GEOFYSISK INSTITUTT 100 ÅR

# Framvekst av den moderne meteorologien

## Med vekt på varsling, lavtrykk og teknologiens rolle

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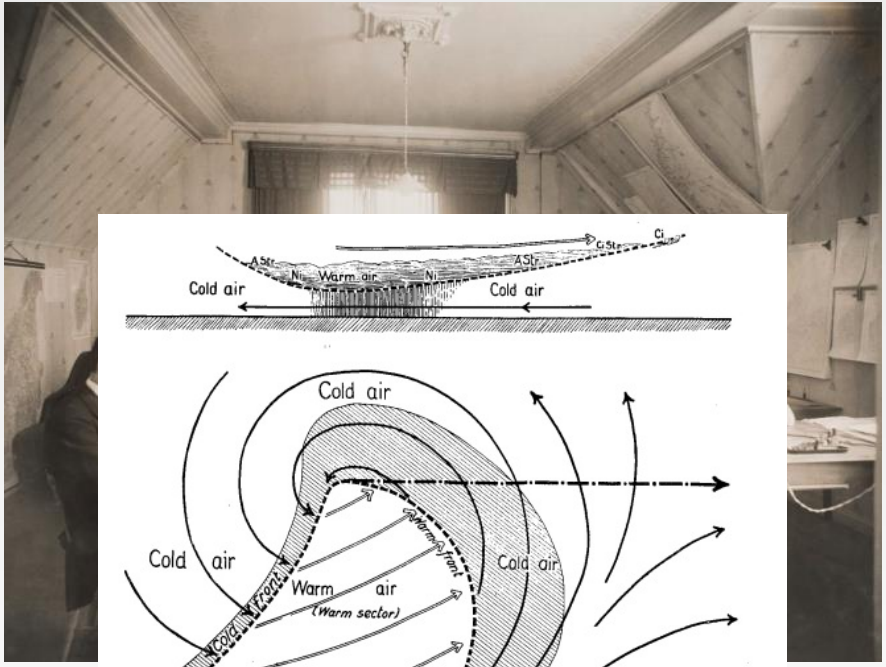
Geofysisk institutt

UNIVERSITETET I BERGEN

# Instituttet blir grunnlagt og Vilhelm Bjerknes blir hentet til Bergen i 1917

Diagnosis + laws of nature = prognosis

# Diagnose - værkartet



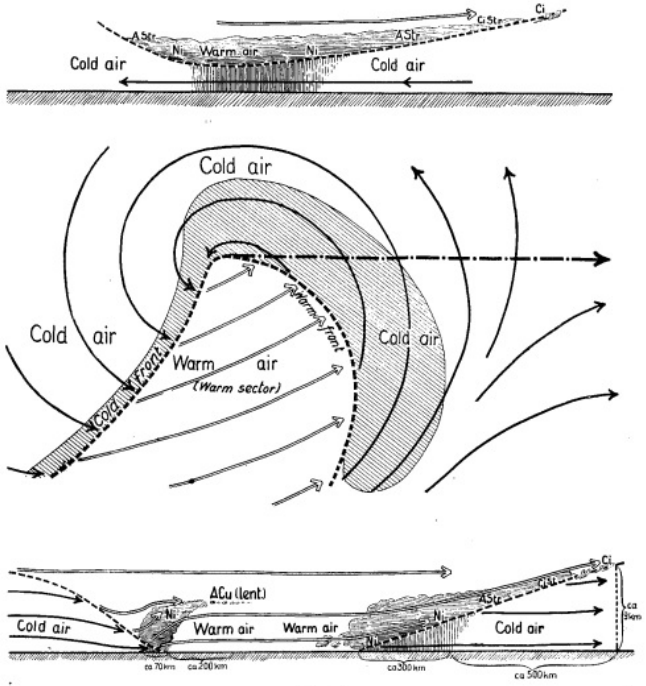



Fig. 1.
Idealized cyclone.

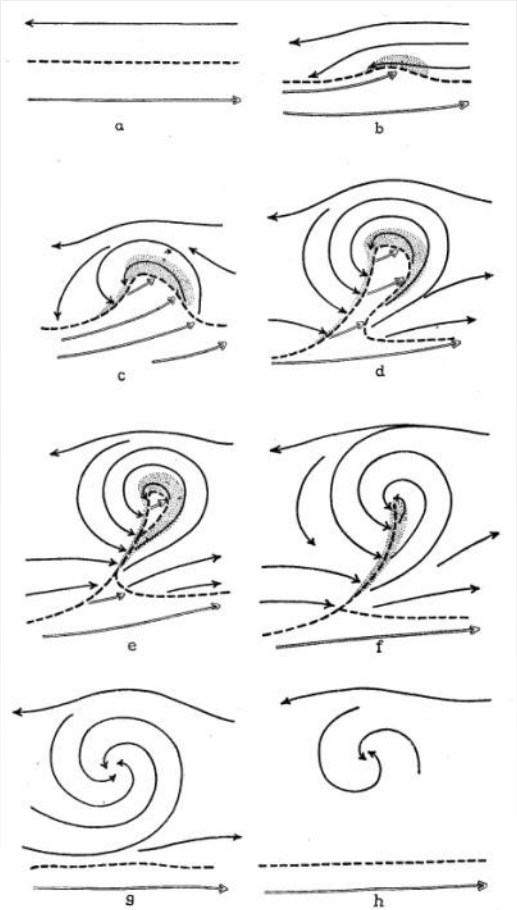
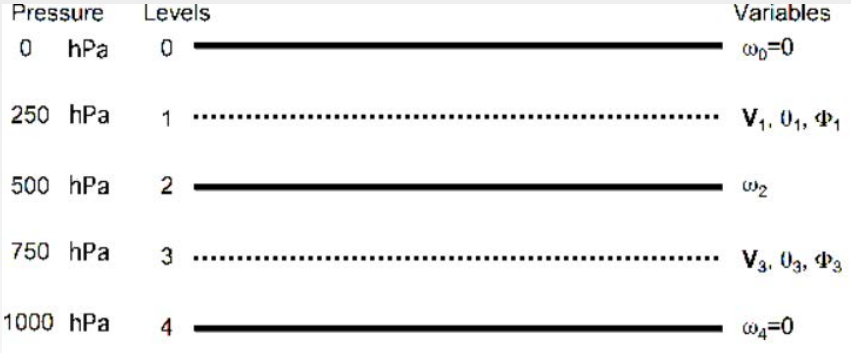
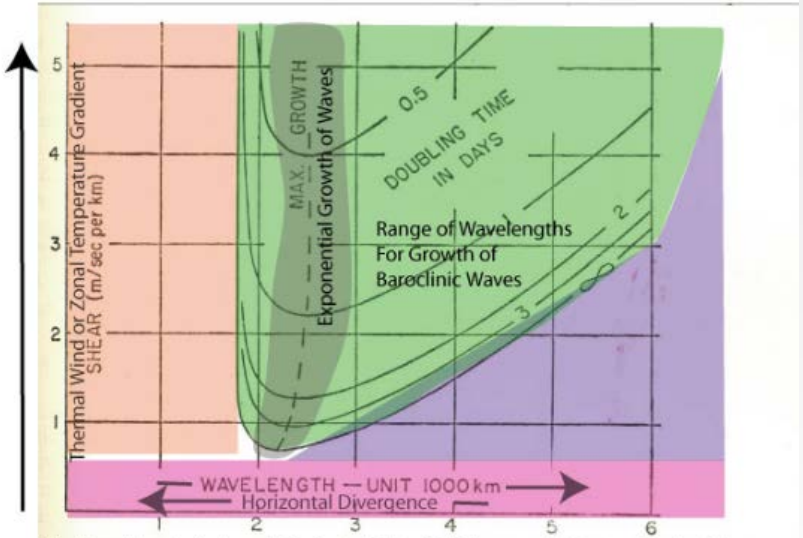



Fig. 2. The »Life cycle« of cyclones.

# Lavtrykk og baroklin instabilitet




4.2. Growth rate in baroclinic instability: Solid curves indicate the *doubling*
Dashed curve indicates wavelength corresponding to maximum growth rate.

Charney (1947)
Eady (1949)

# Så kom regnemaskinene

# Regnemaskinen muliggjorde kvantitative prognoser

## The 20th century: Numerical Weather Prediction (NWP)

C. Abbe (1901), V. Bjerknes (1904) and L.F. Richardson (1922)

- Numerical weather prediction and modelling are based on the physical laws of fluid,

Horizontal Momentum $$\frac{d\mathbf{V}^H}{dt} + \frac{1}{\rho}\nabla p + f\mathbf{k} \times \mathbf{V}^H = \mathbf{F}^H$$

Vertical Momentum $$\frac{dw}{dt} + \frac{1}{\rho}\frac{\partial p}{\partial z} = -g + F^z$$

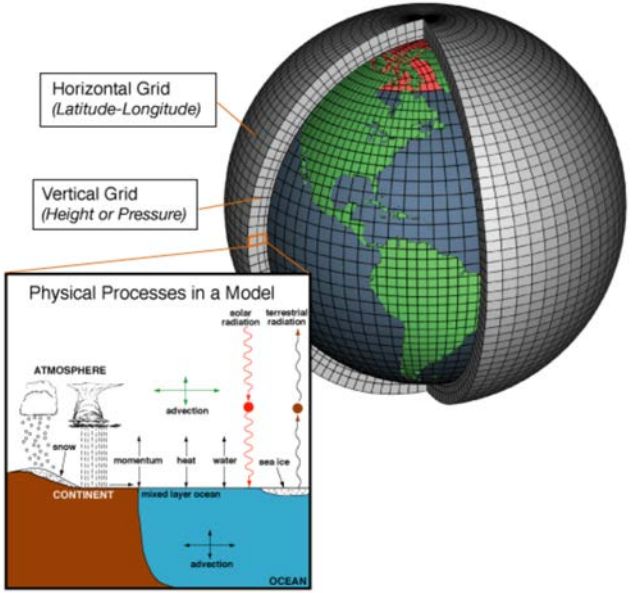
Continuity $$\frac{d \ln \rho}{dt} + \nabla . \mathbf{V} = 0$$

Thermodynamic $$\frac{d\theta}{dt} = F^\theta$$

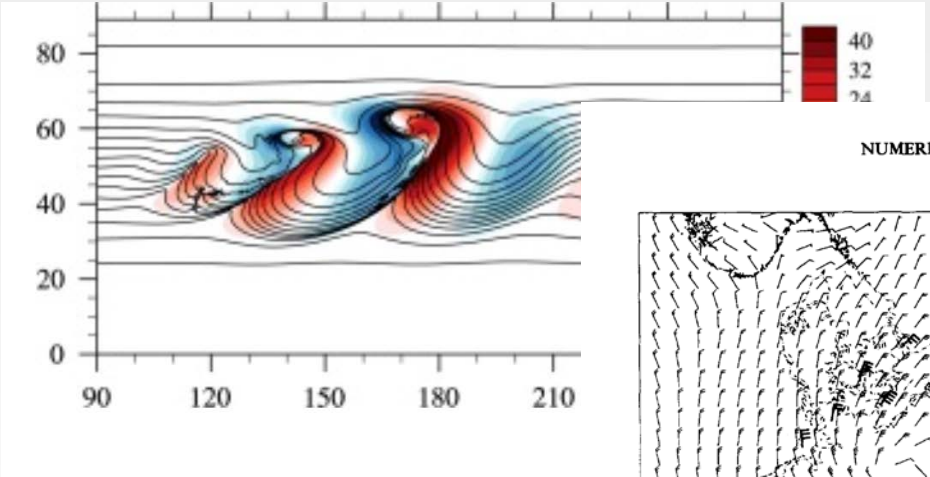
Moisture $$\frac{dq}{dt} = F^q$$

State $$p = \rho RT \quad where \quad \theta = T\left(\frac{p_r}{p}\right)^k$$

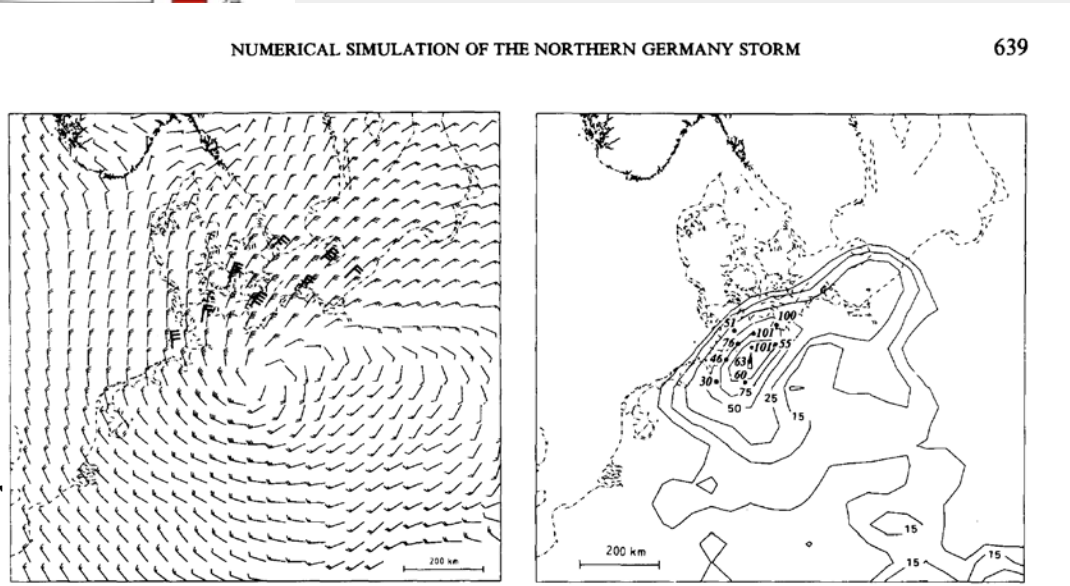
- These equations are the based for predictability and dynamical processes studies



# Modeller som numeriske laboratorier



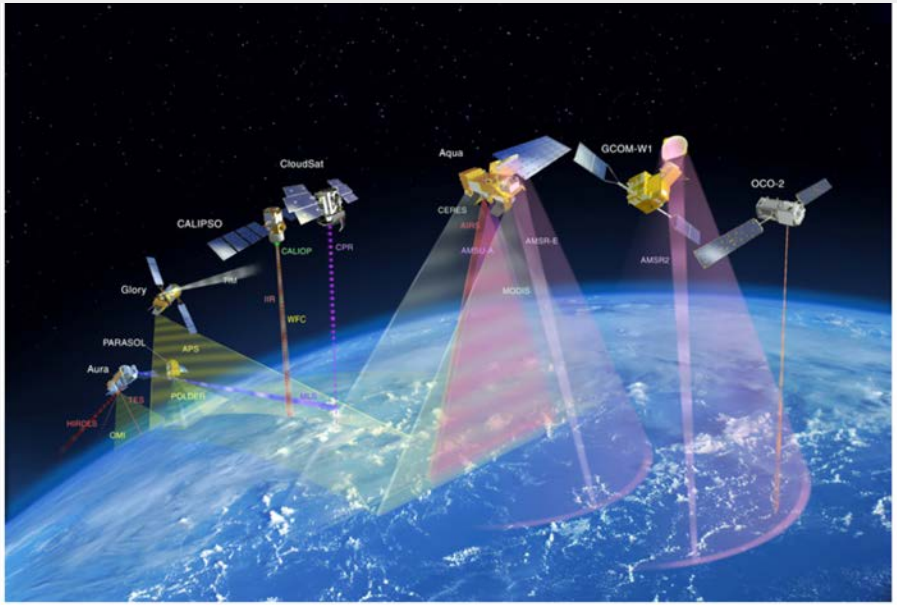

Idealiserte eksperiment

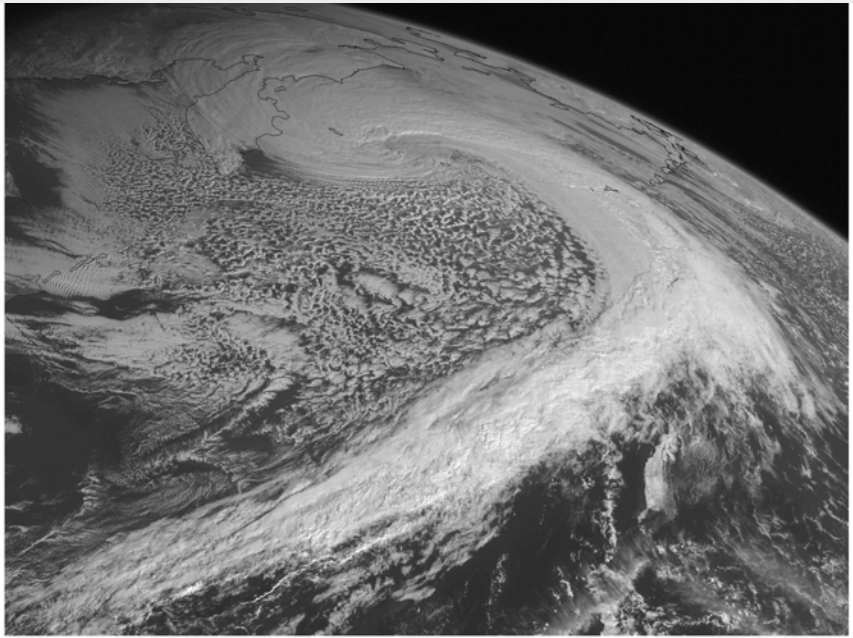



”Case” studier

Grønås et al 1994

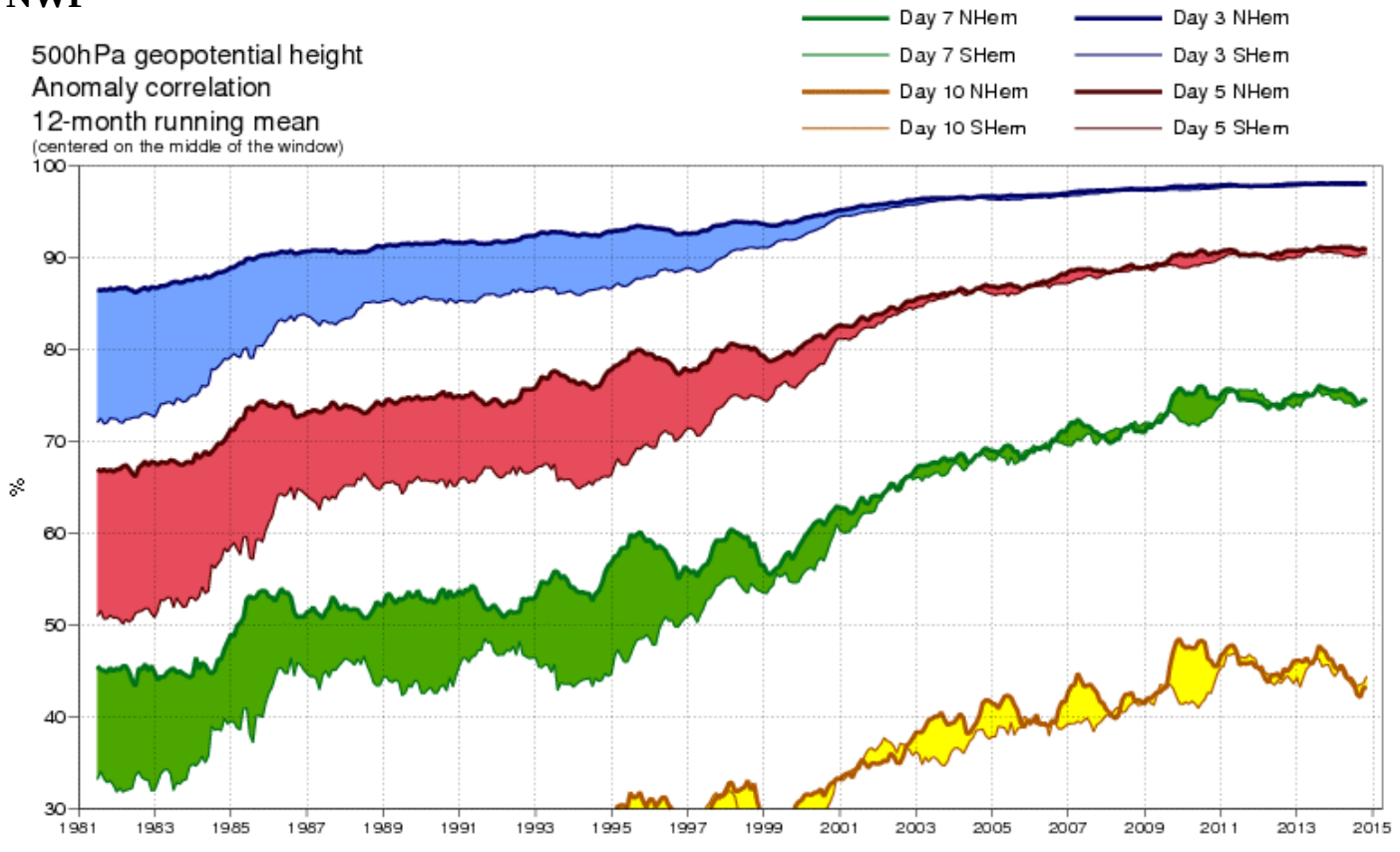
# Satellitdata – en enorm datakilde som endelig kunne utnyttes



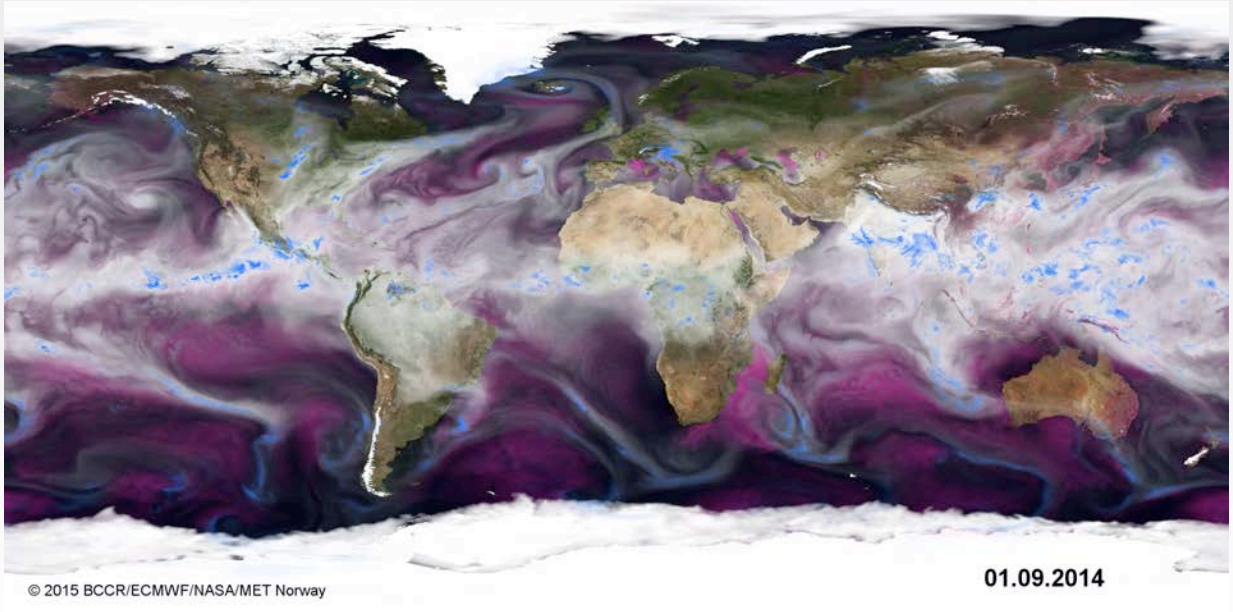
Fra bilder til 3D strukturbeskrivelse

**NWP**

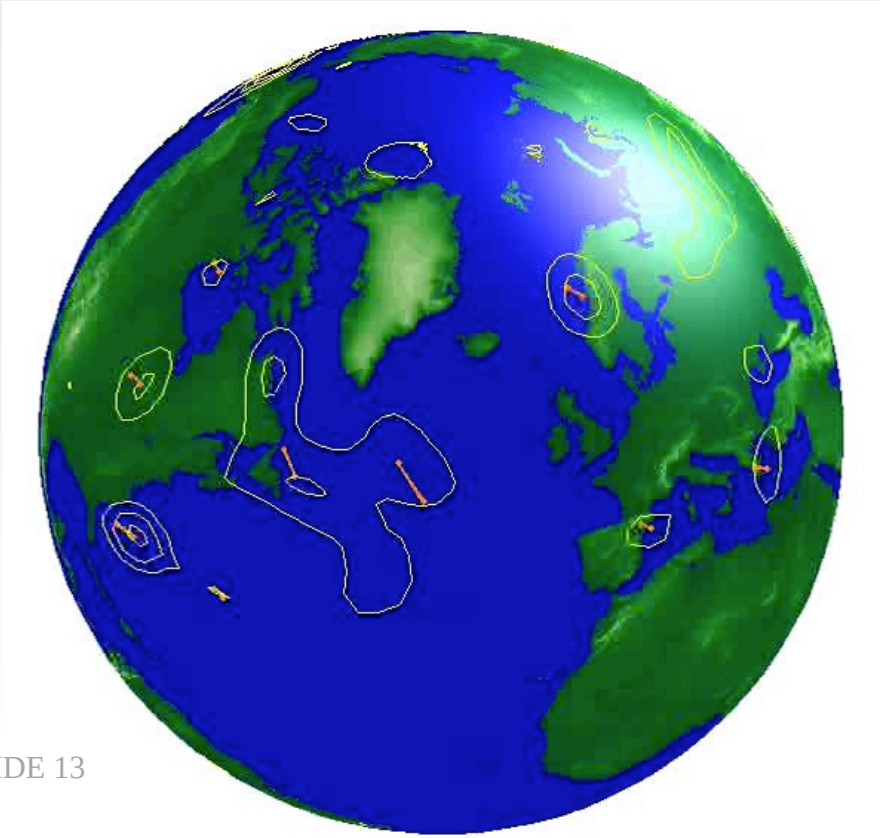



*Quality of 500hPa geopotential height of the ECMWF global model (from ecmwf.int)*

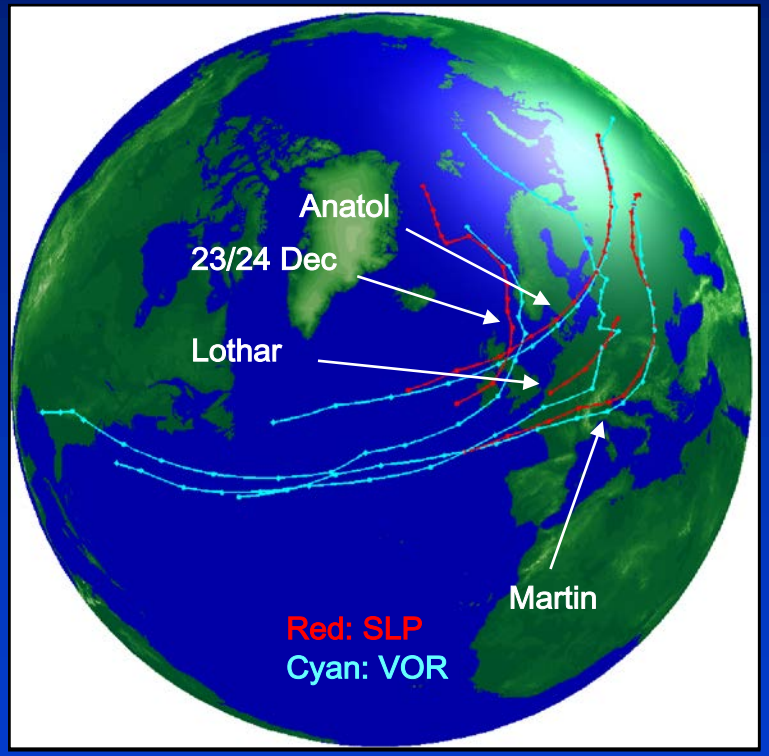
# Globale re-analyser



# Lavtrykksbaner (6t re-analyser)



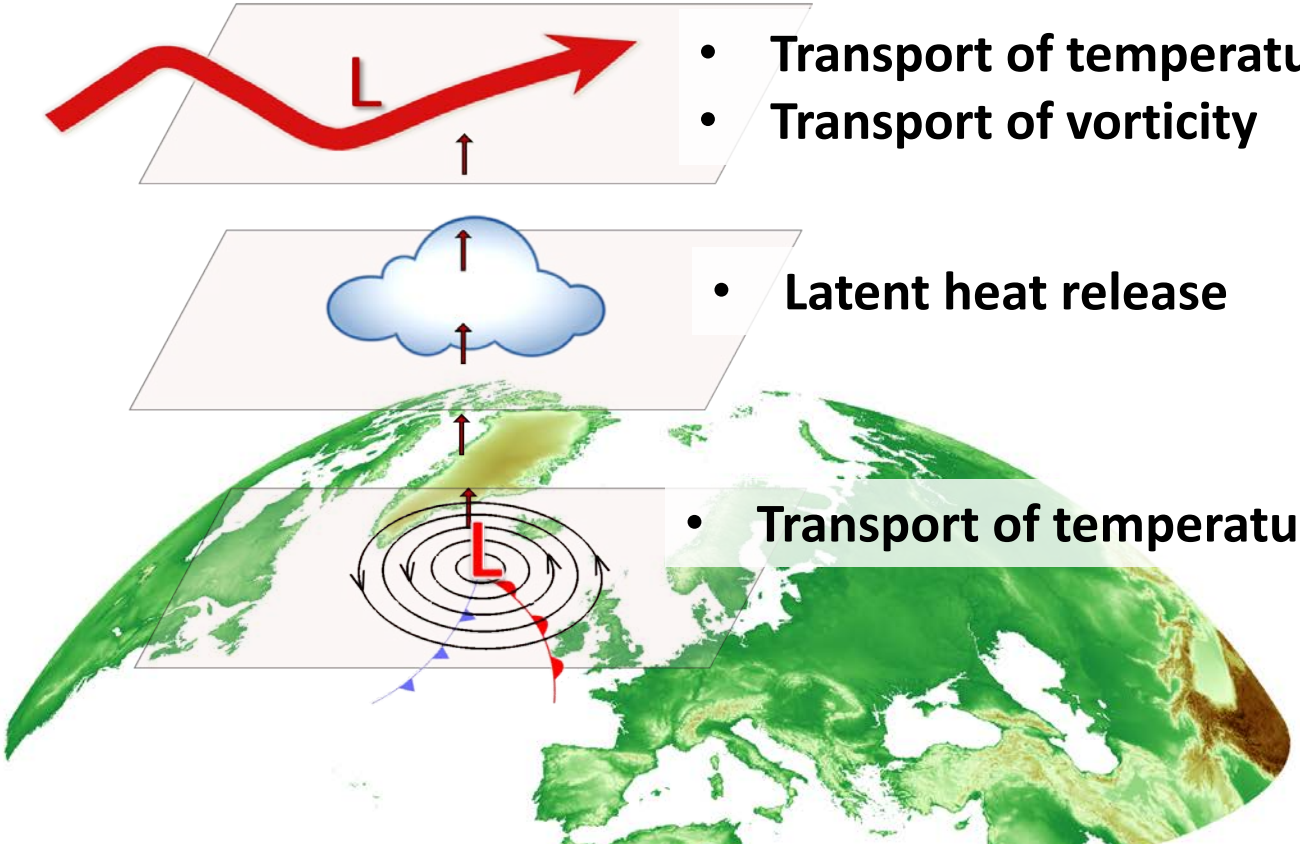
# The Storms of December 1999




→ Kan spore egenskaper ved lavtrykkene langs trajektorien

# Atmospheric circulation

## Synoptic Systems



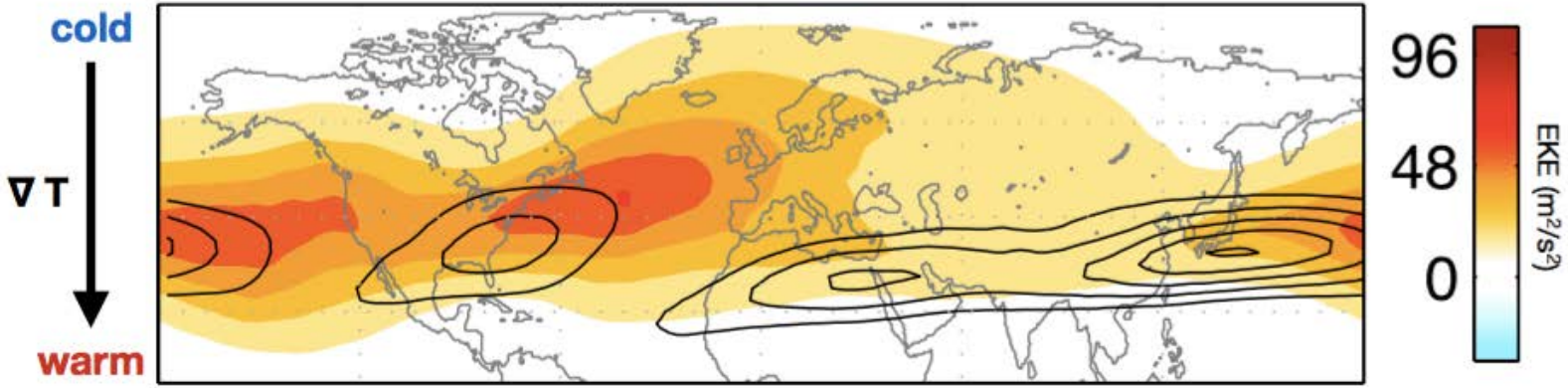

- **Transport of temperature**
- **Transport of vorticity**

- **Latent heat release**

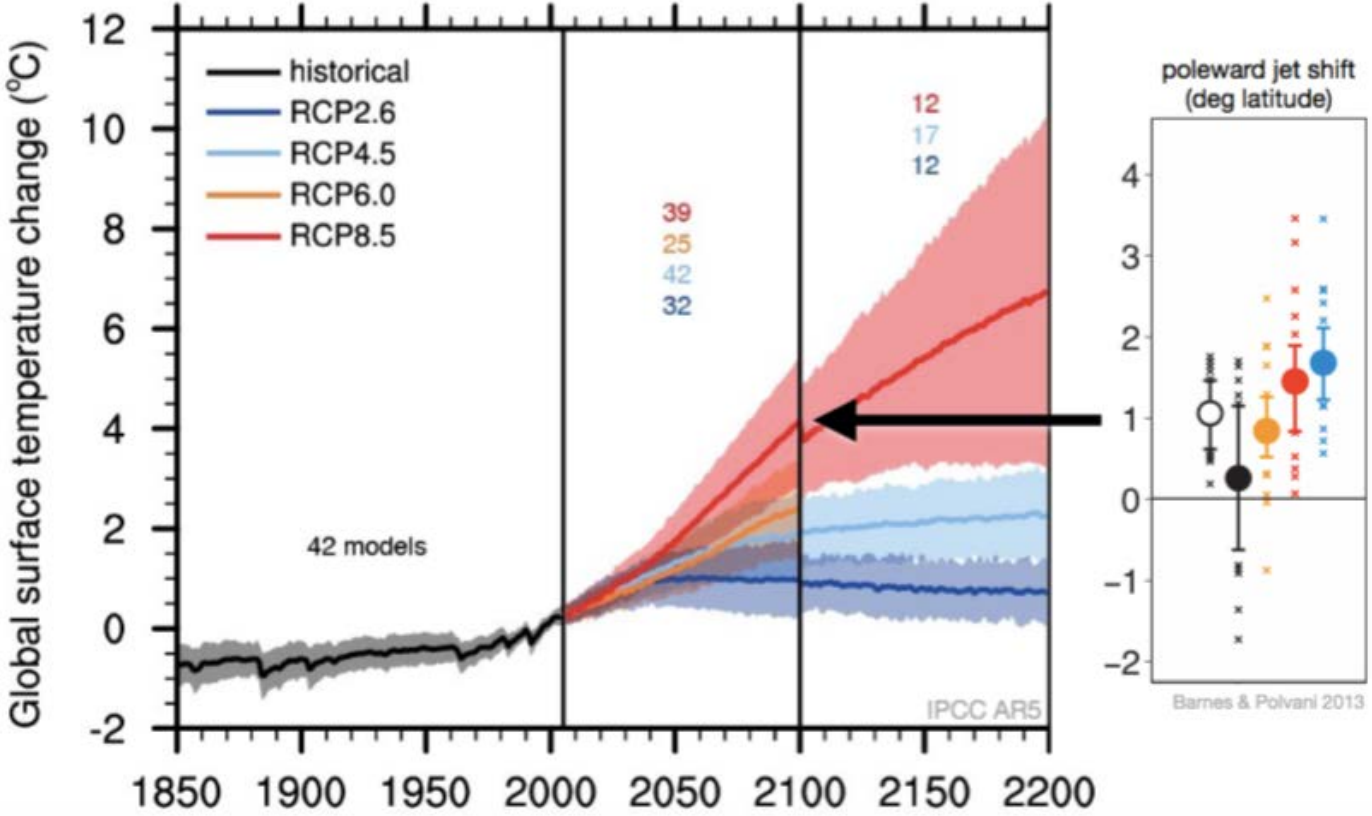
- **Transport of temperature**

# will global warming cause the jet to shift?

**jet streams (eastward wind belts)**
**storm tracks (preferred regions for travelling weather systems)**



# will global warming cause the jet to shift?



# Geofysisk institutt

- Middels stort institutt MatNat fakultetet
- 120 ansatte, ca 100 studenter
- Forskning og undervisning i
  - Meteorologi
  - Oseanografi
  - Klimadynamikk
  - Biogeokjemi
  - Fornybar energi
- Tett og dynamisk samarbeid med våre partnere i Bjerknessenteret, CMR og met.no