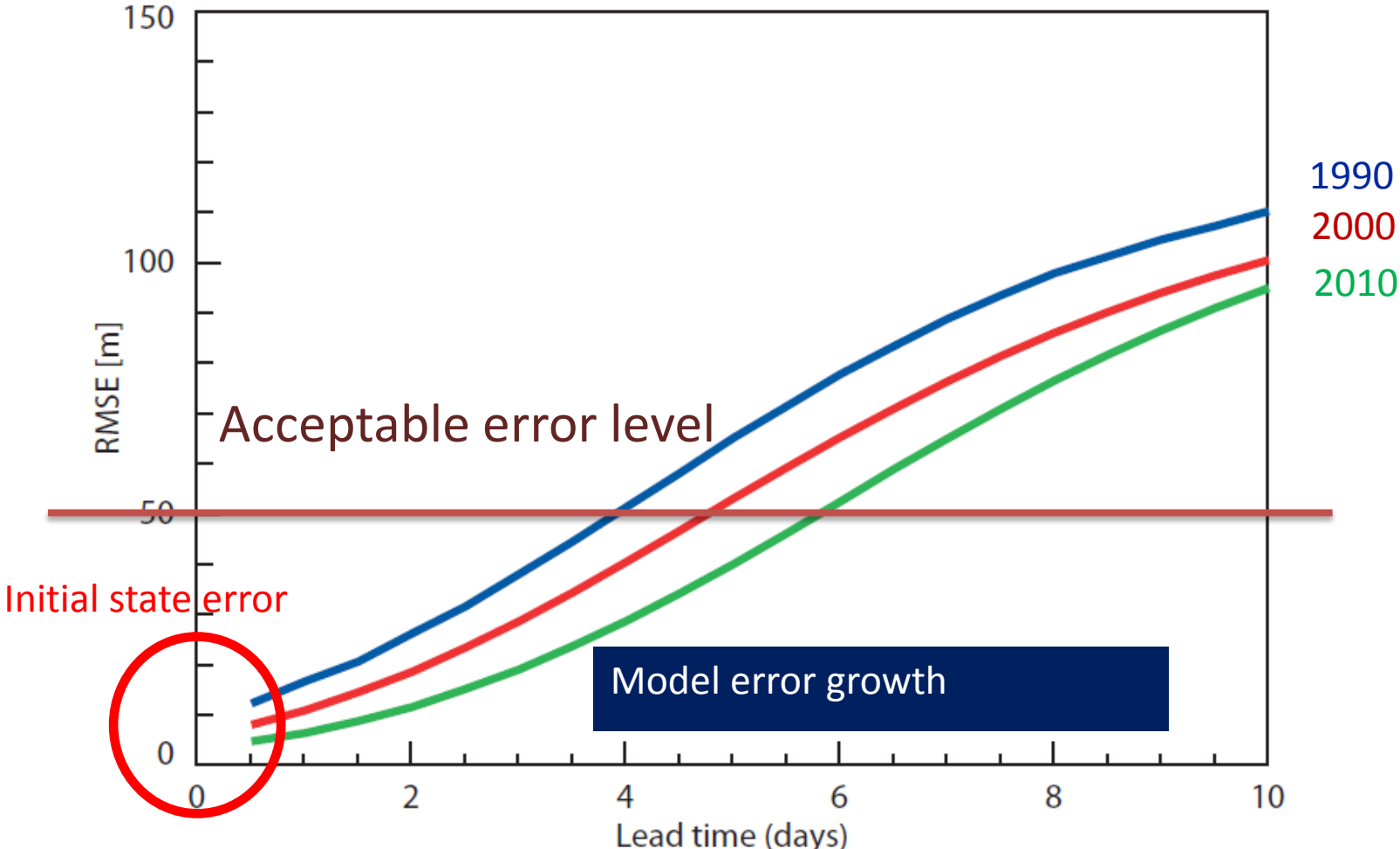# Effect of tropical analysis uncertainties on midlatitude forecast errors
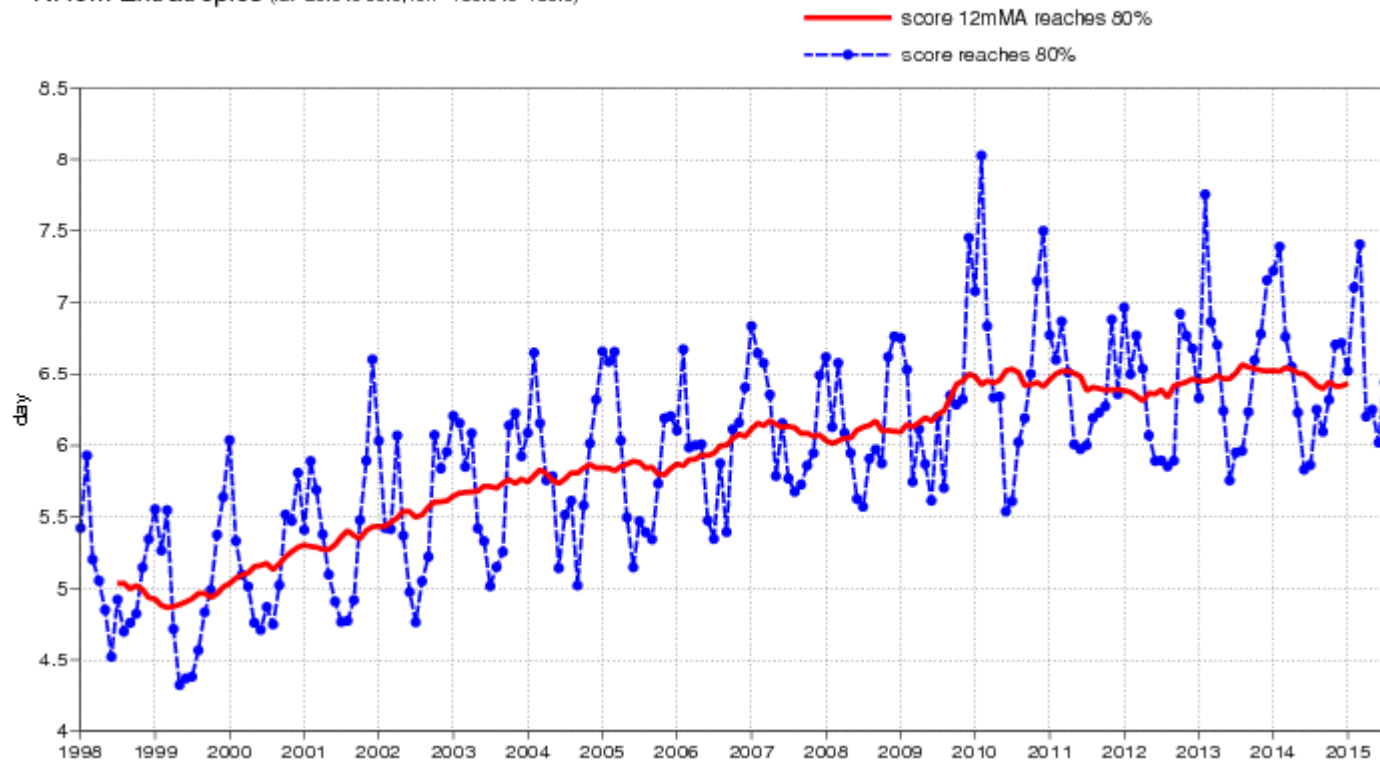
Erland Källén and Linus Magnusson
ECMWF

RMS error of 500 hPa height field Northern Hemisphere

Magnusson and Källén (2014)

Time evolution of predictable range

500hPa geopotential
Lead time of Anomaly correlation reaching 80%
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

score 12mMA reaches 80%
score reaches 80%

ECMWF

Normalisation with ERA-Interim

HRES - ERA
500hPa geopotential
Anomaly correlation
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)
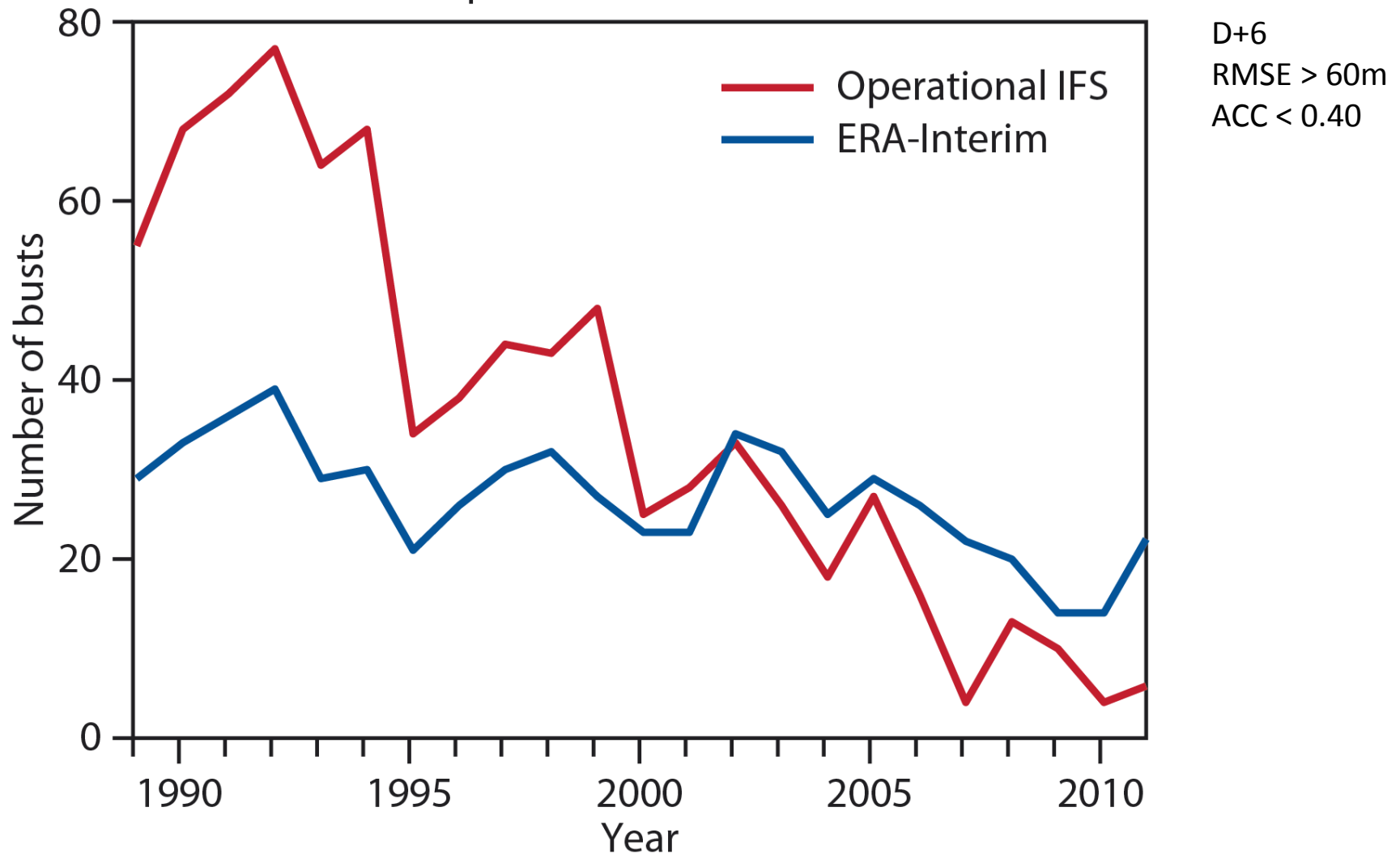T+0 T+12 ... T+240
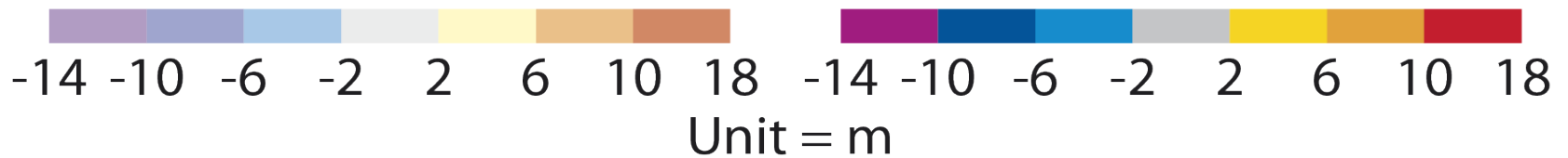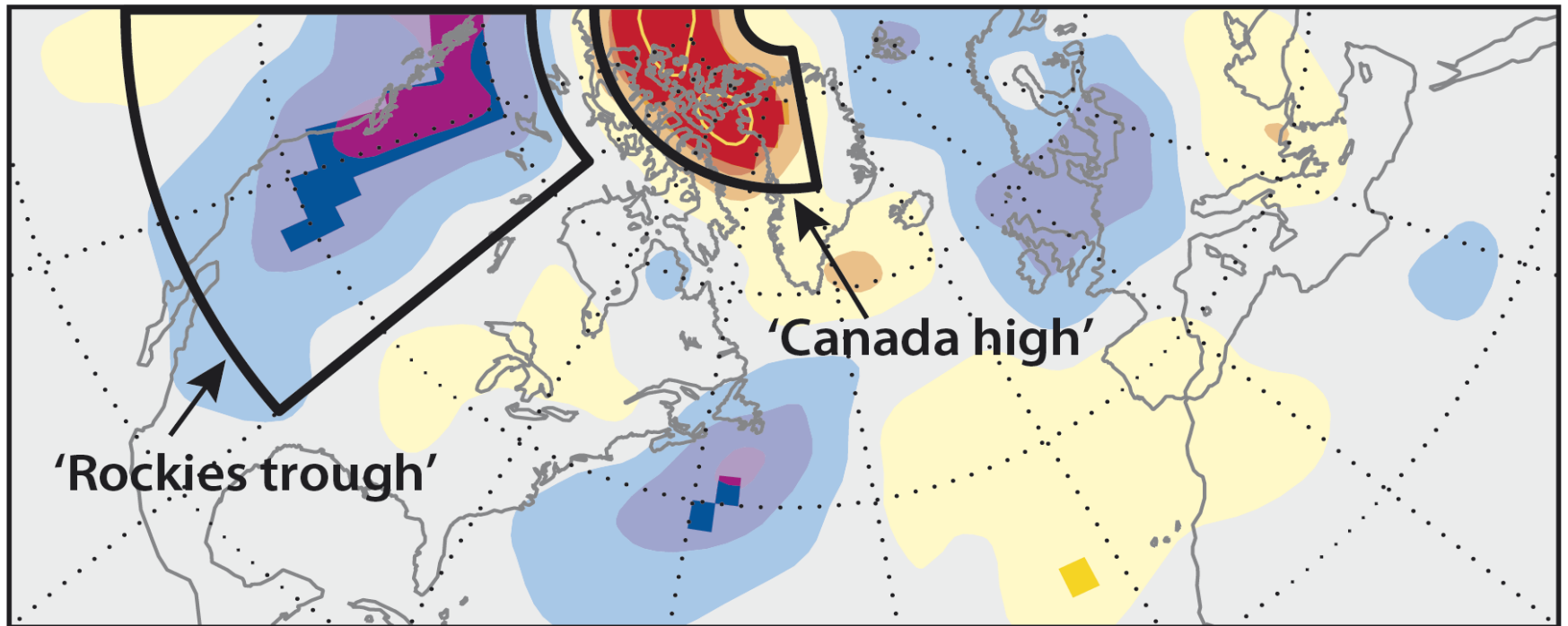oper_an-era_an od-ei oper 0001 | 00UTC,12UTC,beginning

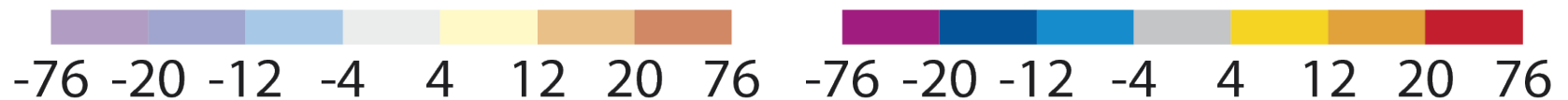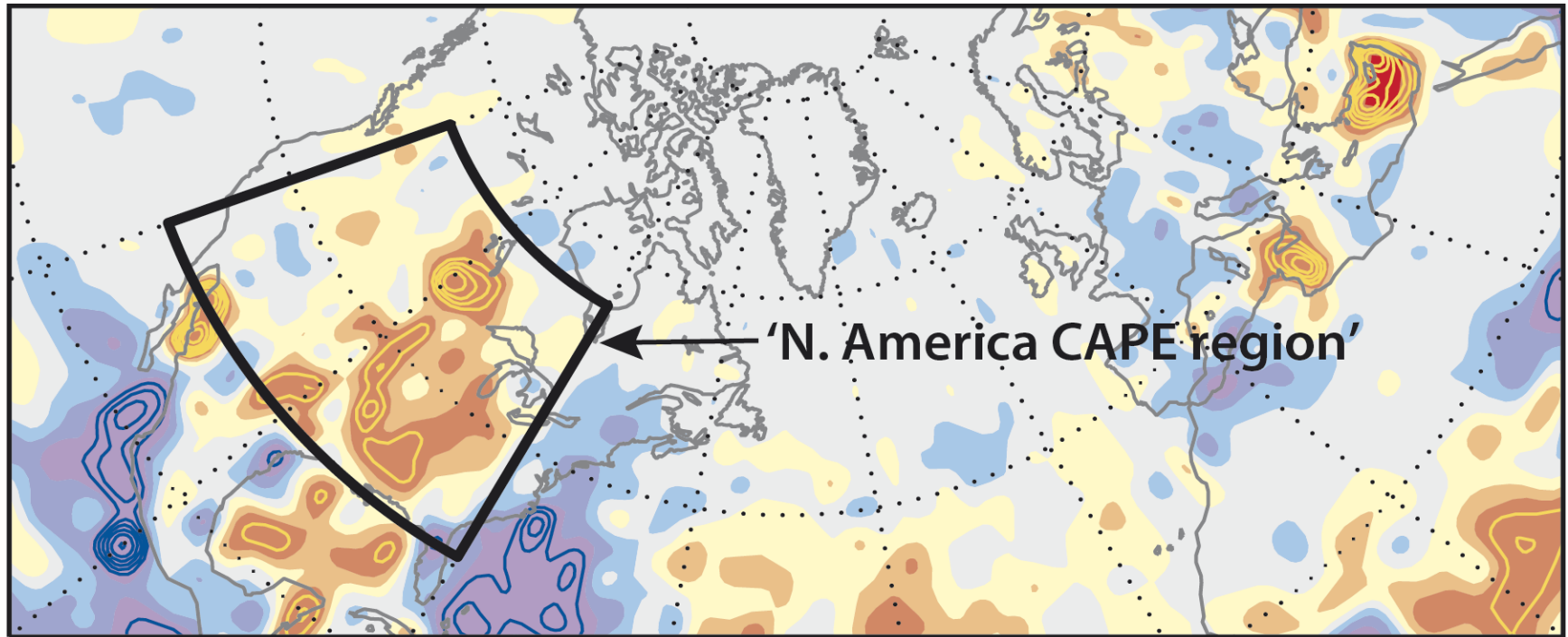# Forecast busts over Europe

a Number of European busts

D+6
RMSE > 60m
ACC < 0.40

Operational IFS
ERA-Interim

Rodwell et al., 2013

Flow anomaly before forecast bust over Europe

a Z500 anomaly

'Canada high'

'Rockies trough'

Unit = m

Rodwell et al., 2013

CAPE anomaly before forecast bust over Europe

b CAPE anomaly

'N. America CAPE region'

-76 -20 -12 -4   4   12 20 76   -76 -20 -12 -4   4   12 20 76

Unit = J/kg

Rodwell et al., 2013

ECMWF
EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

A poor forecast

200 mb winds on 15 March

error propagation

Day 6

Day 5

Day 4

Day 3

Day 2

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS
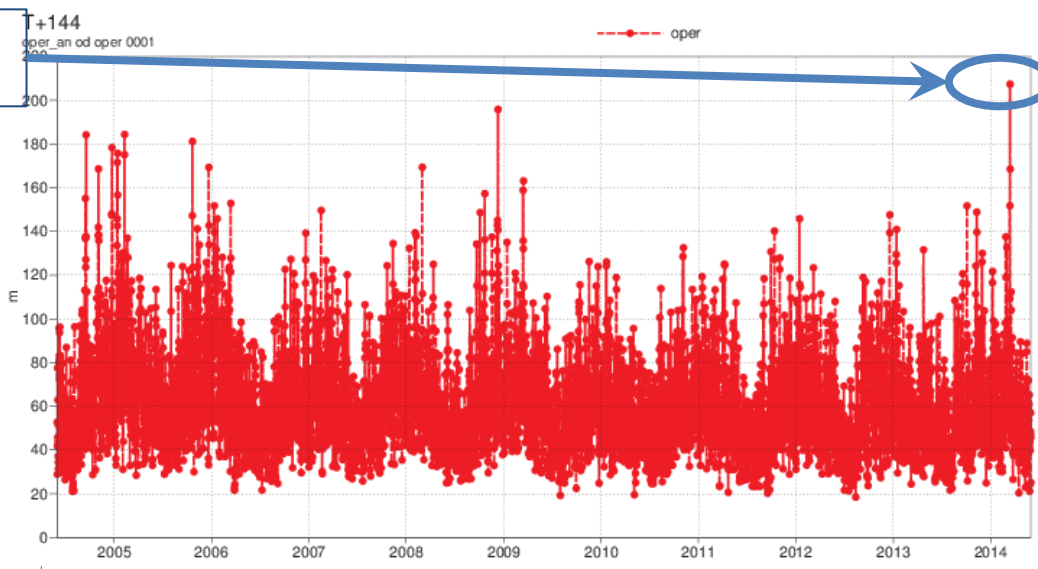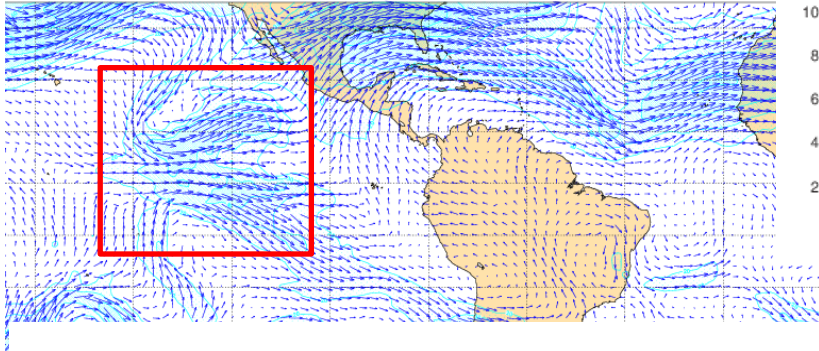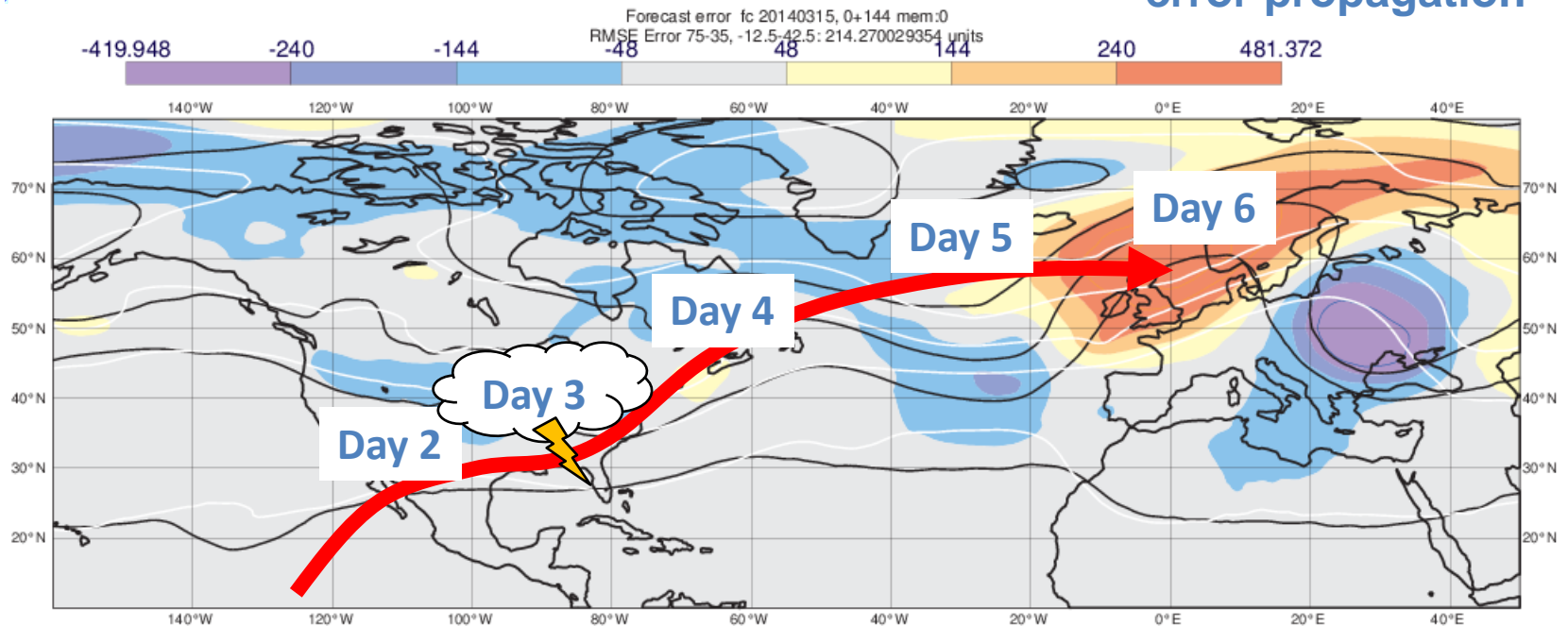
Tropical wave
Equatorial Rossby wave

Zagar, 2004

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS
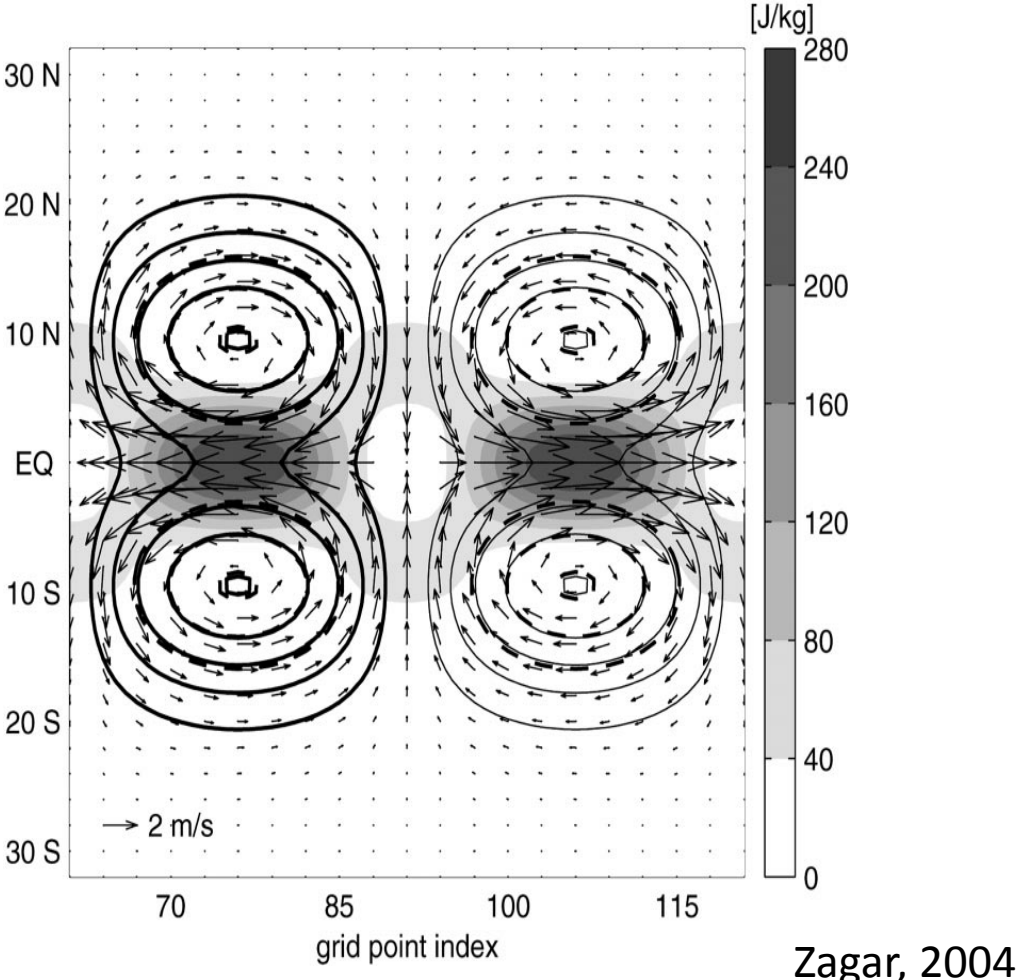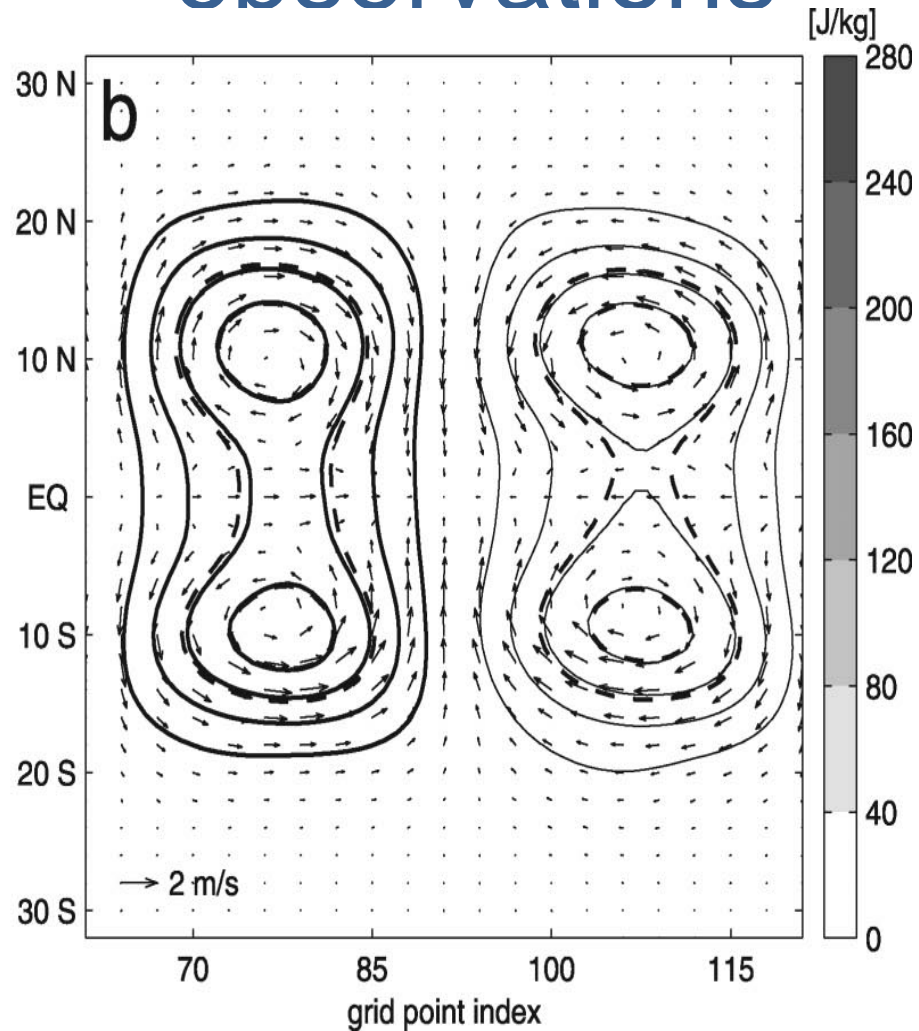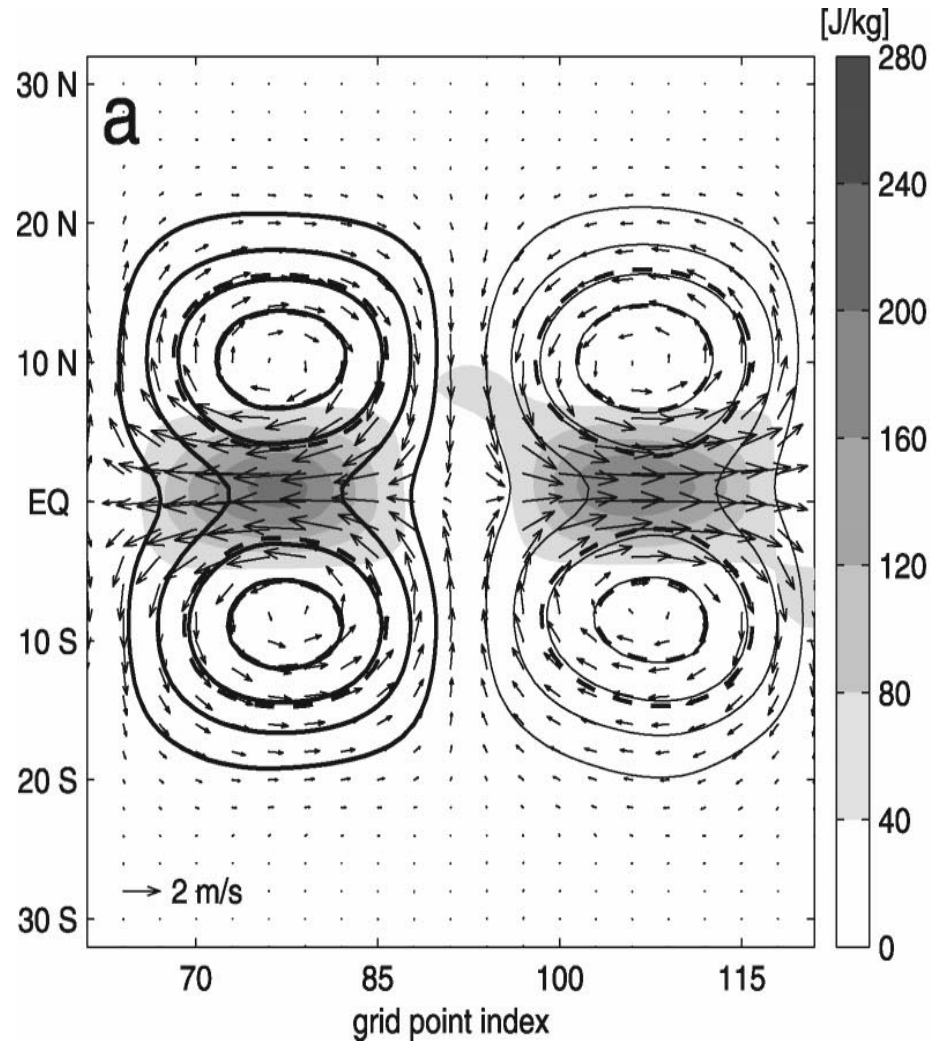
Assimilation using only height observations
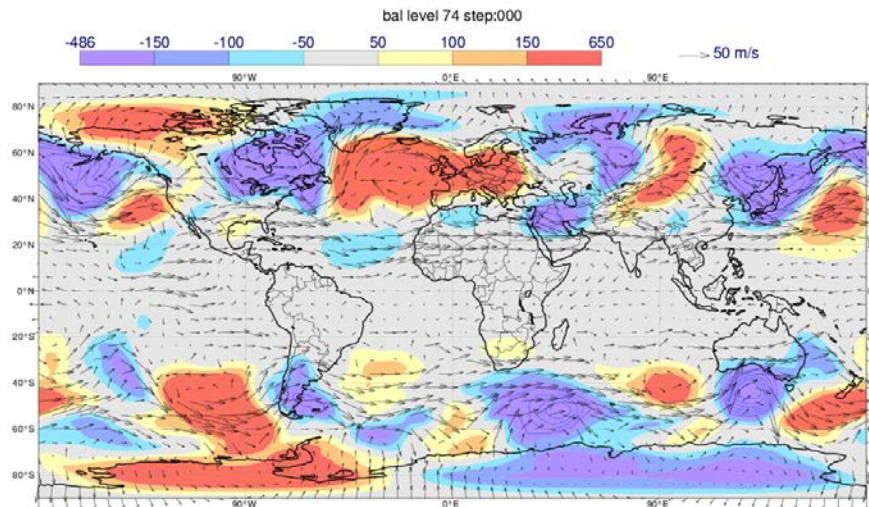

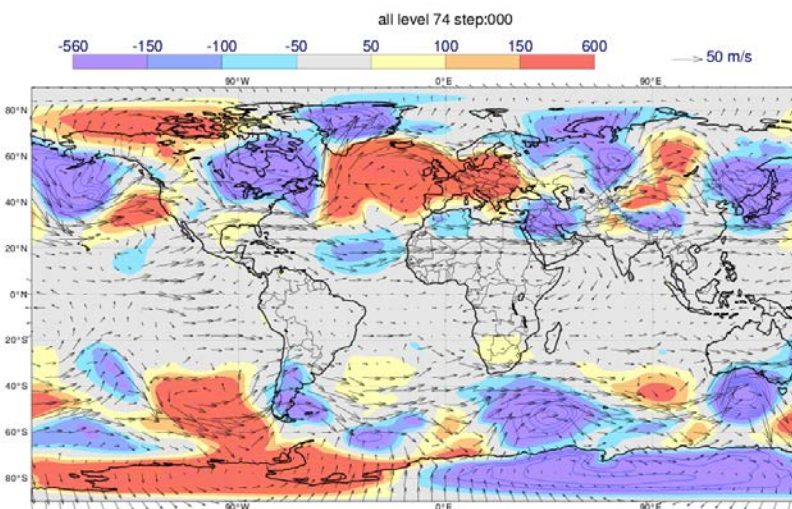Zagar, 2004

Assimilation using height and u wind observations

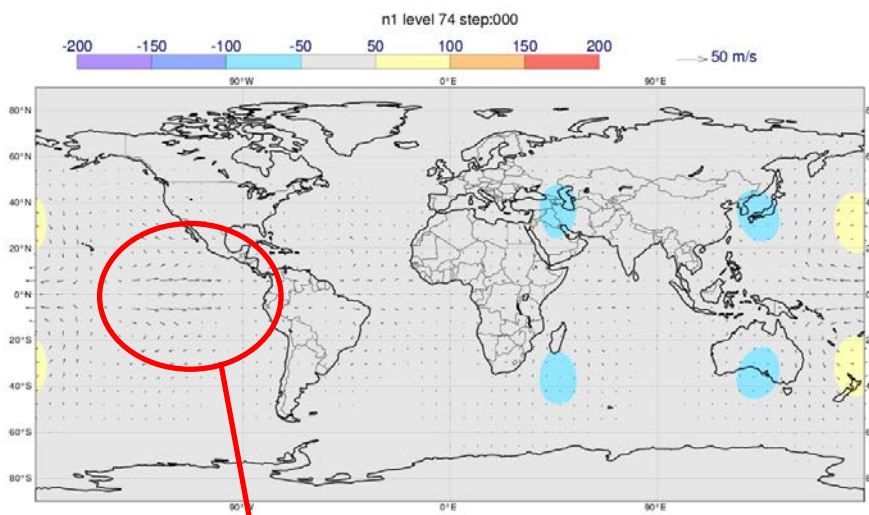Zagar, 2004

Analysis 14 March 2014 18UTC

Balanced flow

bal level 74 step:000
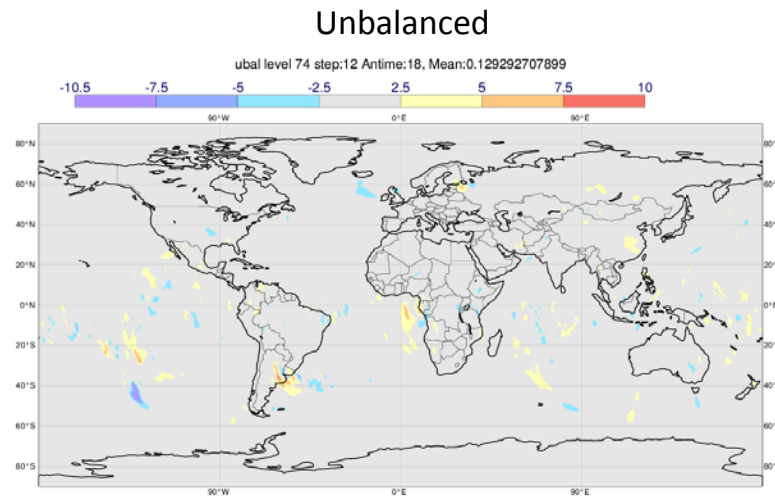
Full field
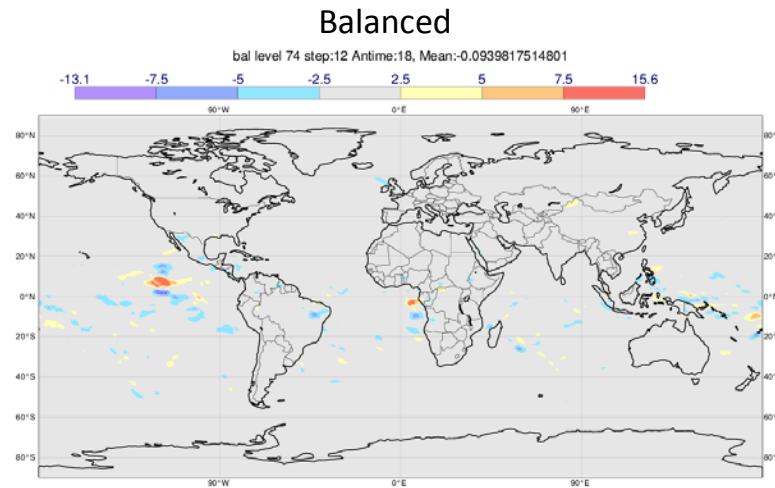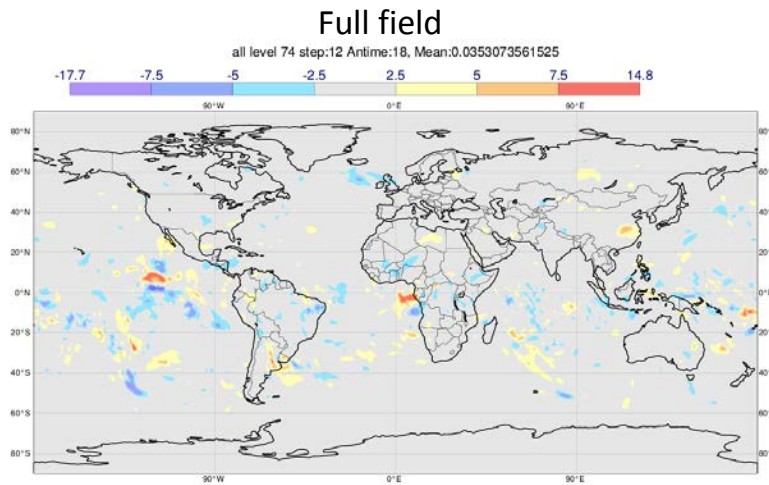
all level 74 step:000

N=1 Rossby mode

n1 level 74 step:000

Strong N=1 Rossby mode over eastern Pacific

Analysis increments of u at 200 hPa
14 March 2014 18UTC

Balanced

bal level 74 step:12 Antime:18, Mean:-0.0939817514801

| -13.1 | -7.5 | -5 | -2.5 | 2.5 | 5 | 7.5 | 15.6 |

Full field

all level 74 step:12 Antime:18, Mean:0.0353073561525

| -17.7 | -7.5 | -5 | -2.5 | 2.5 | 5 | 7.5 | 14.8 |

Unbalanced

ubal level 74 step:12 Antime:18, Mean:0.129292707899

| -10.5 | -7.5 | -5 | -2.5 | 2.5 | 5 | 7.5 | 10 |

ECMWF
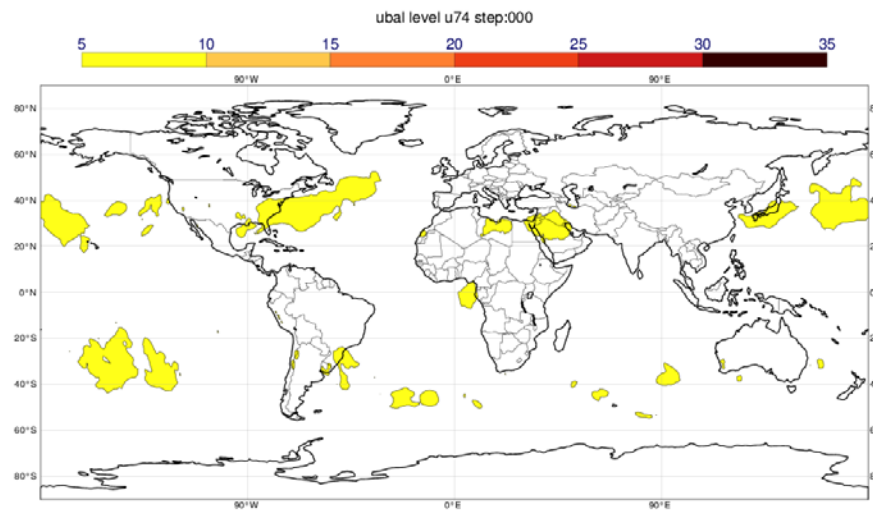EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

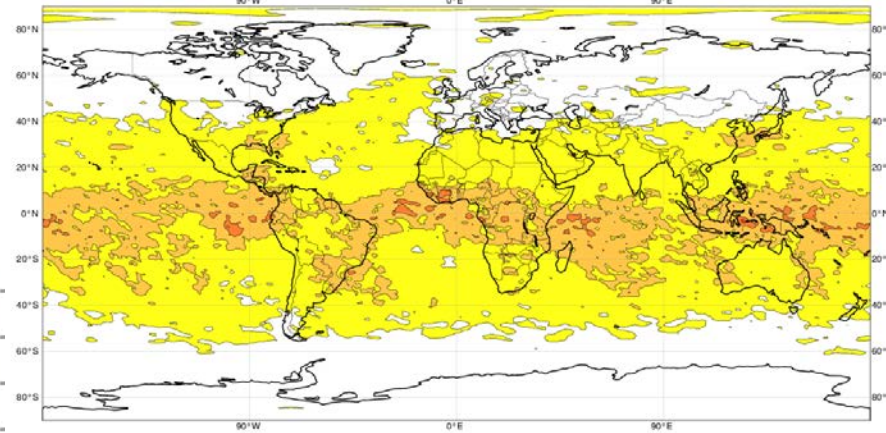# Standard deviation of u_{200} for March 2014

Full field
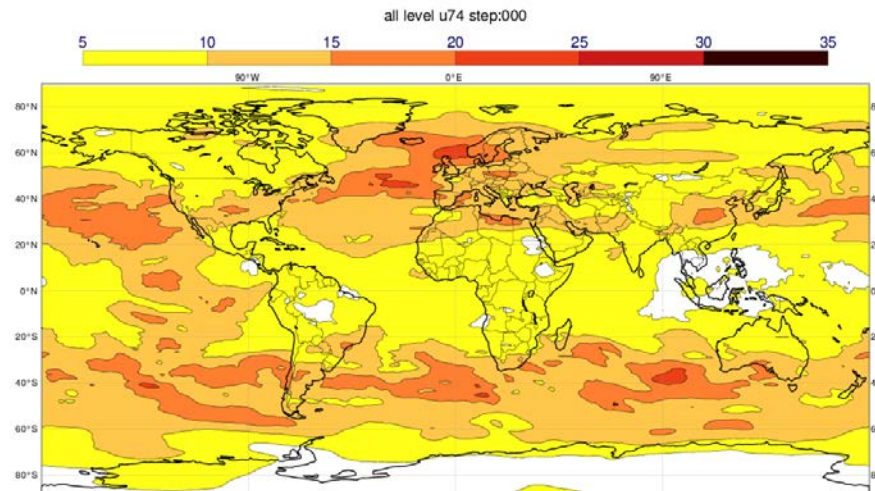
Unbalanced modes

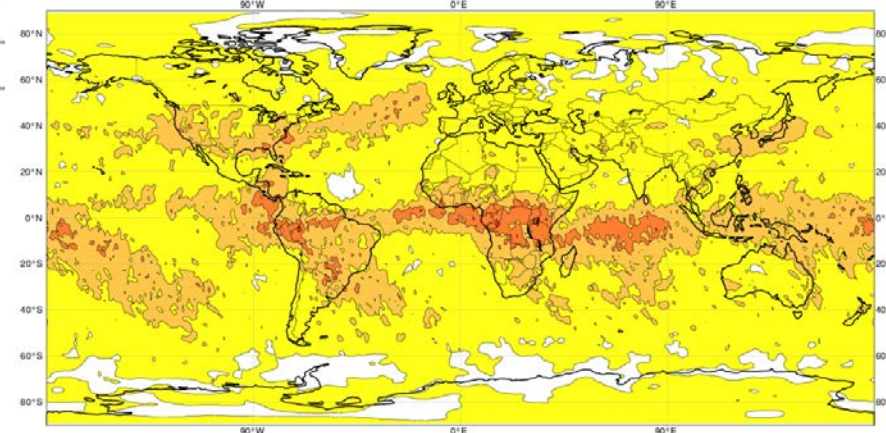# Absolute analysis increments u_{200}
06UTC average for March 2014

Balanced

bal level u74 step:12

Full field

all level u74 step:12
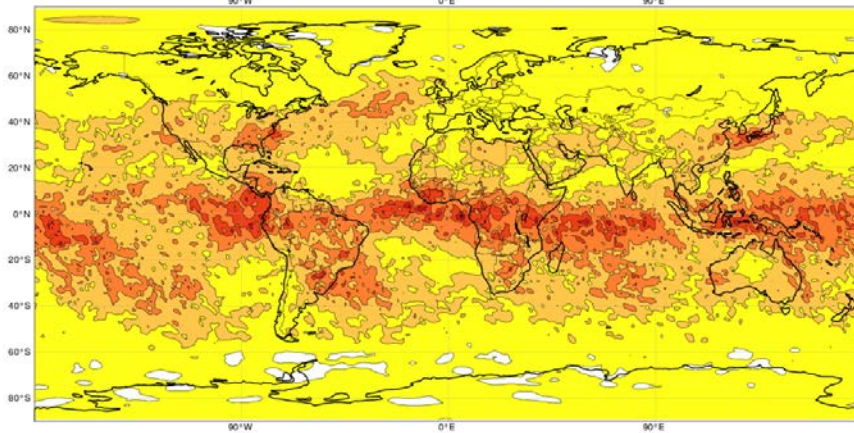
Unbalanced

ubal level u74 step:12

ECMWF

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

NWP impact experiment

Aeolus u-wind profile impacts

Horanyi et al., 2014
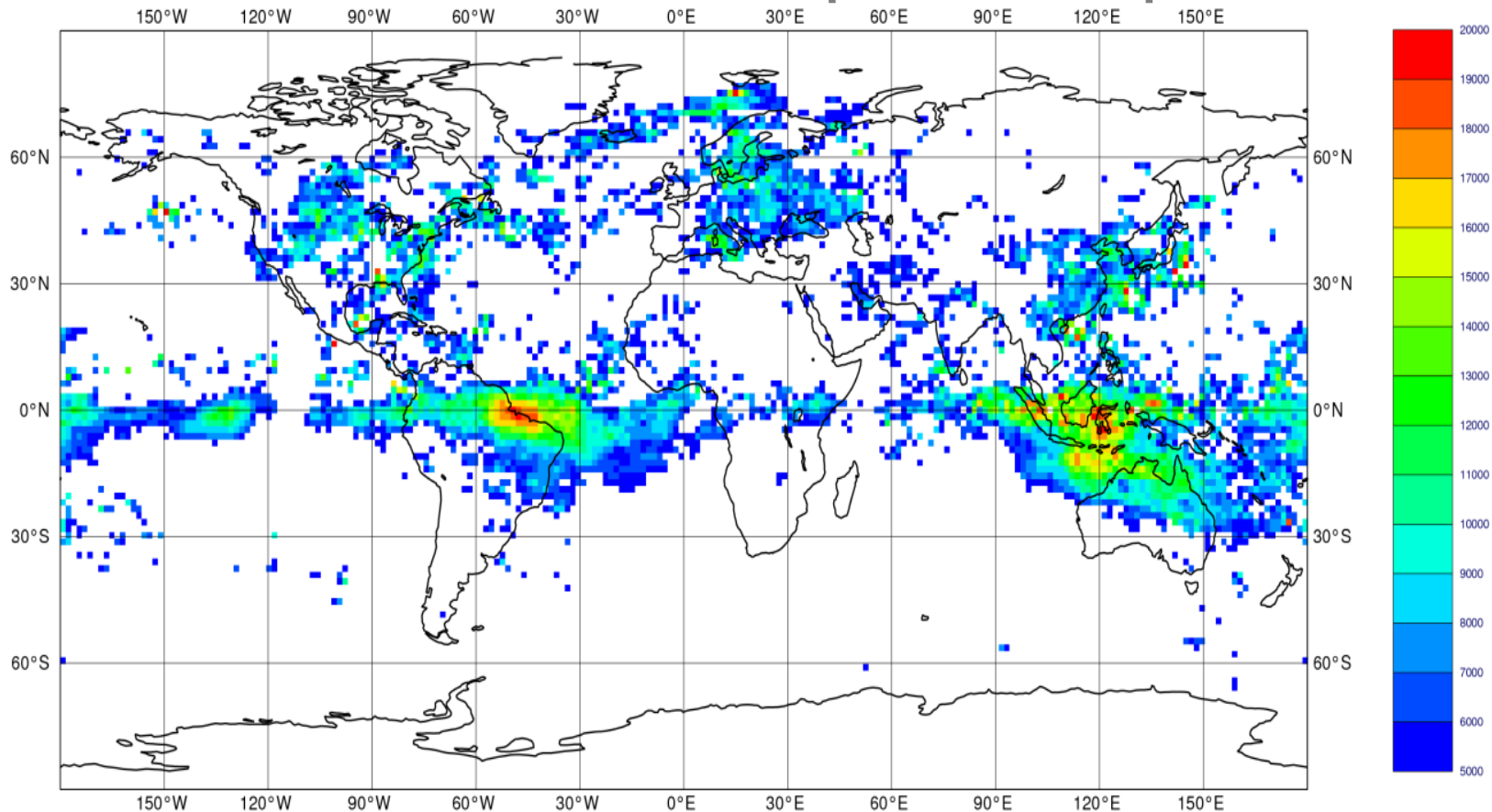
Conclusions

- Tropical analysis errors propagate into midlatitudes in the medium range
- Zonal wind information vital in the tropics
- Modal analysis helps to identify NWP analysis deficiencies