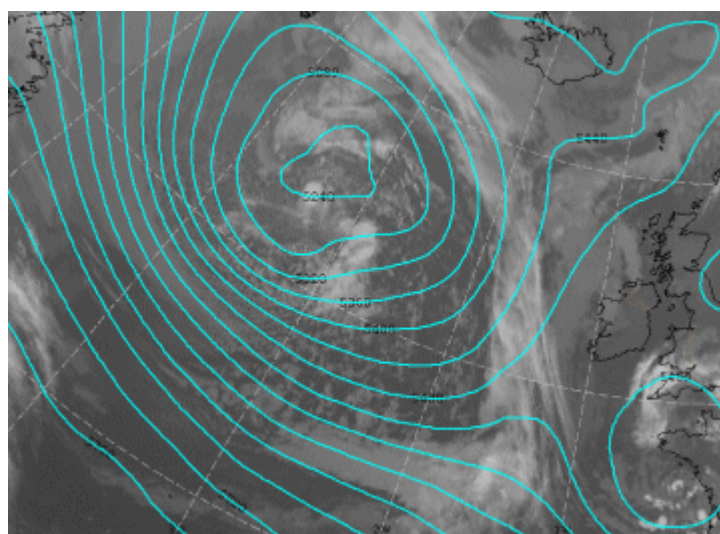
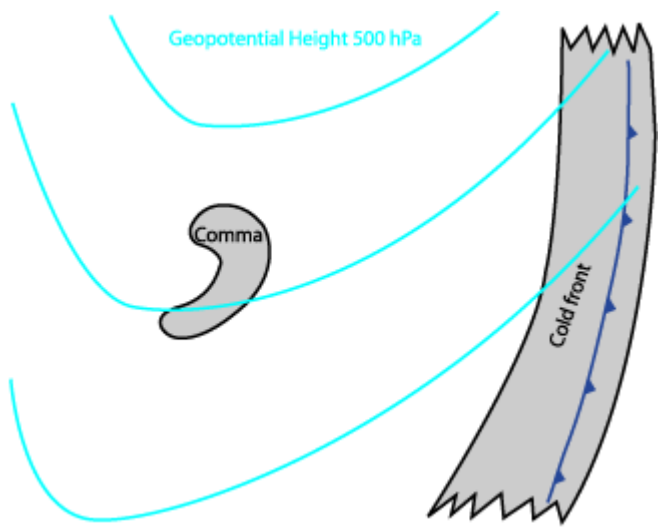
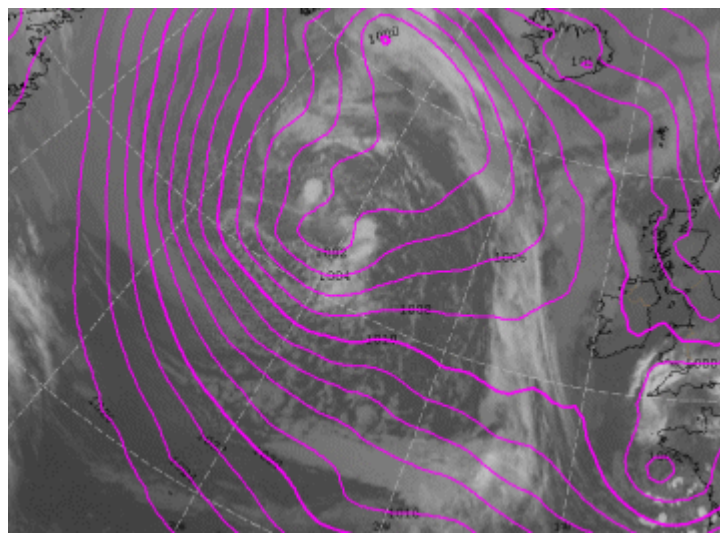
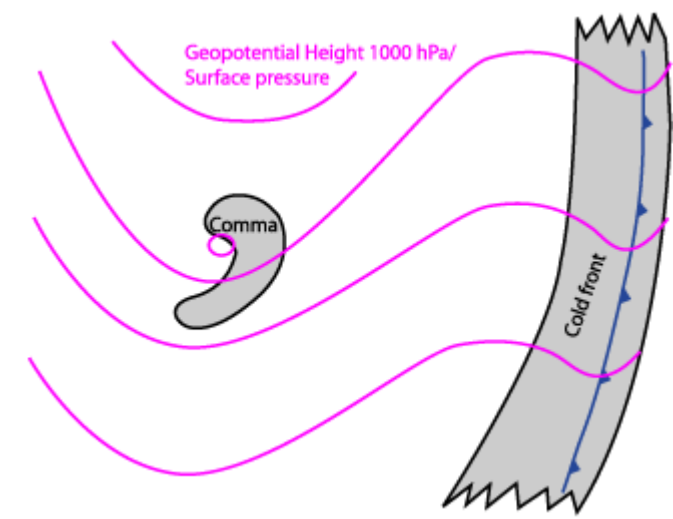
A comma can have further developments:

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- If comma is growing a CAD (cold air development) is possible, getting frontal characteristics
- If a comma merges a CF cloud band, it is called an instant occlusion

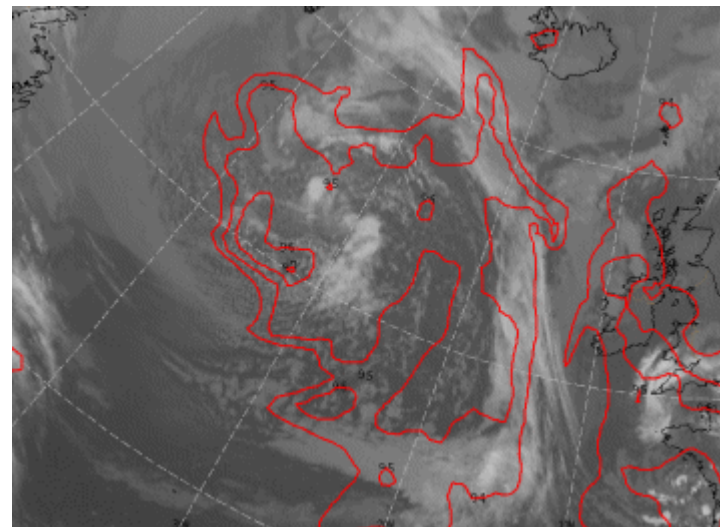
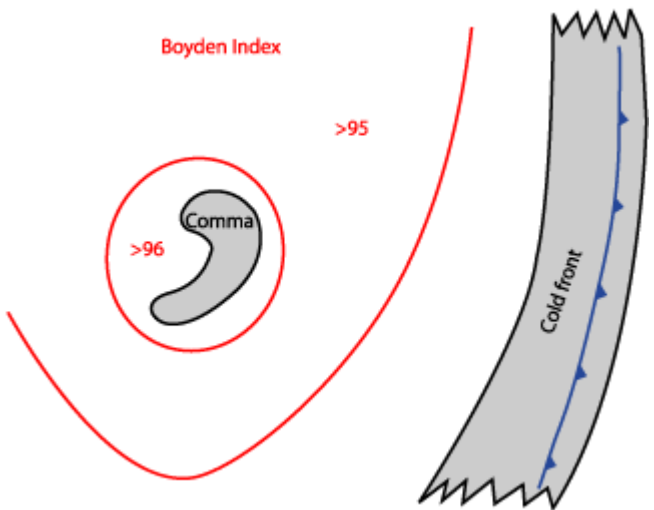
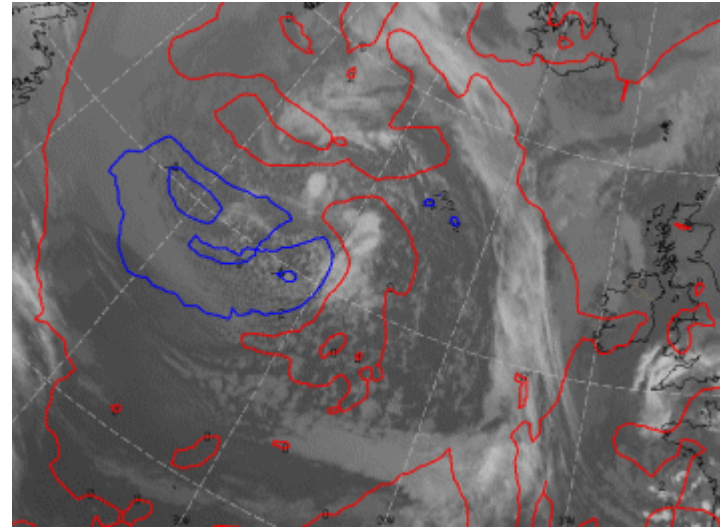
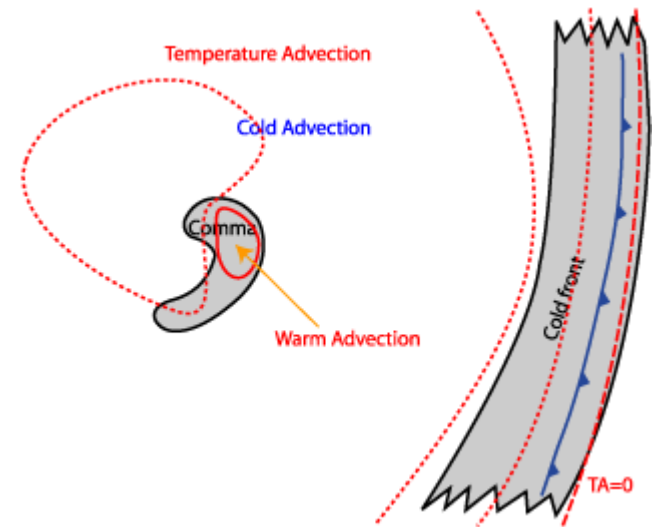


# Key parameters



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# Key parameters

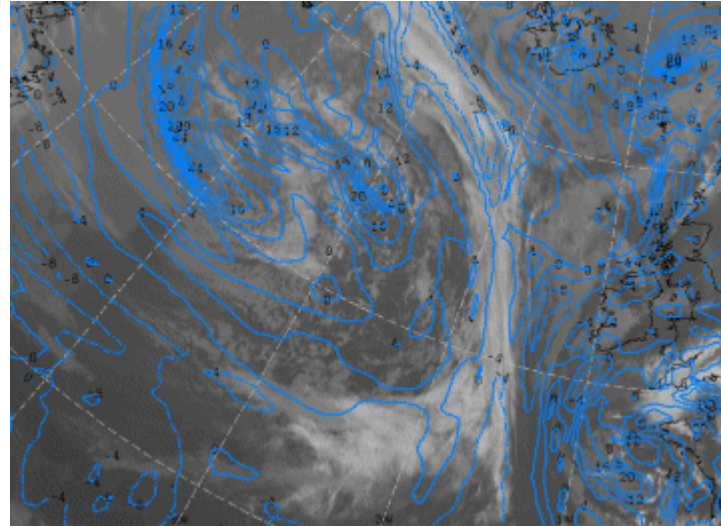
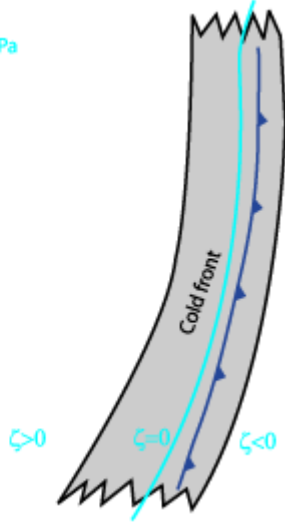


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# Key parameters



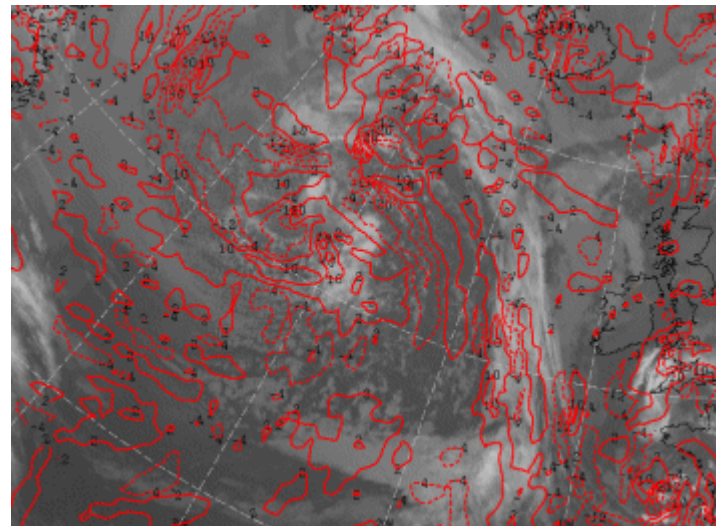
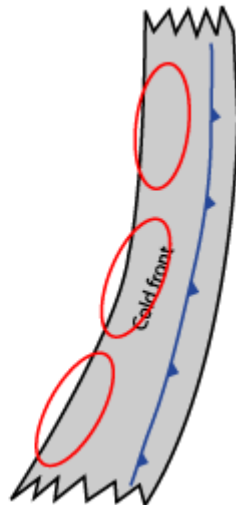
Relative Vorticity 500 hPa



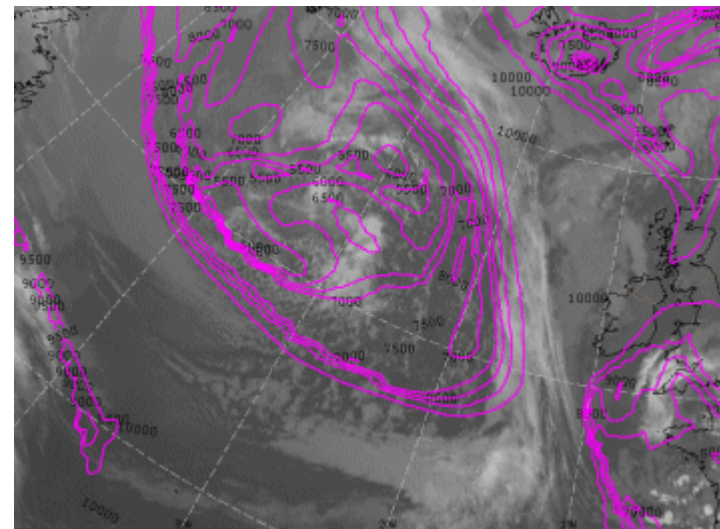
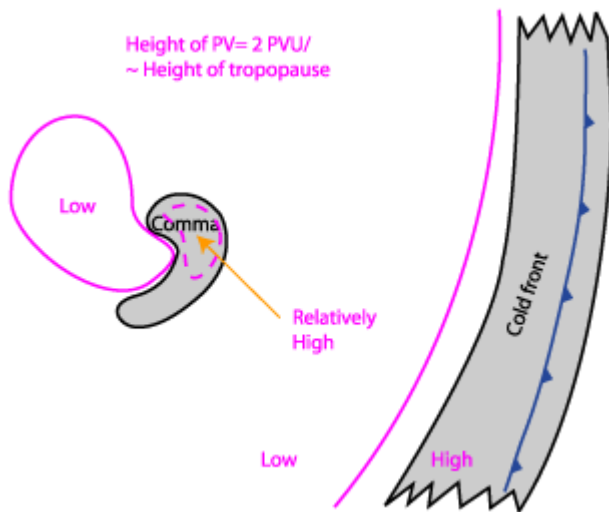
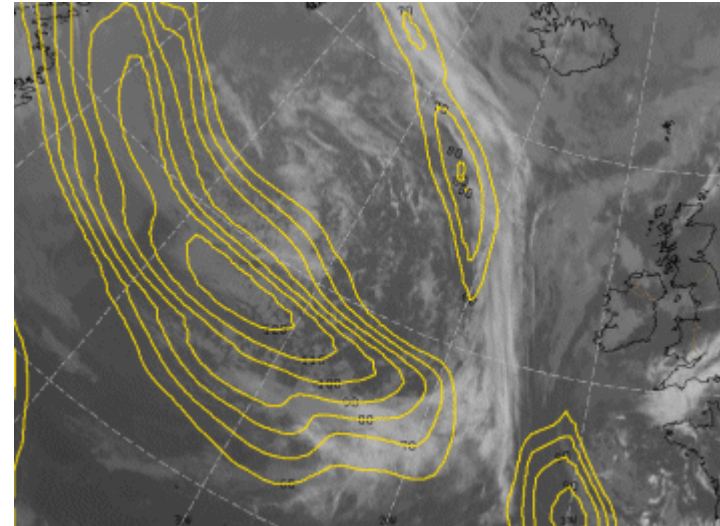
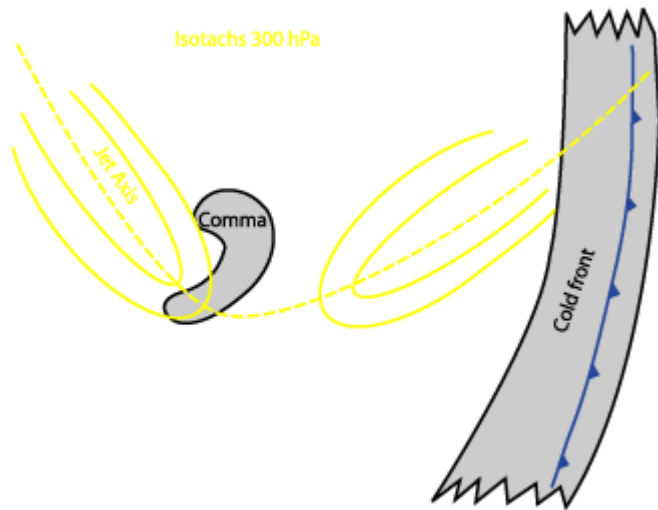
Vorticity Advection 500 hPa



VA < 0    VA = 0    VA > 0



# Key parameters

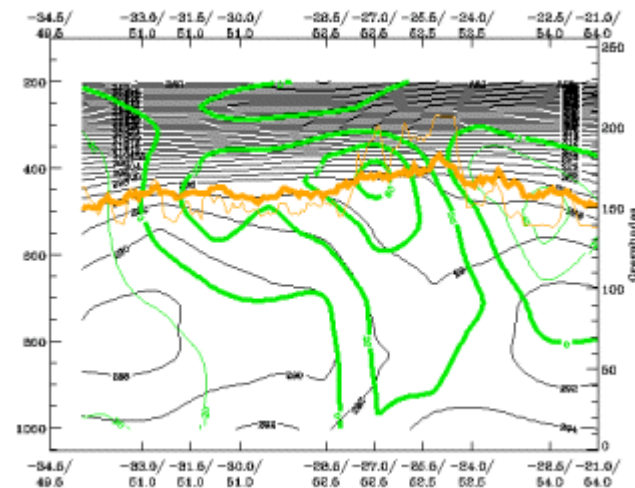
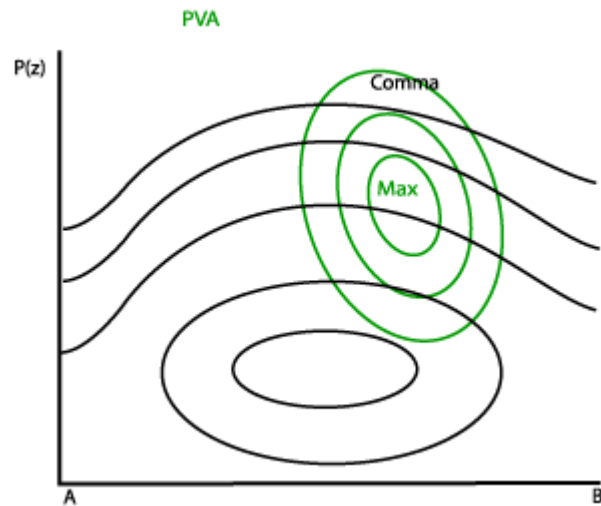
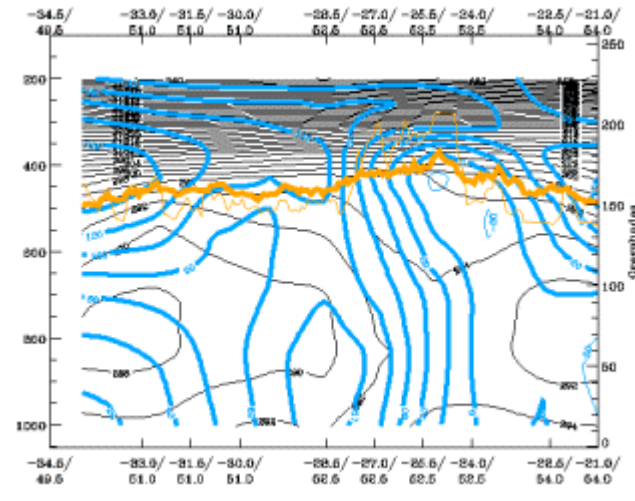
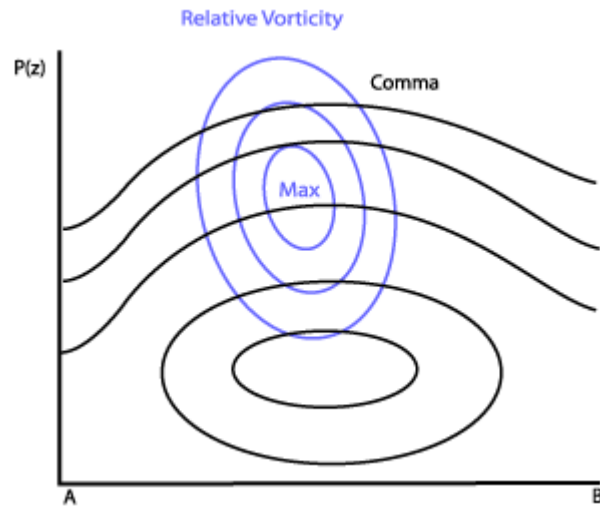


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# Vertical cross sections



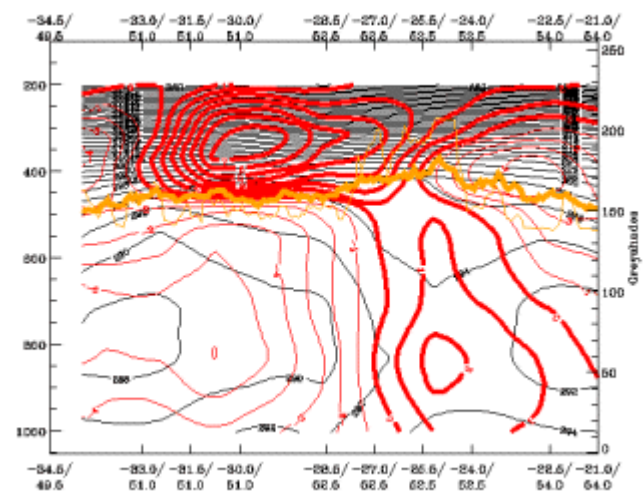
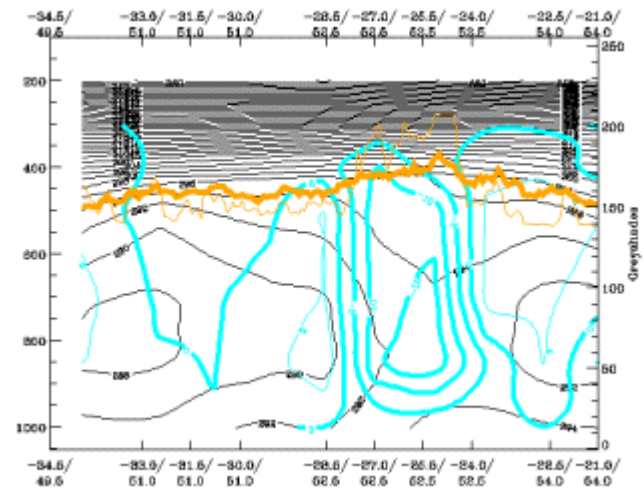
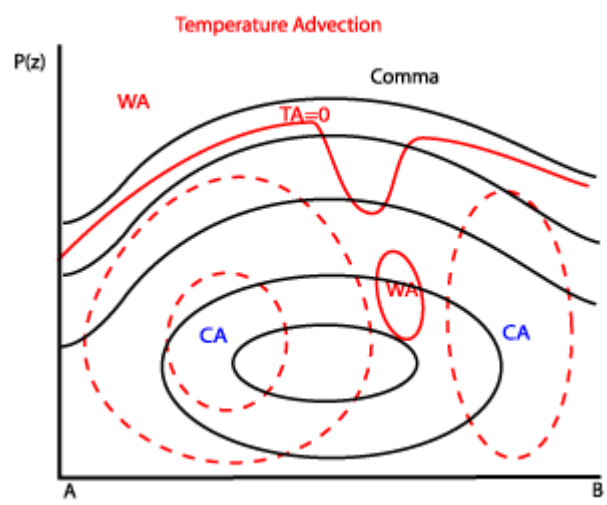
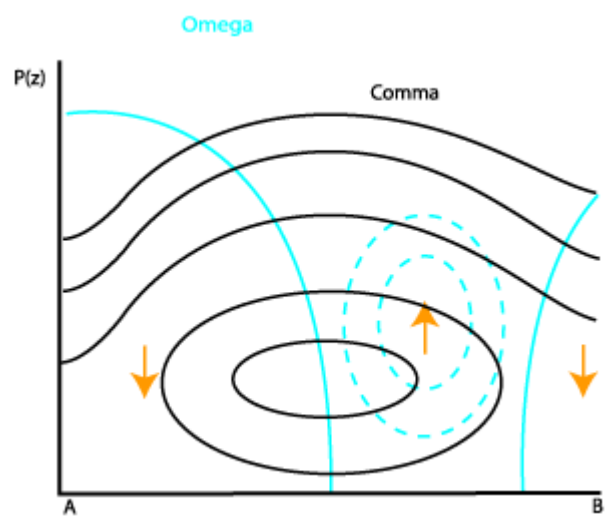
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# Vertical cross sections



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Folie 22



# Weather phenomena



- Comma clouds can be associated with severe weather situations
- Comma tail: showery precipitation, thunderstorm, hail
- Comma head: moderate to heavy precipitation
- Especially during winter high wind speeds can be expected
- strong gusts ahead of the Comma head
- Icing and turbulence

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Folie 23

# Weather phenomena



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