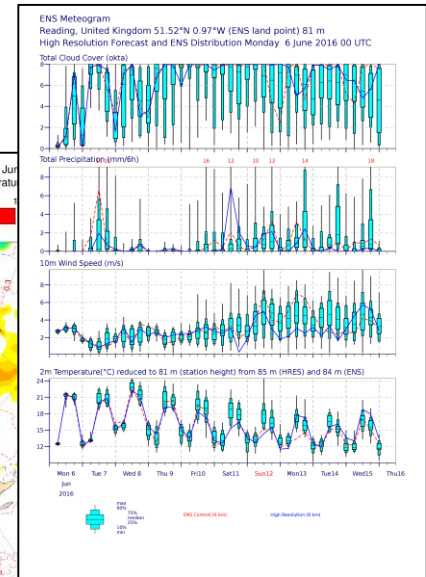
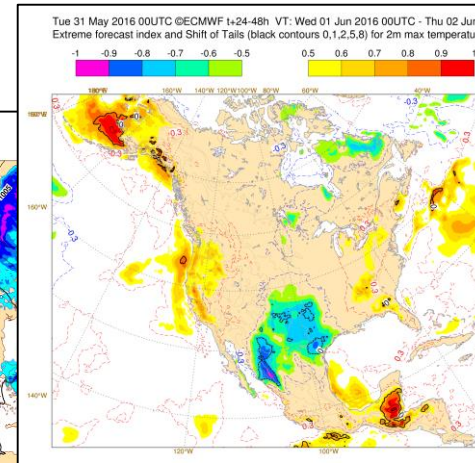
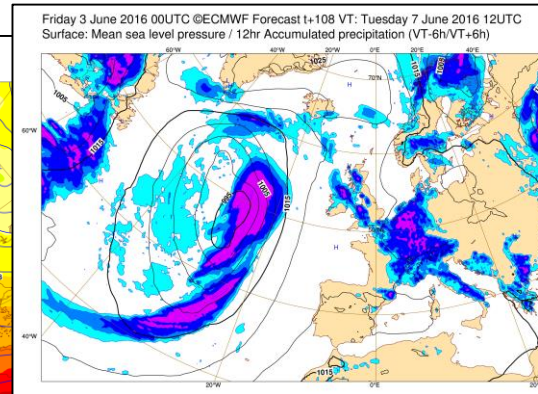
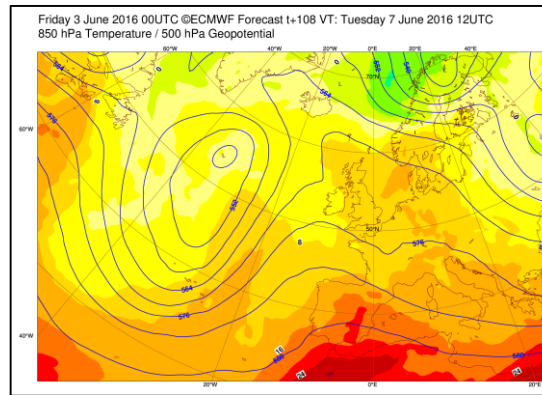


# Update on ECMWF forecast performance

Thomas Haiden, Martin Janousek



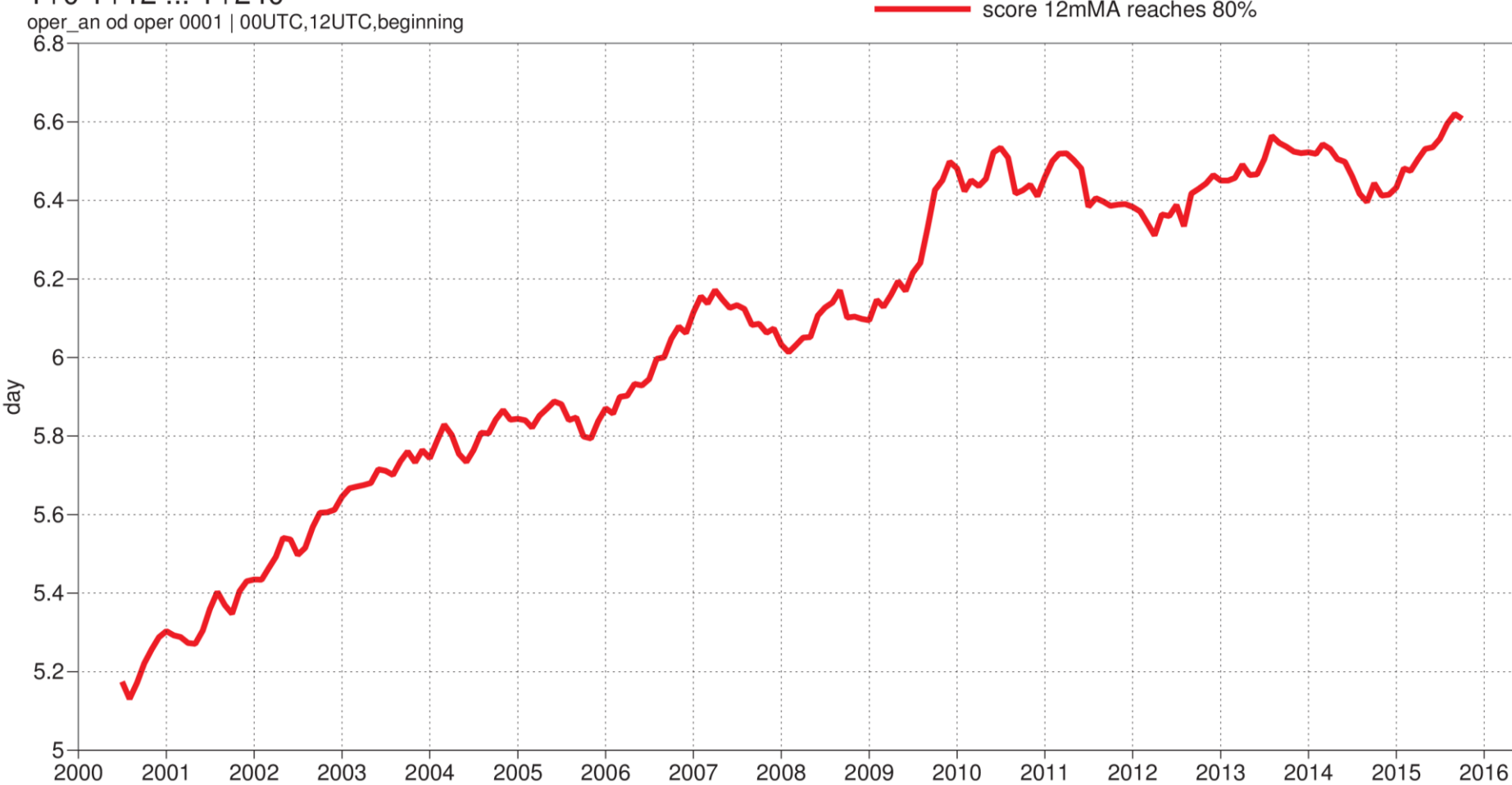
# Contents

- Upper-air performance
- Surface parameters
- Model upgrade 2016 (cycle 41r2)
- High-impact weather
- Scale-dependence of skill

# Upper-air forecast skill

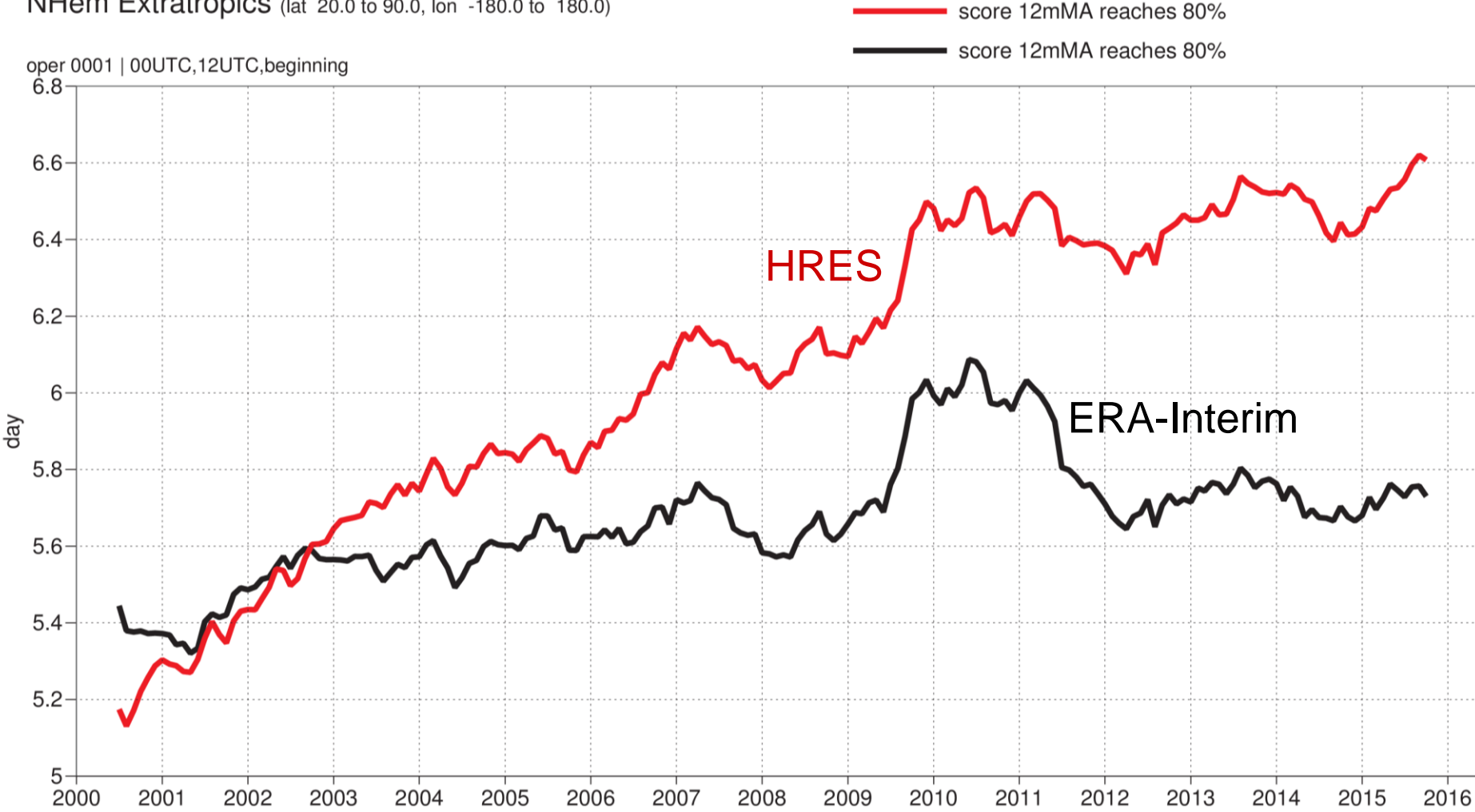
500hPa geopotential  
Lead time of Anomaly correlation reaching 80%  
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

T+0 T+12 ... T+240  
oper\_an od oper 0001 | 00UTC,12UTC,beginning



# Upper-air forecast skill

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



# Upper-air forecast skill

500hPa geopotential

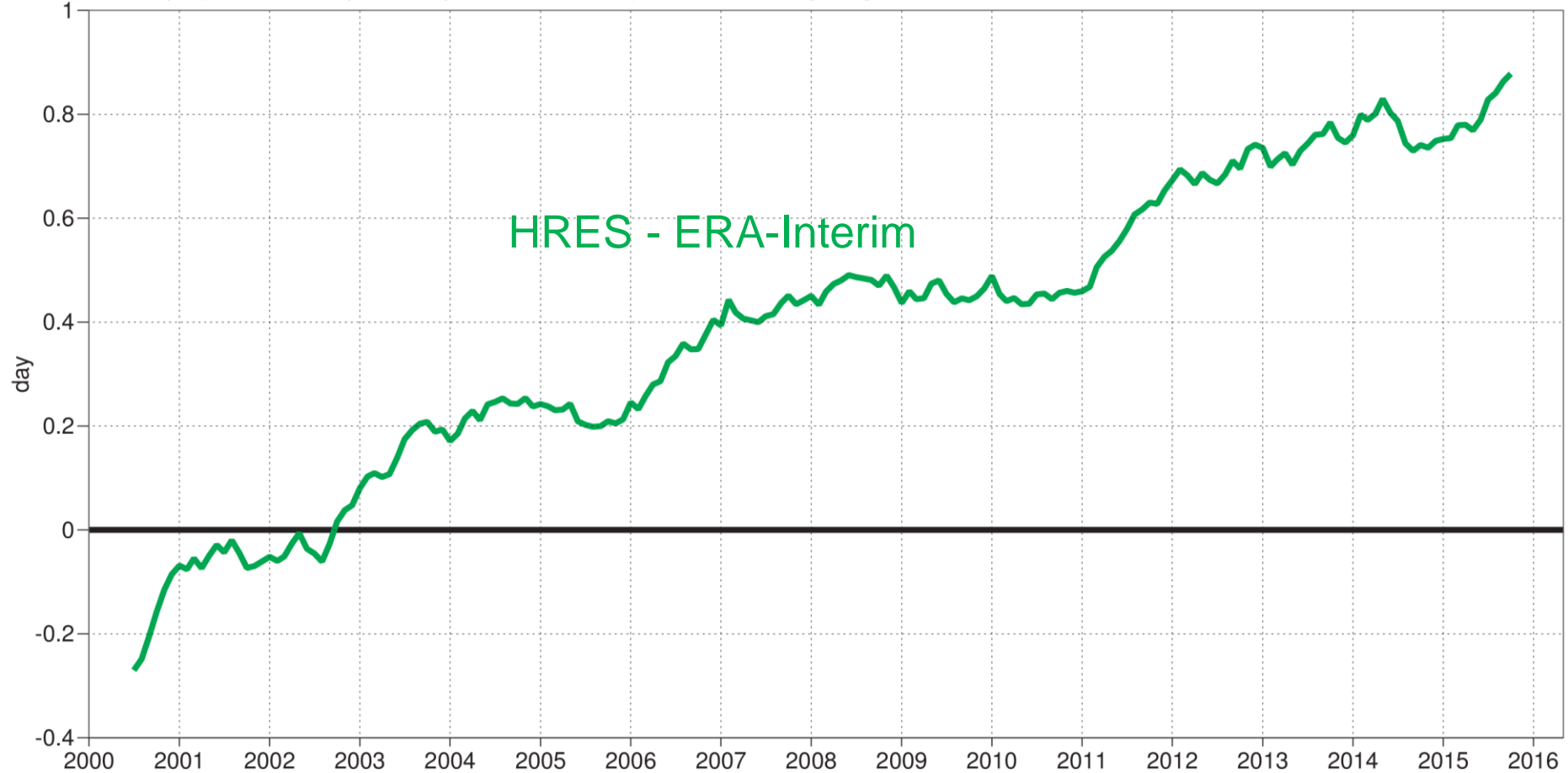
Lead time of Anomaly correlation reaching 80%

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

T<sub>+1</sub> T<sub>+0</sub> ... T<sub>+240</sub>

era\_an\*-1.0+oper\_an ei\*-1.0+od oper\*-1.0+oper 0001\*-1.0+0001 | 00UTC,12UTC,beginning

score 12mMA reaches 80%



# Model intercomparison

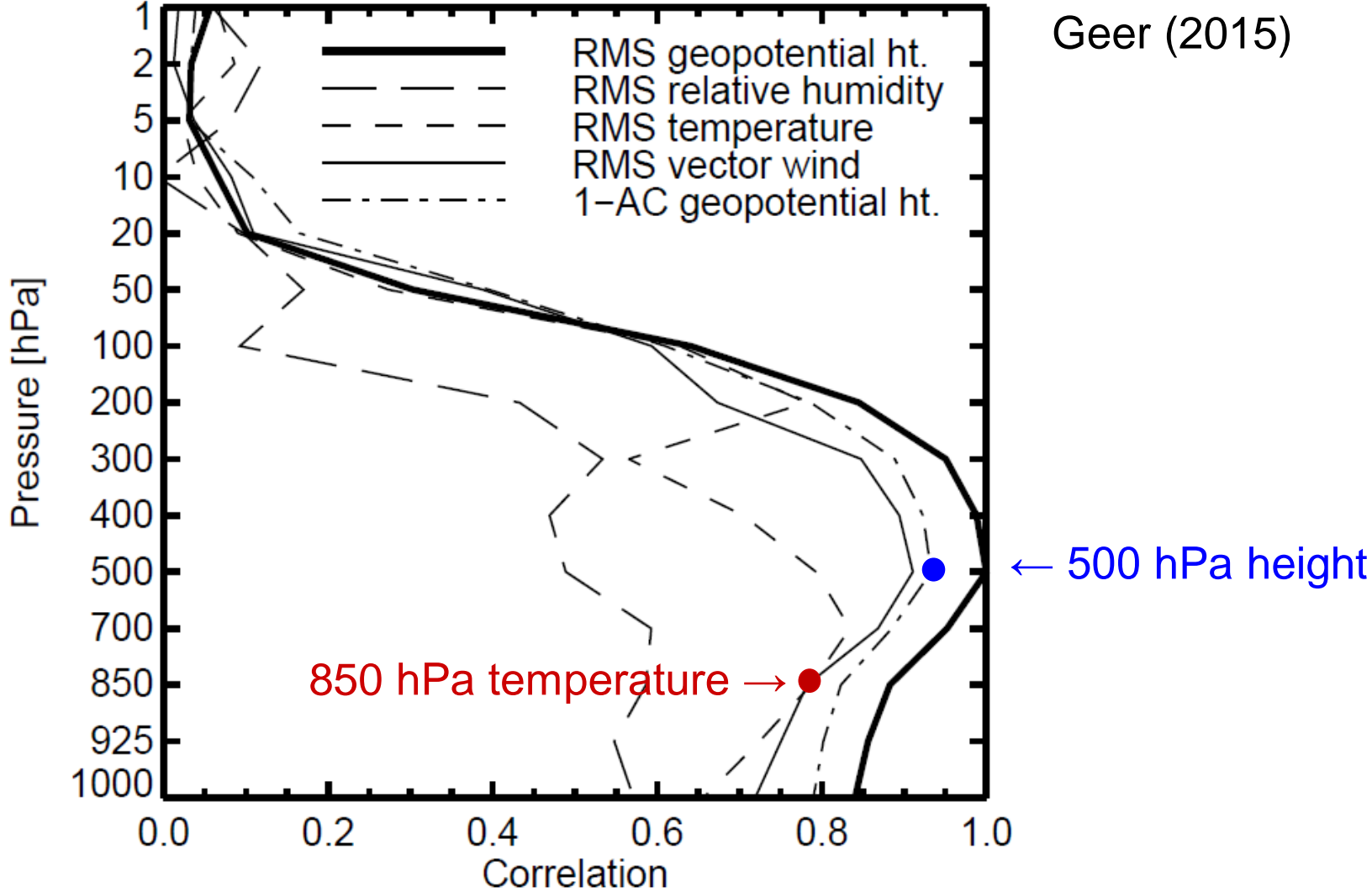
500hPa geopotential  
Anomaly correlation  
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

- JMA(WMO)
- UKMO(WMO)
- ECMWF(WMO)
- ERA-Interim
- NCEP
- CMC(WMO)

ACC reaching 80%



# Forecast skill: vertical correlation



# Upper-air ensemble forecast skill

850hPa temperature

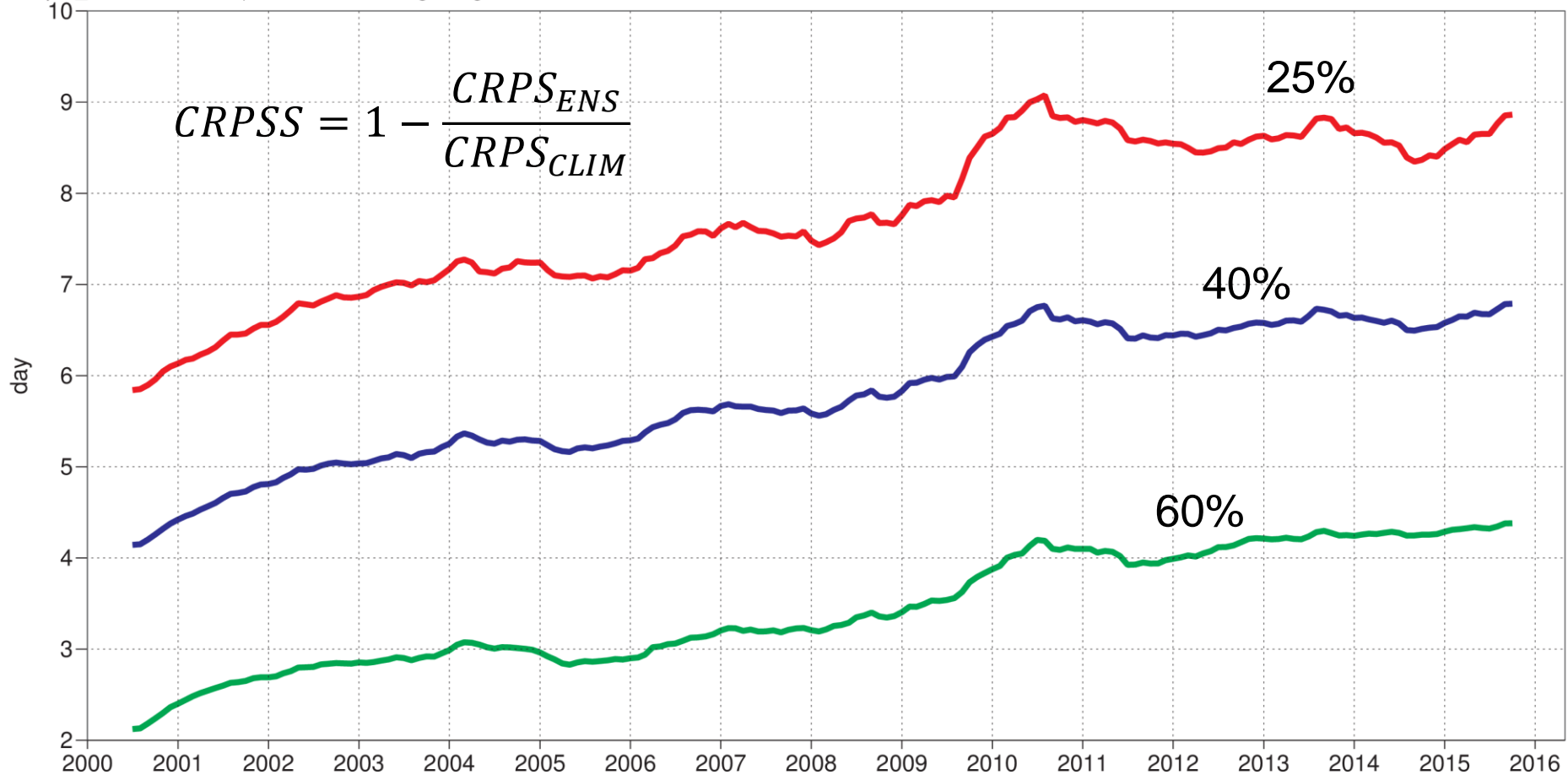
Continuous ranked probability skill score

NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

T+12 T+24 ... T+240

oper\_an od enfo 0001 | 00UTC,12UTC,beginning

- crps 12mMA reaches 60%
- crps 12mMA reaches 40%
- crps 12mMA reaches 25%

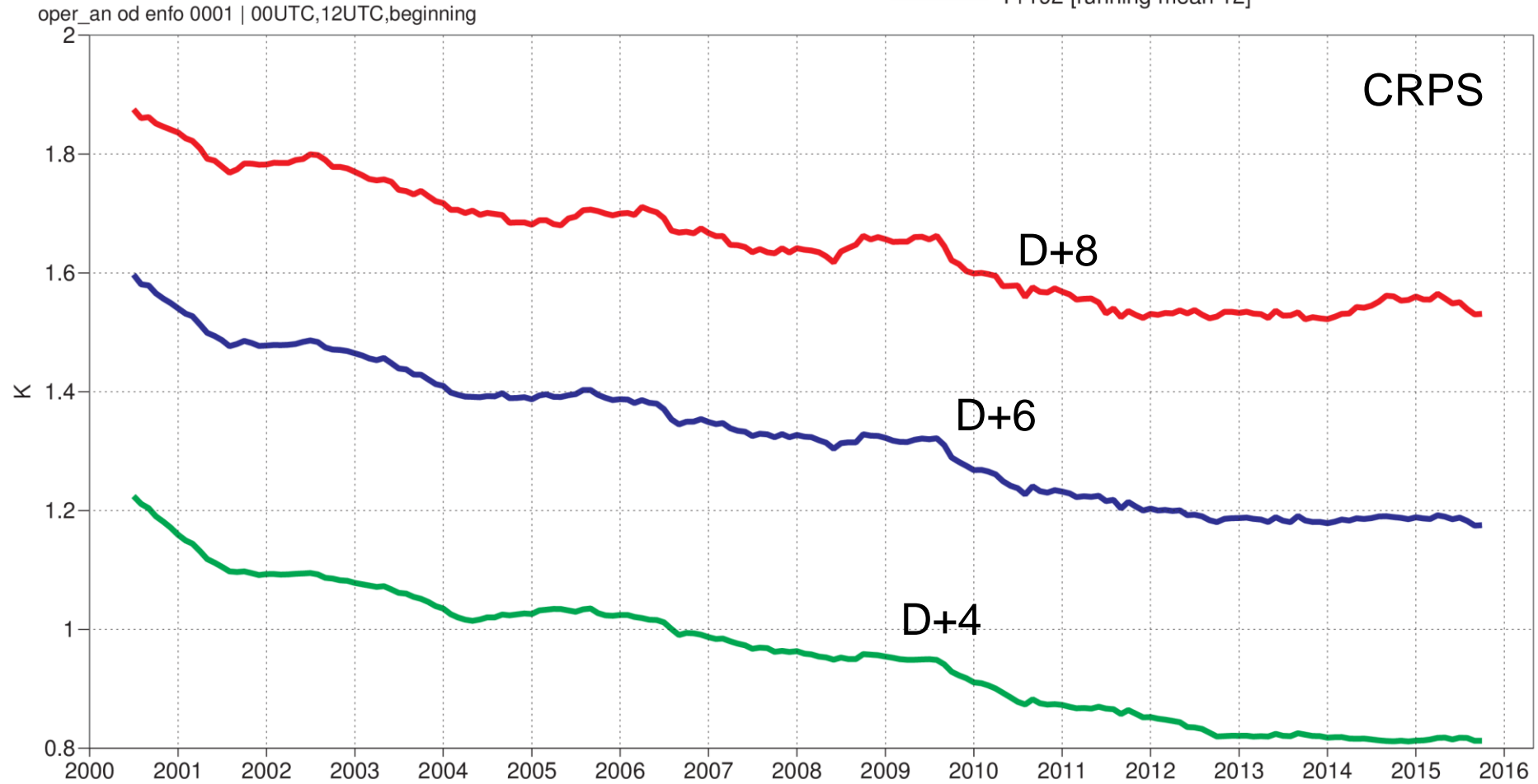




# Upper-air ensemble forecast skill

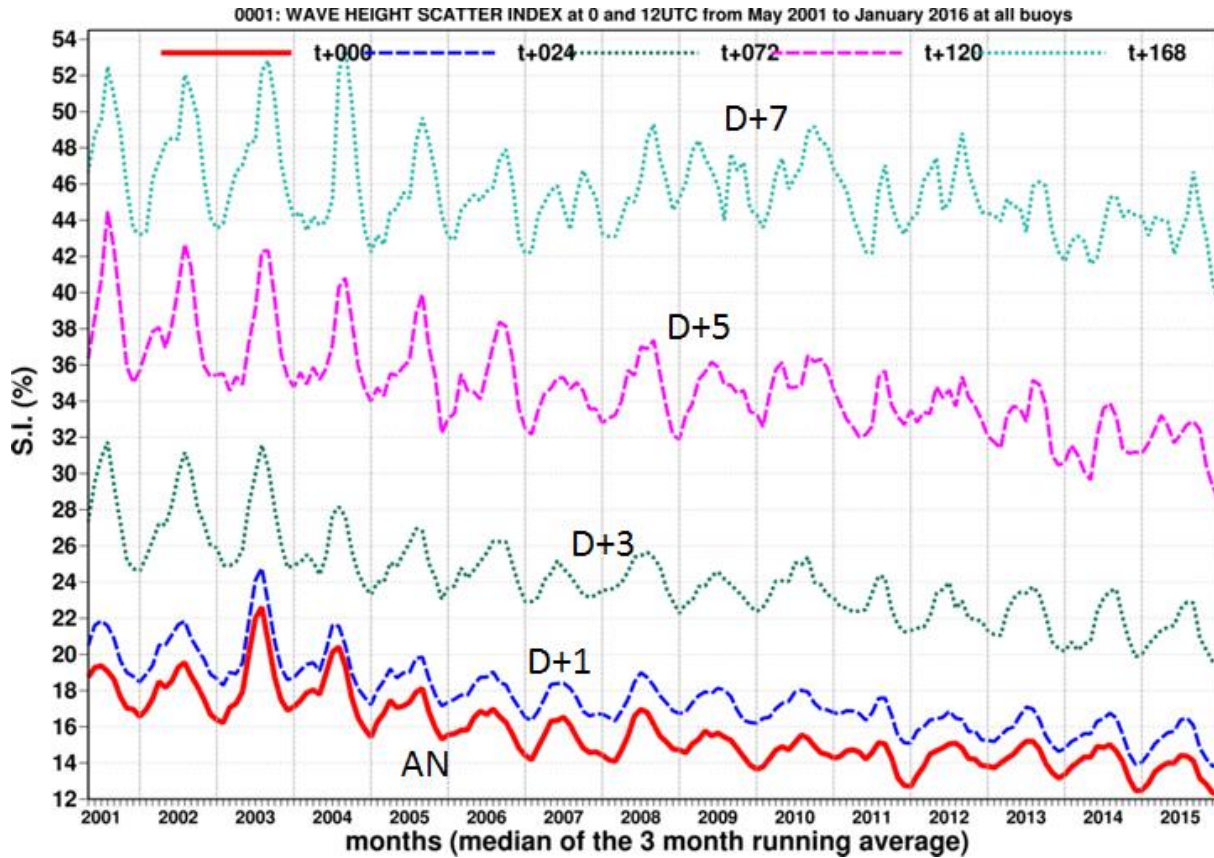
850hPa temperature  
Continuous ranked probability score  
NHem Extratropics (lat 20.0 to 90.0, lon -180.0 to 180.0)

— T+96 [running mean 12]  
— T+144 [running mean 12]  
— T+192 [running mean 12]

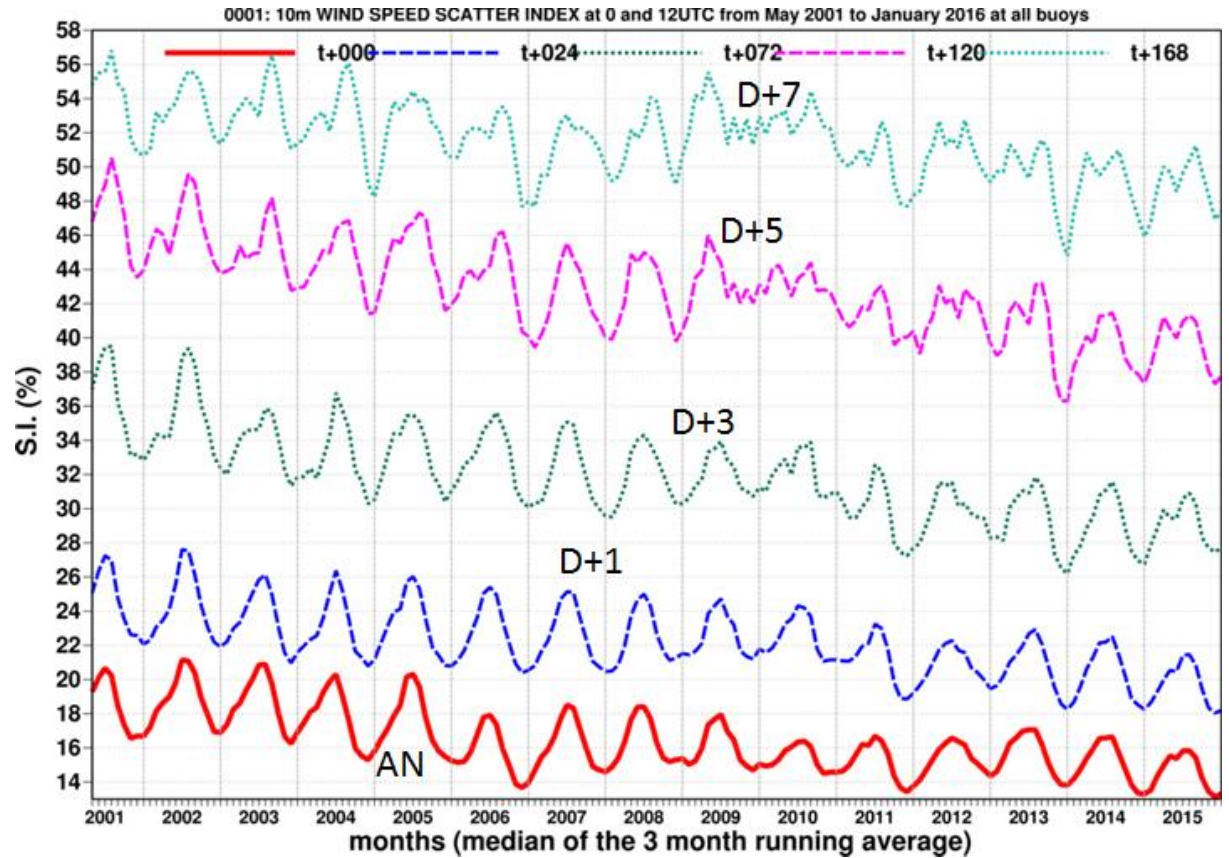


# Wave forecast: verification against buoys

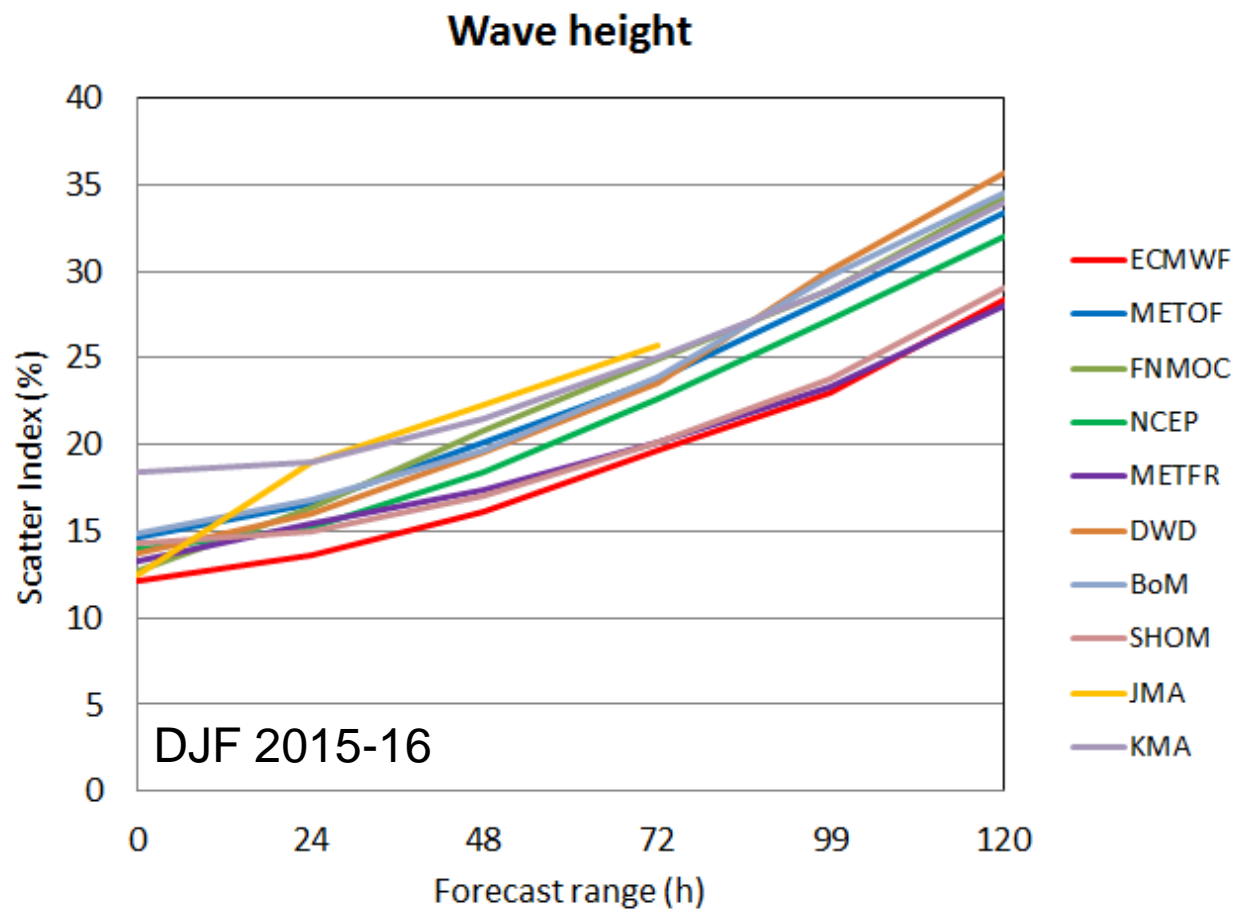
## Wave height



## Wind speed



# Wave height – model intercomparison

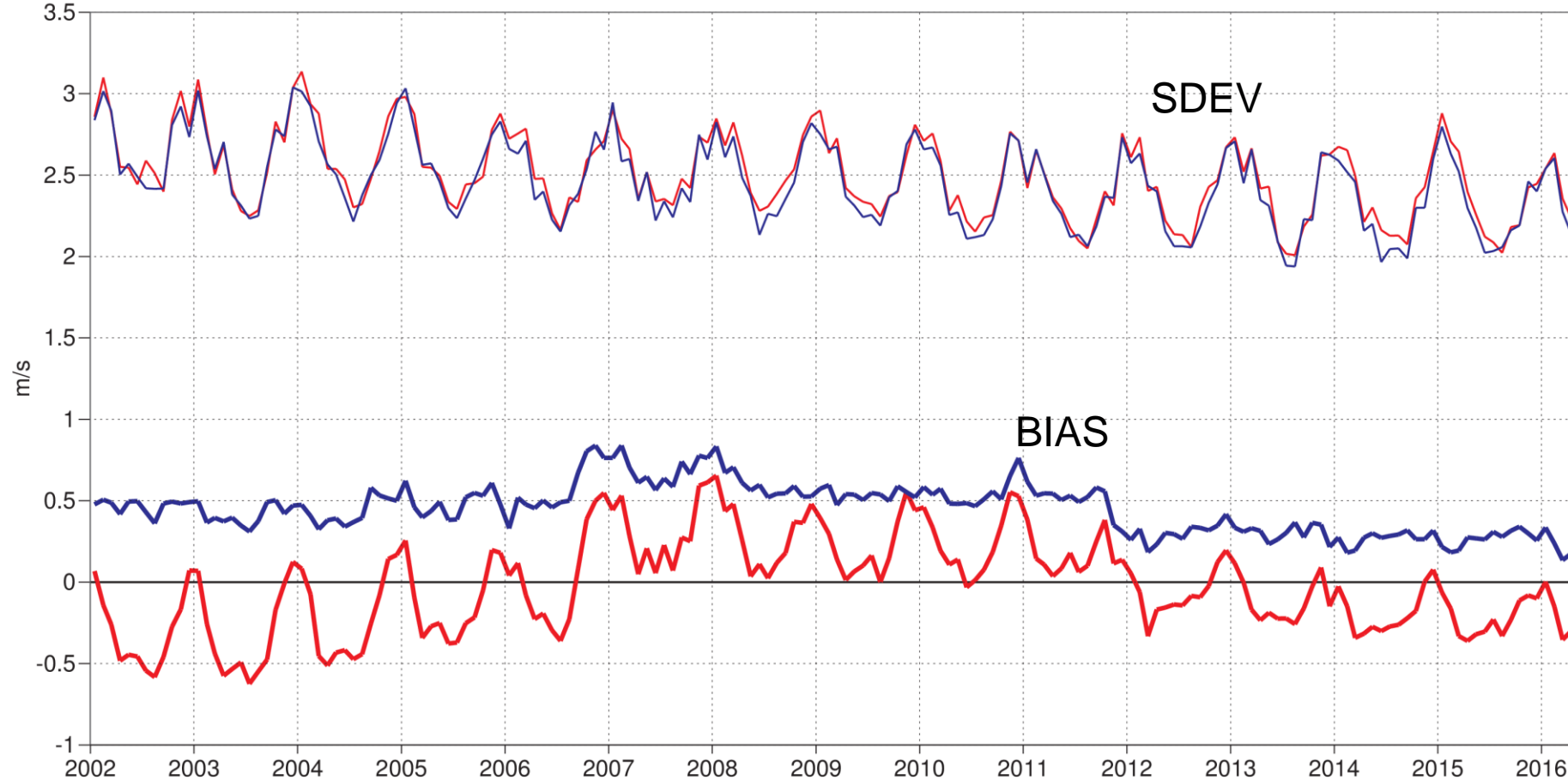


# 10 m wind speed

10m wind speed

Europe N Africa (lat 25.0 to 70.0, lon -10.0 to 28.0)

12 UTC forecasts



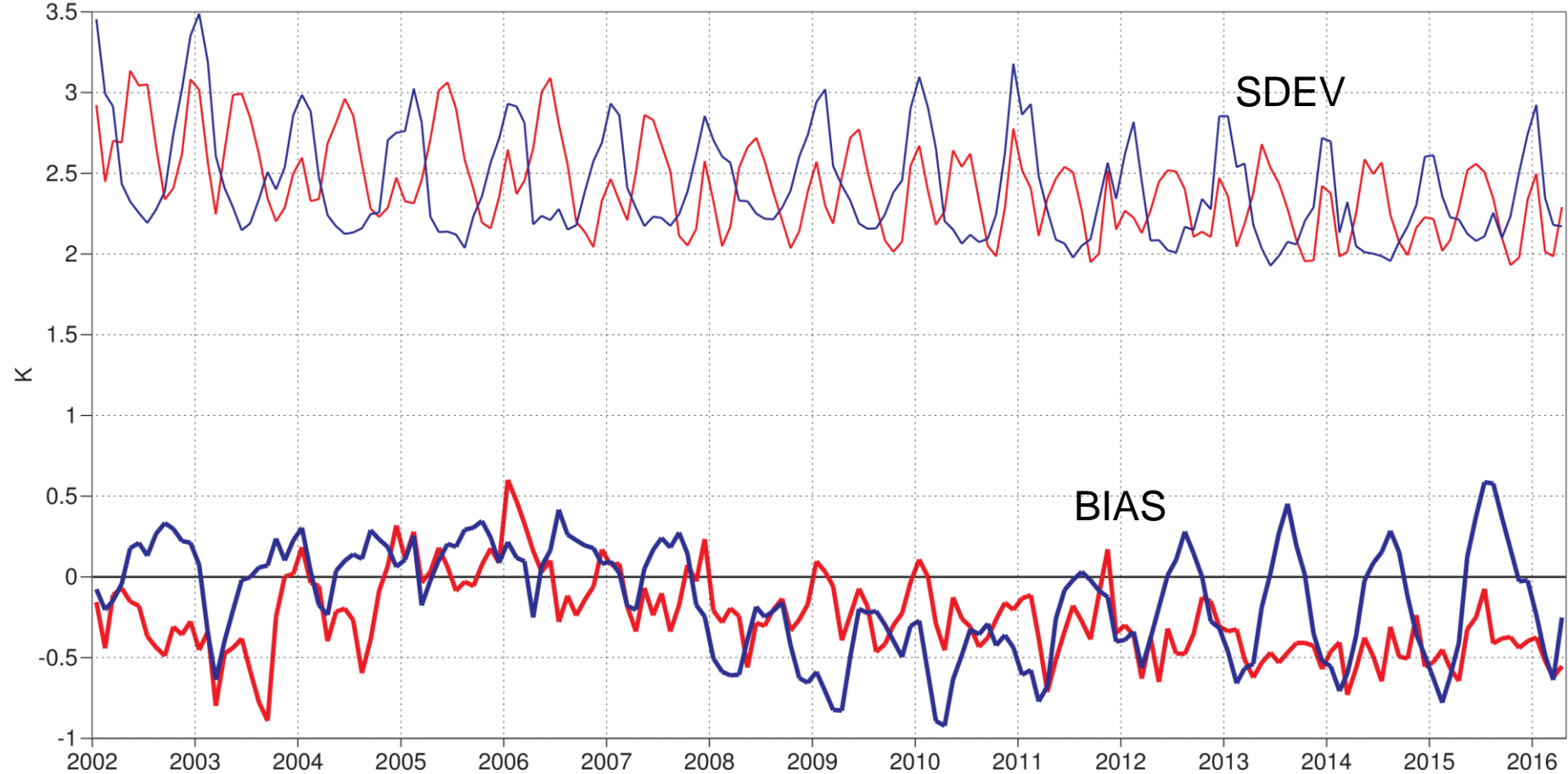
D+3

# 2 m temperature

2m temperature

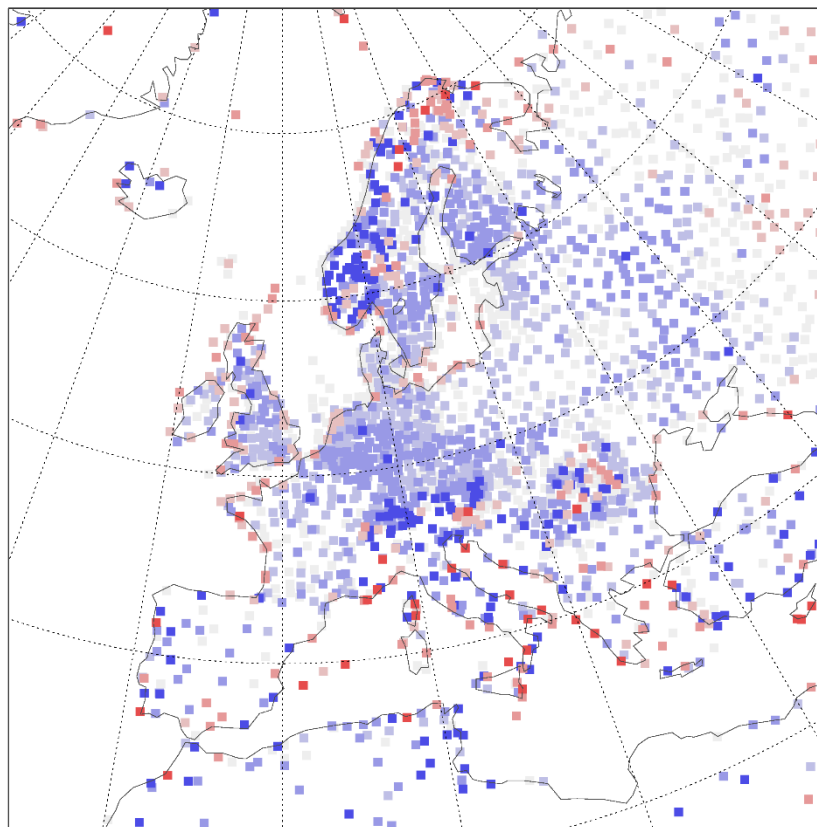
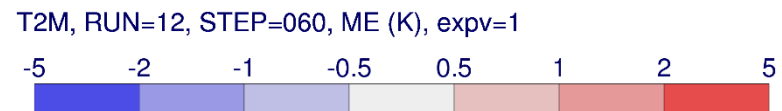
Europe N Africa (lat 25.0 to 70.0, lon -10.0 to 28.0)

12 UTC forecasts

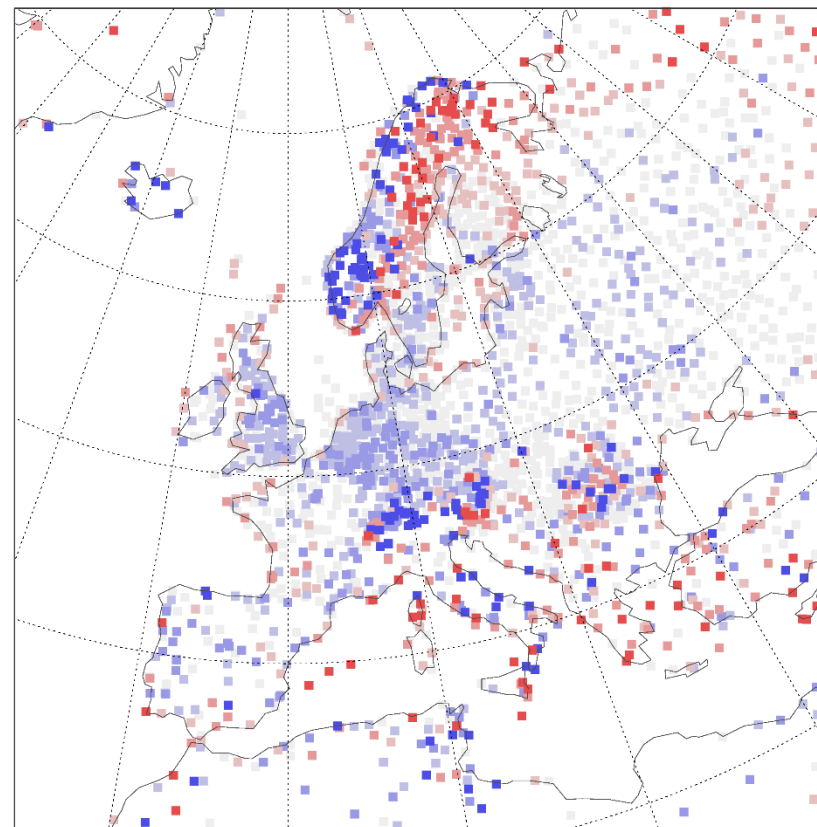
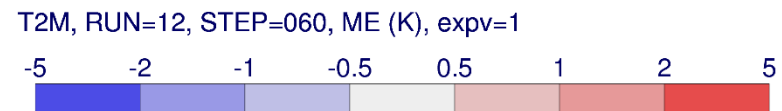


D+3

# 2 m temperature bias at 00 UTC (DJF)



Winter 2014-15



Winter 2015-16

# Precipitation



Simbach, Germany, 2 June 2016

# Performance during individual events

https://software.ecmwf.int/wiki/display/FCST/Severe+Event+Catalogue

ECMWF Spaces Calendars Create

Forecast charts  
Forecast evaluation

PAGE TREE

- Chart dashboard
- Calibration
- Dealing with Enquiries - add "mofu" as
- How-To Articles
- Severe Event Catalogue**
  - 2010-2011 - Drought - Horn of Afr
  - 201112 - Windstorm - Europe (colle
  - 201306 - Floods - Central Europe
  - 201306 - Floods - India
  - 201308 - Floods - Russia
  - 201309 - Rainfall - Boulder CO, US
  - 201210 - Tropical cyclone - Hurric
  - 201310 - Tropical cyclone - Hurric
  - 201310 - Tropical cyclone - Typhoc
  - 201310 - Windstorm - St Jude / Sim
  - 201311 - Tropical cyclone - Super-
  - 201311 - Rainfall - Sardinia, Italy
  - 201311 - Windstorm - Hilde (Norwa
  - 201312 - Windstorm - Xaver/Bodl
  - 201312 - Air quality - Shanghai
  - 201312 - Windstorm - Ivar (Norwa
  - 201312 - Windstorm + flood - Chris
  - 201312 - Icestorm - Canada, US
  - 201312 - Snowstorm - Israel
  - 201401 - Snowstorm - North-easte
  - 201401 - Cold spell - U.S.
  - 201401 - Rainfall (+ snowfall) - Ital
  - 201402 - Windstorm - British Isles
  - 201402 - Floods - England
  - 201402 - Windstorm - British Isles
  - 201402 - Snowstorm - US east-co
  - 201402 - Convection - SW France
  - 201403 - Windstorm - Norway, Sw
  - x - Initial discussions about the cor
  - x - List of other events
  - 201404 - Convection - Arkansas U

Pages / Forecast User Home

## Severe Event Catalogue

Created by Florian Pappenberger, last modified by Linus Magnusson on Jun 02, 2016

On this space we collect material for evaluation of severe/extreme weather events. The focus is on the meteorological conditions and the forecast performance. The amount of material differs from case to case, and we are not claiming to give the full picture of the cases here. Users are welcome to contribute with material for the cases by using the comment function in the bottom of each page. To suggest a new case to evaluate, please contact us at the email address given below. If you have any initial comments and material, please include them in the mail.

Contact email address:

(Please note that some of the links on the pages are only accessible from ECMWF.)

**Featured**

### 201605 - Convection - Europe

During the last days of May, western and central parts of Europe from France to Poland and Hungary was hit by events of severe convection and heavy rainfall. A man was killed in southern Poland hit by lightning. In Paris, a birthday party in Parc Monceau was struck, injuring 11 people, eight of them children on Saturday afternoon, 28 May. Several are in a life-threatening condition. Three people were seriously hurt at a youth football match in Germany. Heavy rain caused some localized flooding as well. On 29 May to 30 May torrential rain hit south-western Germany and killed four people. Flash floods affected many businesses and homes. The worst affected region is the town of Braunsbach where floodwaters swept away two bridges as well. Dozens of homes there are at risk of collapse and must be evacuated. This investigation will focus on the event in Germany.

[Read more ...](#)

### 201601 - Windstorm - Thor

On 29 January a severe windstorm swept from northern British Isles to Norway. It was named as Gertrude and in Norway as Tor. The storm managed to break the all-time wind speed measurement record setting a new value of 48.9 m/s at Krakenes lighthouse north of Bergen on the coast.

[Read more ...](#)

### 201601 - Snowstorm - US east coast

On 22-24 January a severe blizzard hit the U.S east-coast and broke records in accumulated snowfall in several places. The amount was only mm from the record in Central Park (NYC) and broke the record on JFK. For Washington DC (Dulles) it ranks as the 2nd worst snowstorm. After the cyclone New Jersey was hit by coastal flooding.

[Read more ...](#)

Navigation

List of (recent) cases

- 201605 - Tropical cyclone - ROANU
- 201605 - Heatwave - India
- 201605 - Convection - Europe

Search

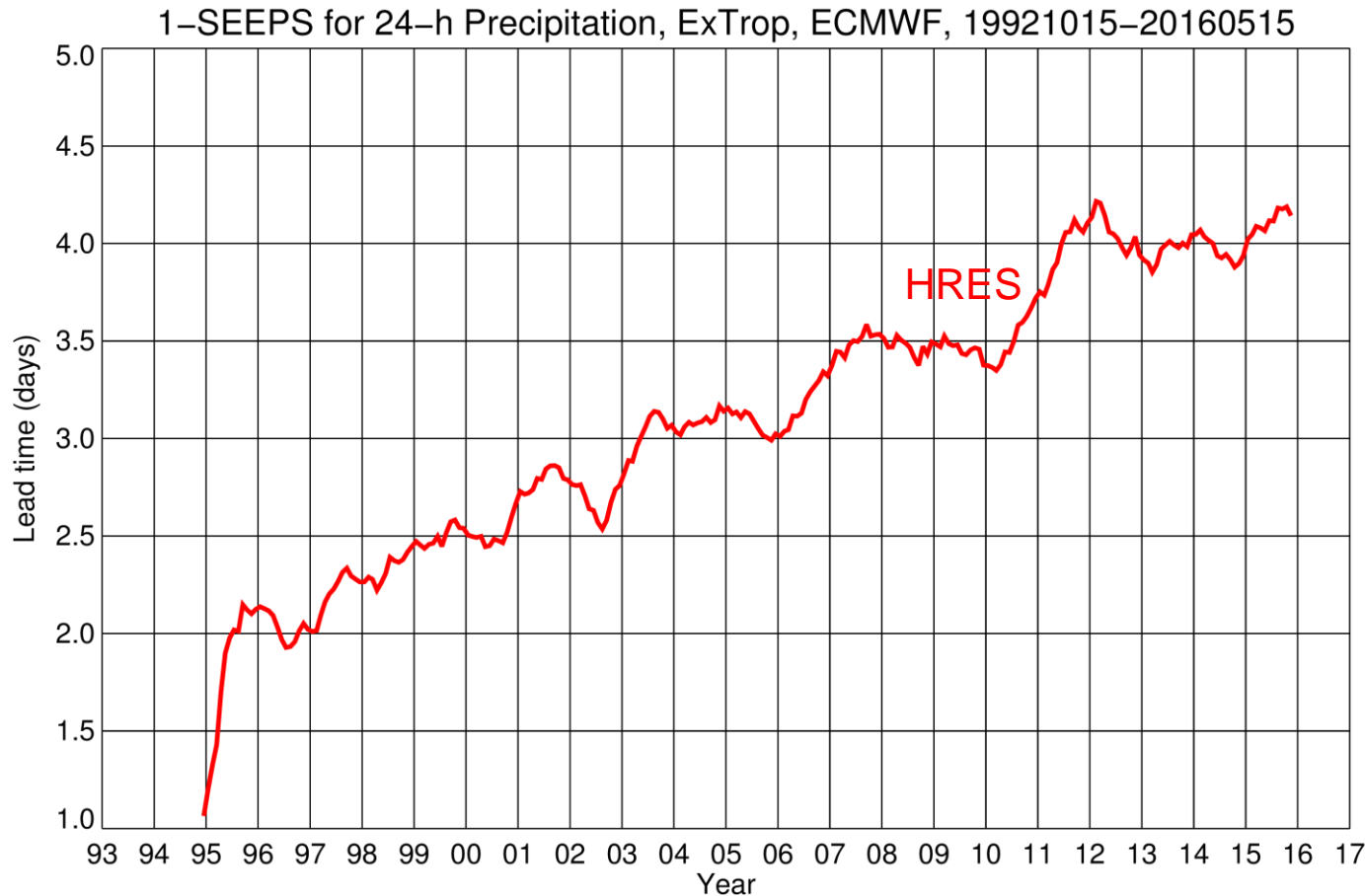


# Headline score for HRES precipitation: SEEPS

Skill in discriminating between

- Dry
- Light
- Moderate-to-heavy

Adapted to local climatology

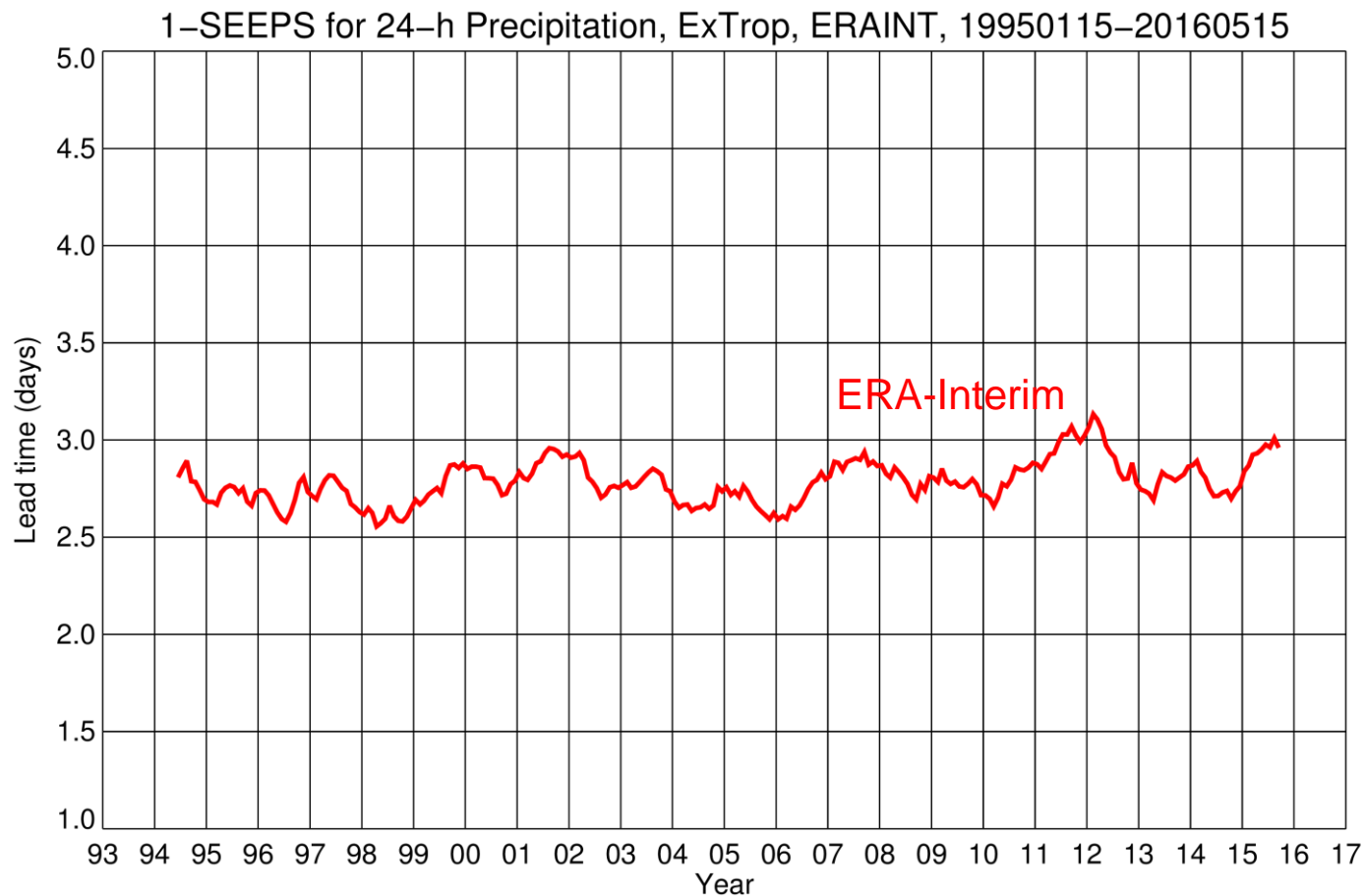


# HRES precipitation

Skill in discriminating between

- Dry
- Light
- Moderate-to-heavy

Adapted to local climatology

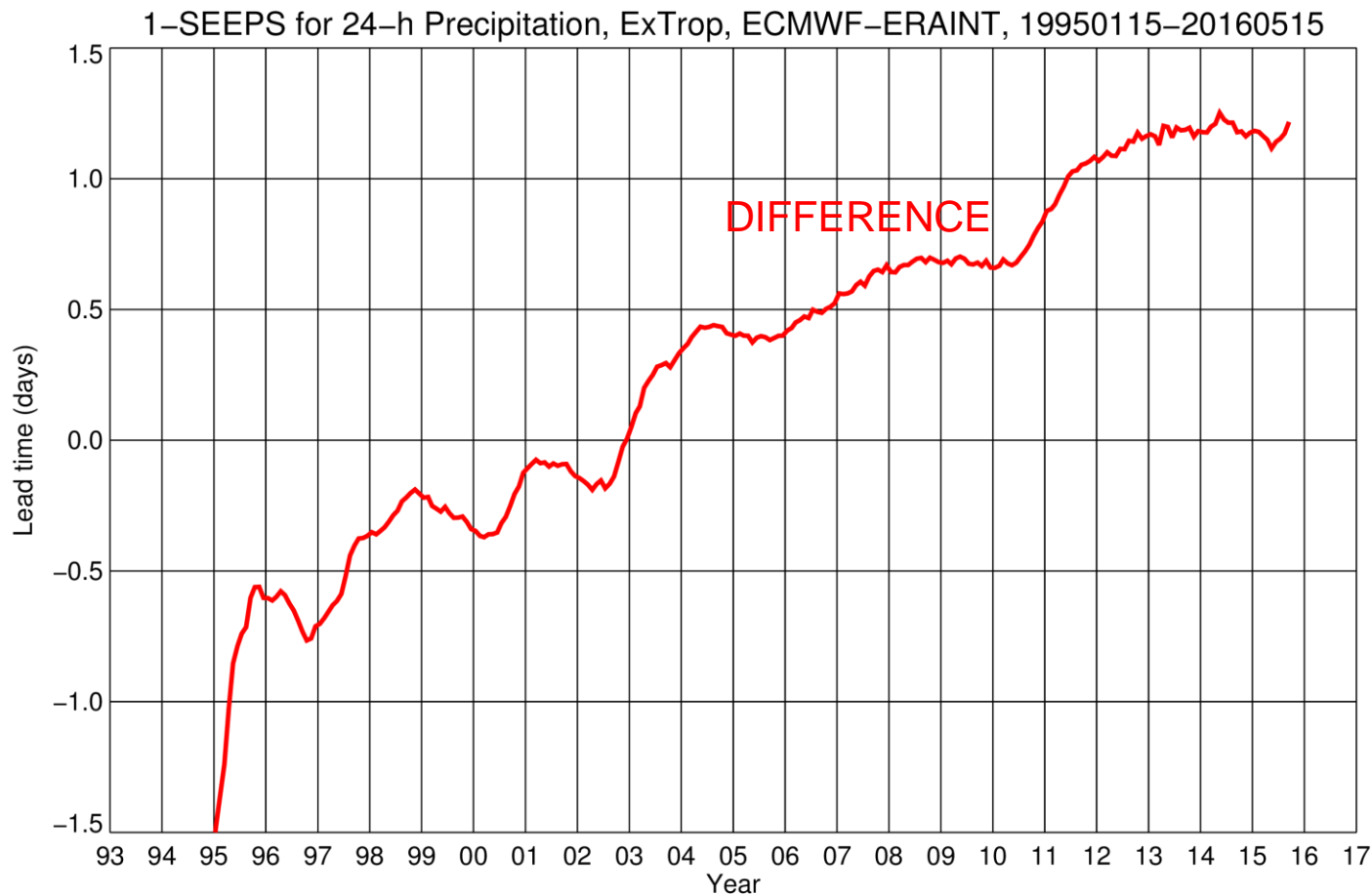


# HRES precipitation

Skill in discriminating between

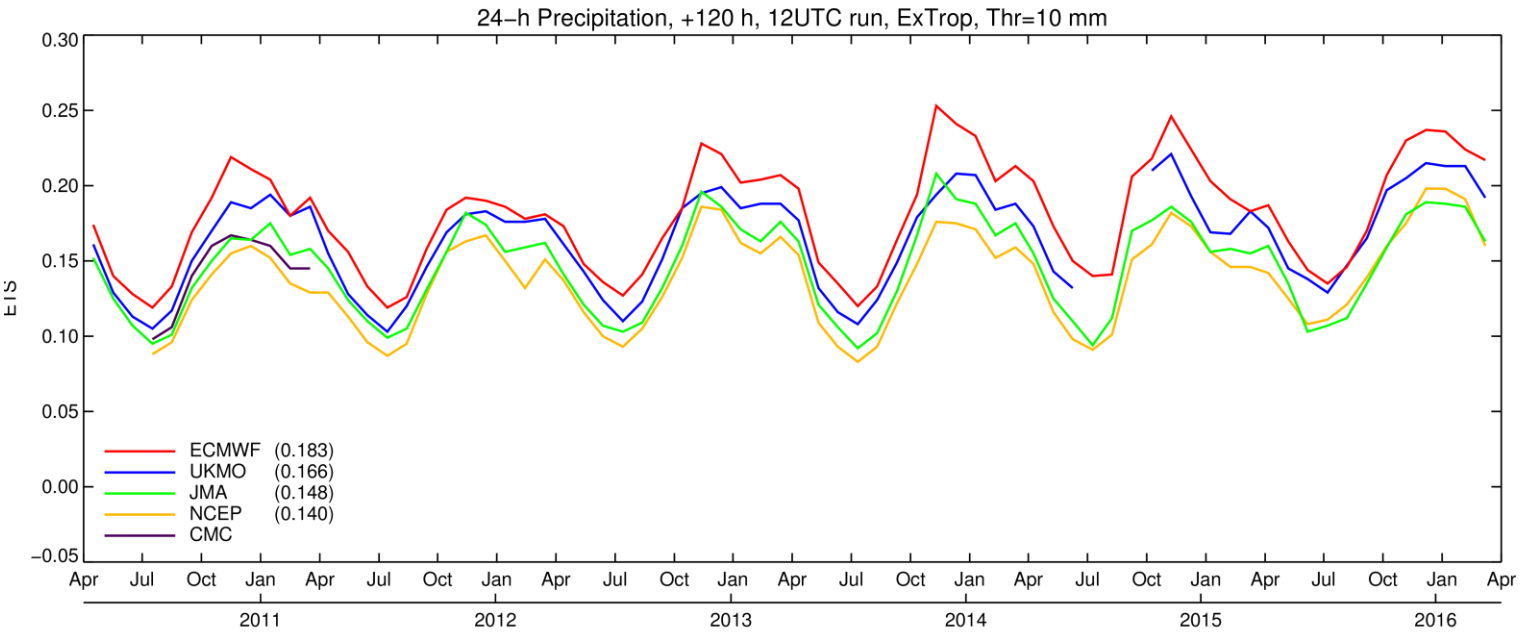
- Dry
- Light
- Moderate-to-heavy

Adapted to local climatology

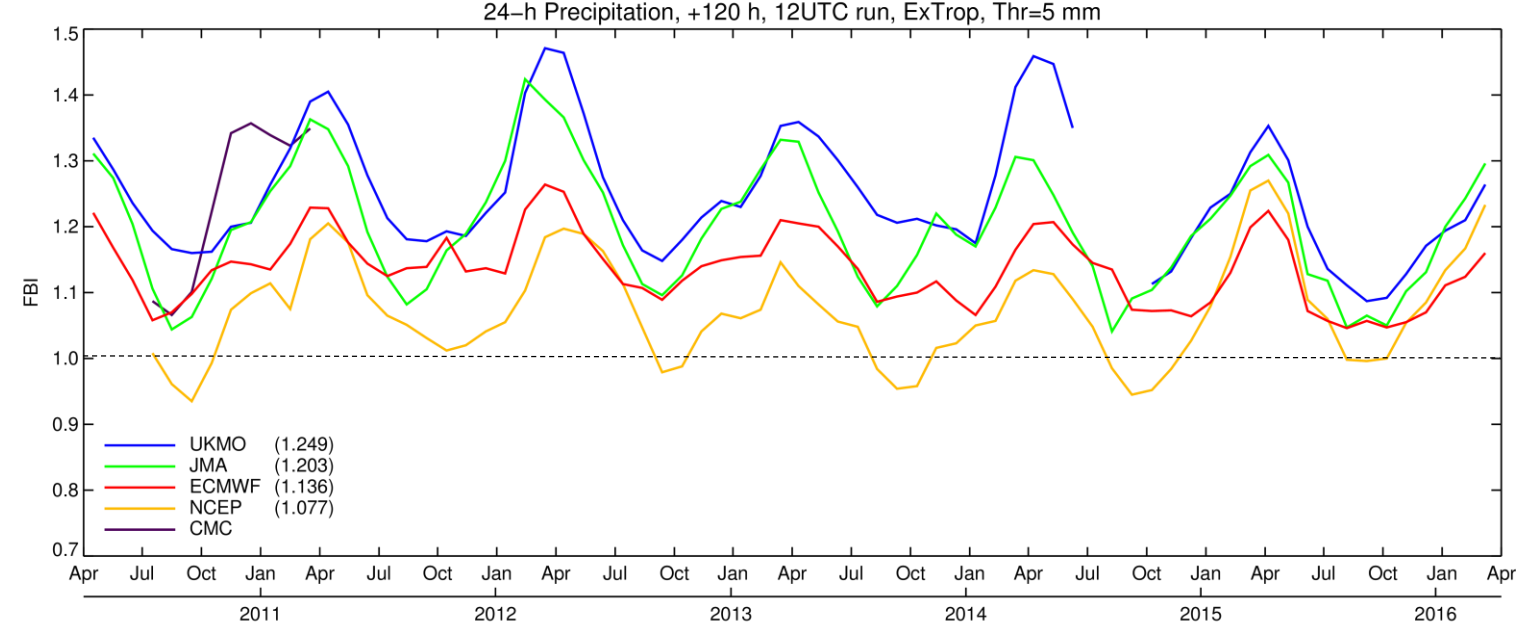


# HRES precipitation – other centres

D+5  
Extra-tropics  
Thr=10mm/24h



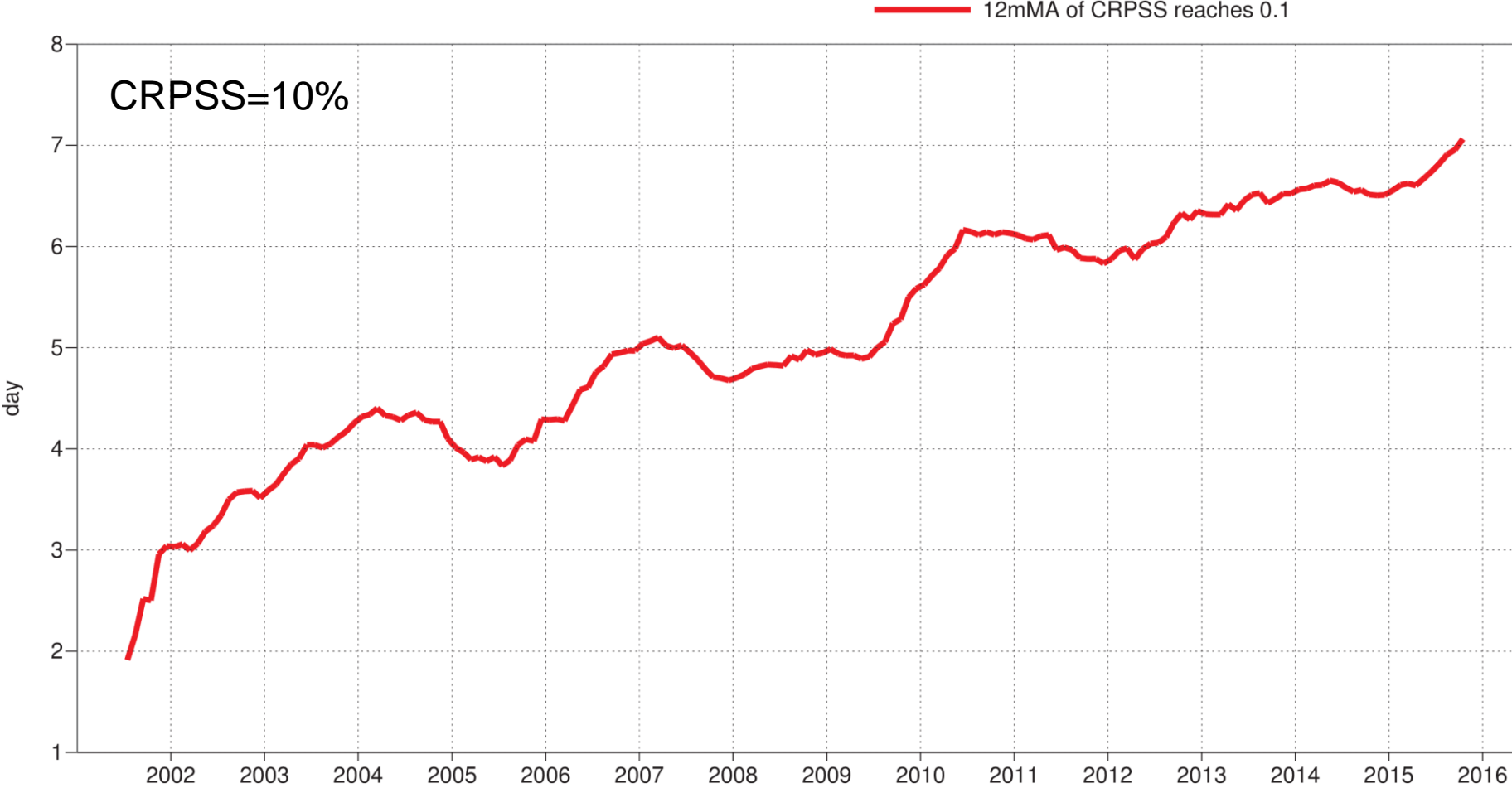
Skill (ETS)



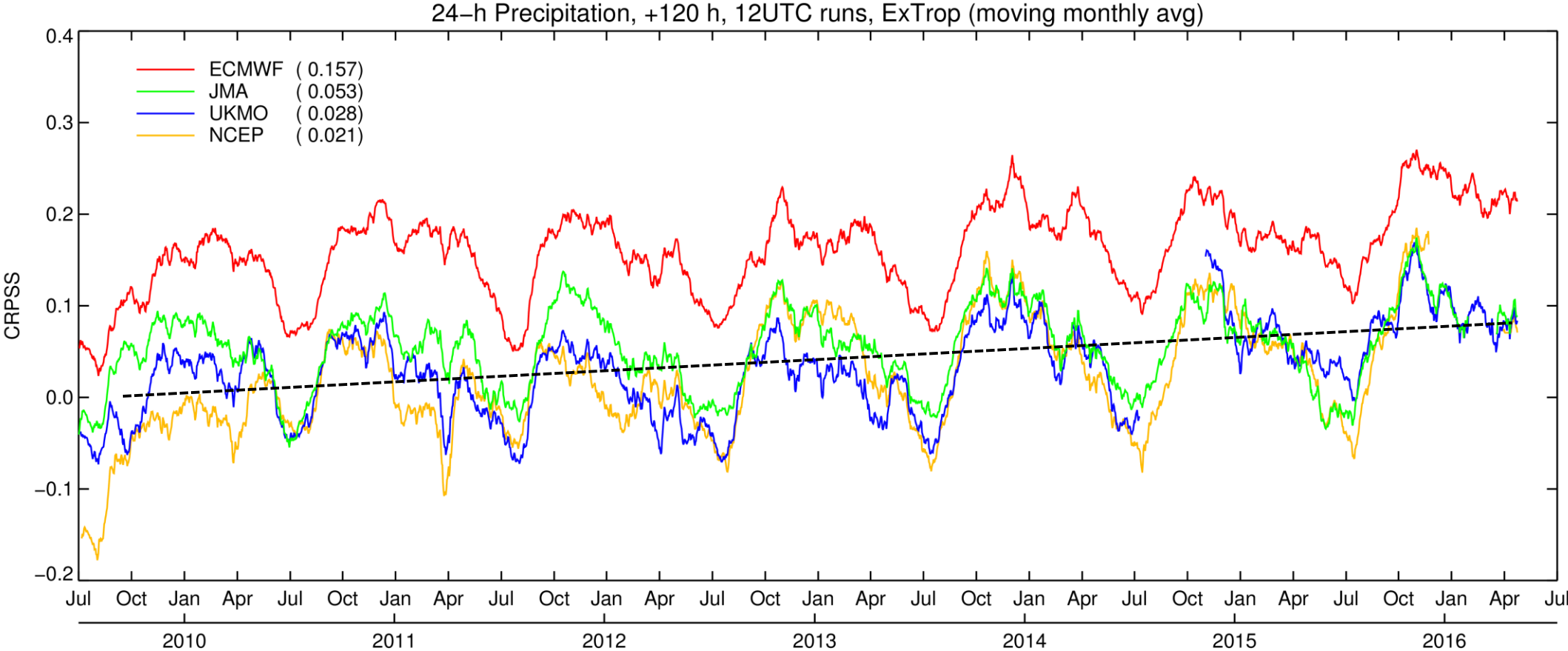
Frequency bias

# ENS precipitation

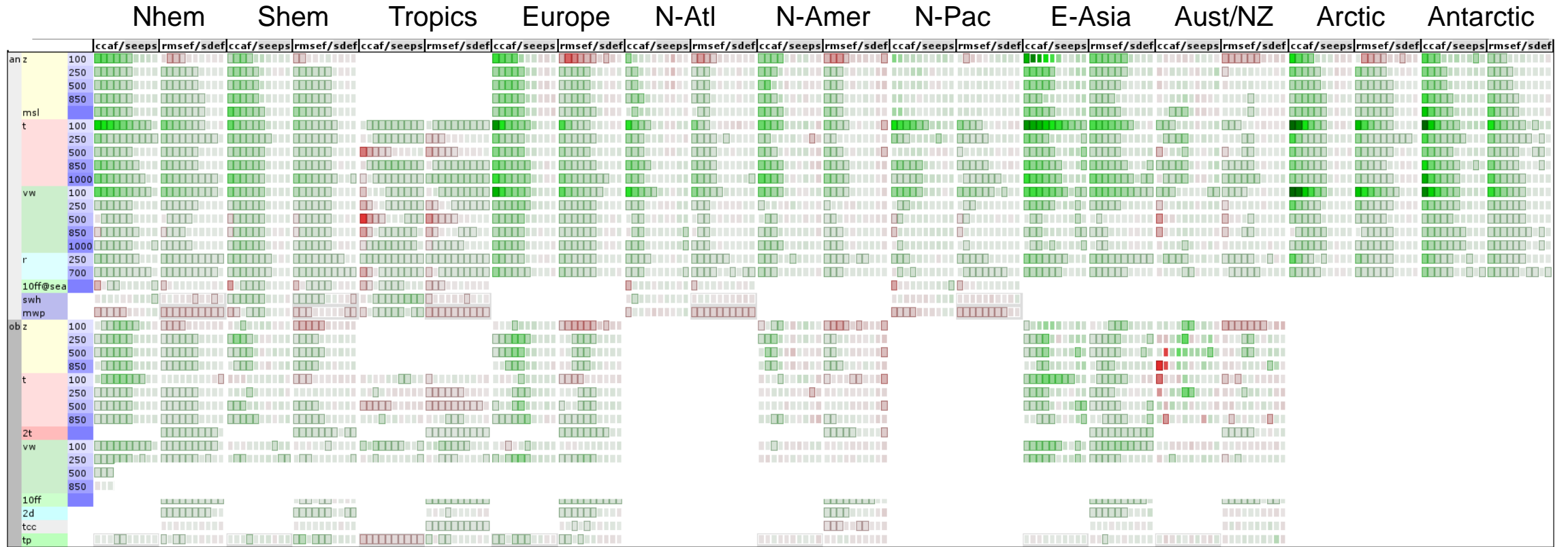
total precipitation  
Continuous ranked probability skill score  
Extratropics (lat -90 to -30.0 and 30.0 to 90, lon -180.0 to 180.0)



# ENS precipitation – other centres

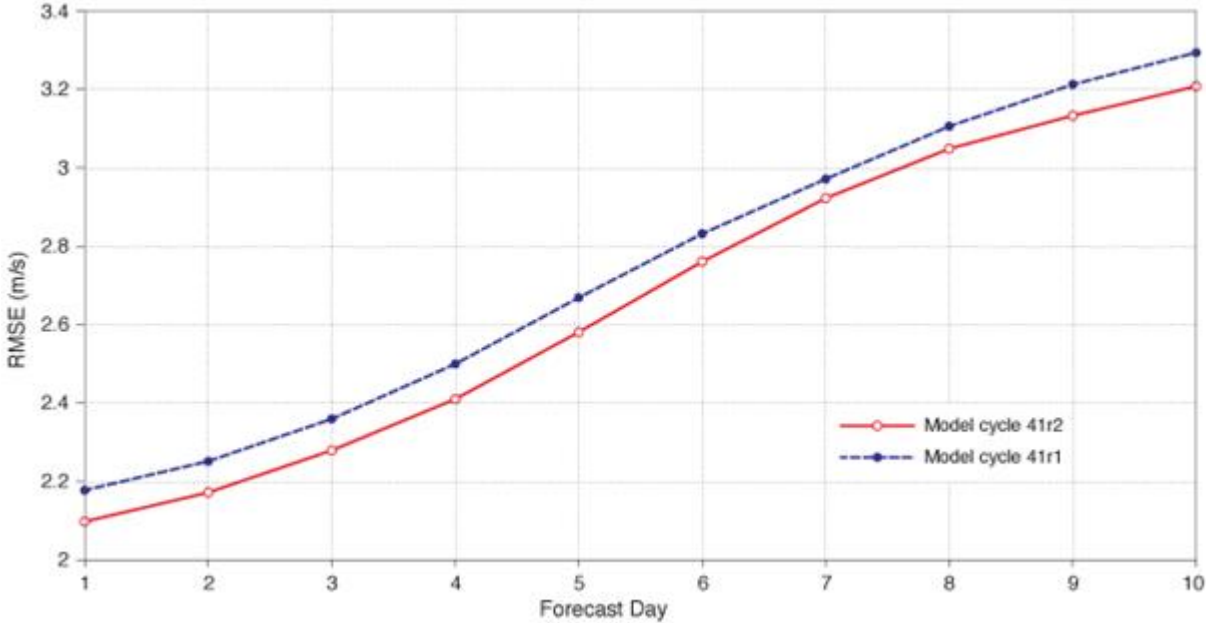


# Model upgrade in March 2016 (Cycle 41r2)

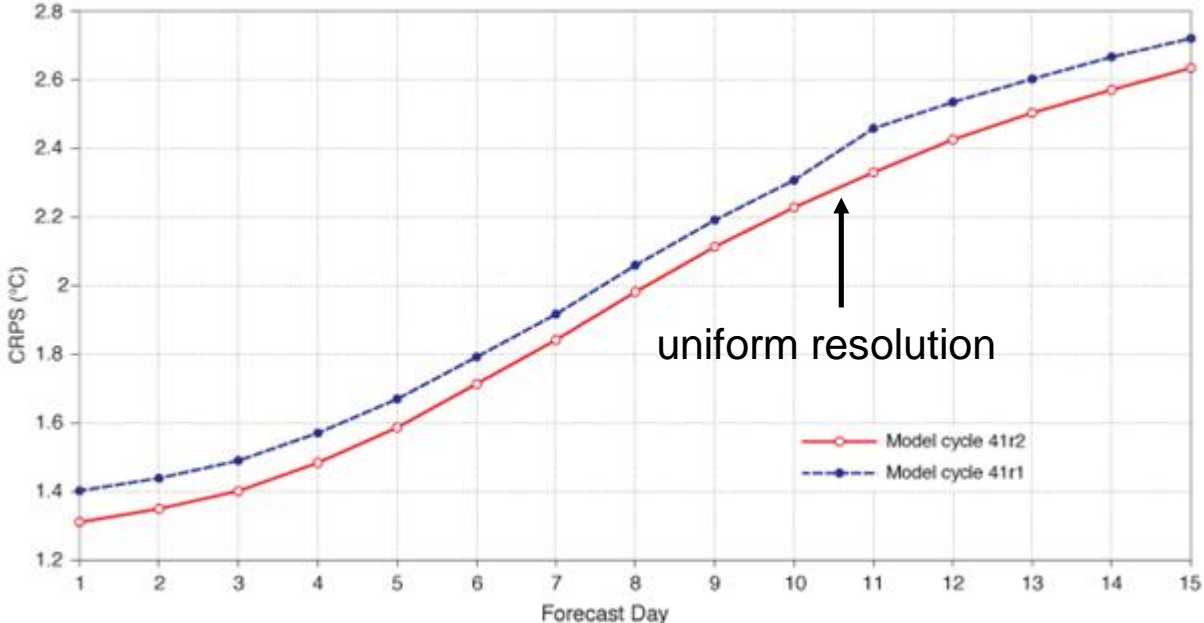


Upper-air: improvements 2-3%  
 Surface: up to 5% in the medium range

# Improvements in surface parameters



HRES 10 m wind speed



ENS 2 m temperature

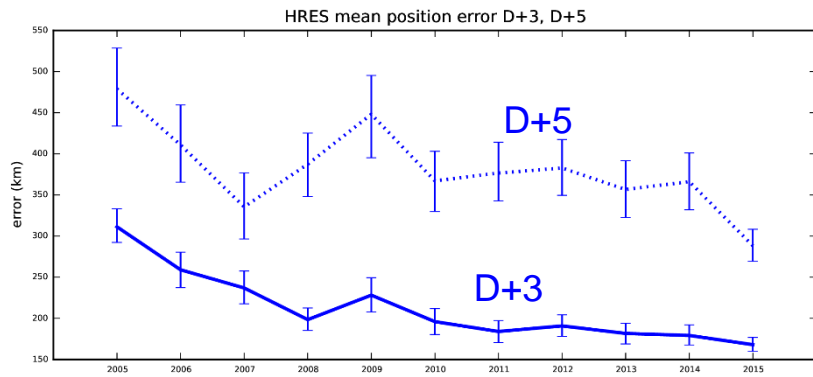


# High-impact weather

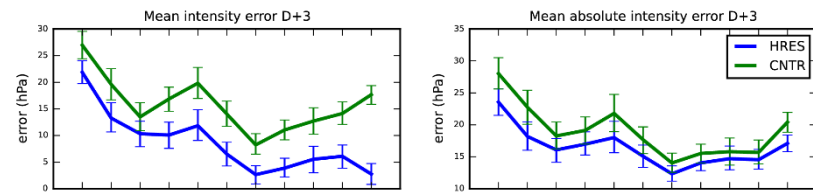


# Monitoring of forecast skill for extremes

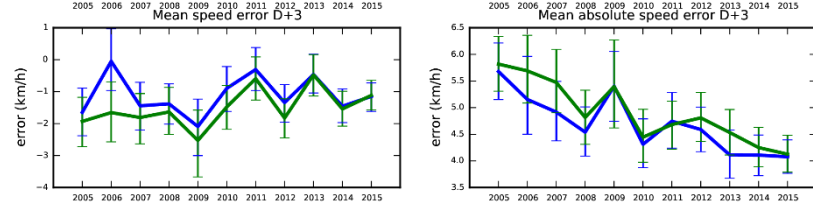
## Tropical cyclones



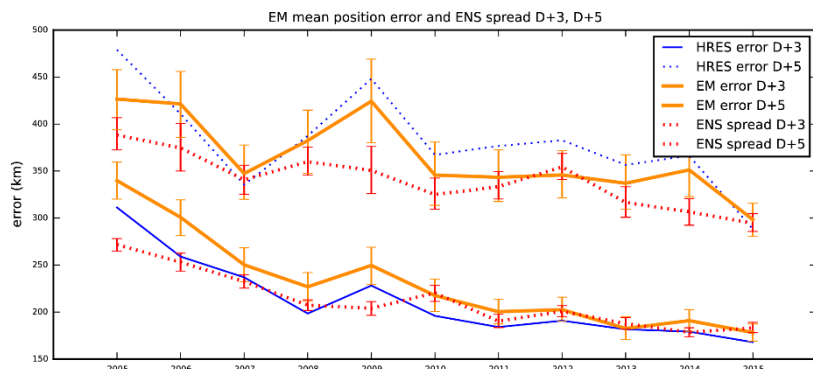
Position



Intensity

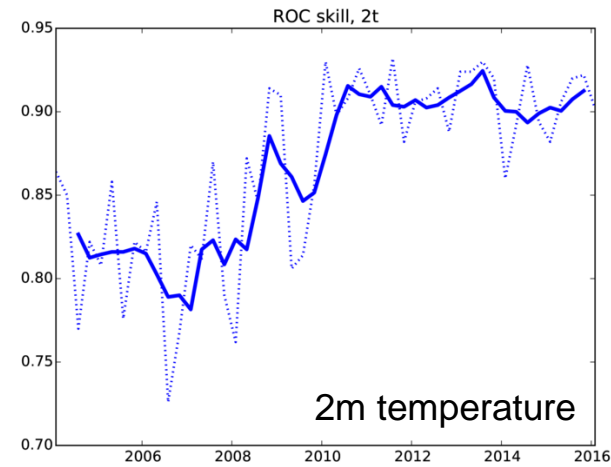


Speed

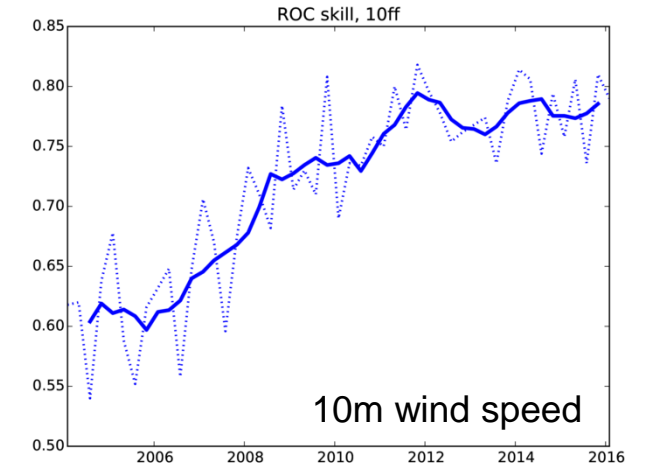


Position  
spread/error

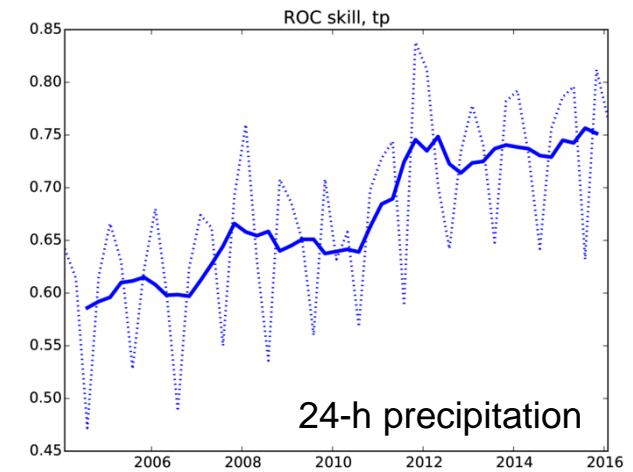
## Extreme forecast index (EFI), D+4



2m temperature

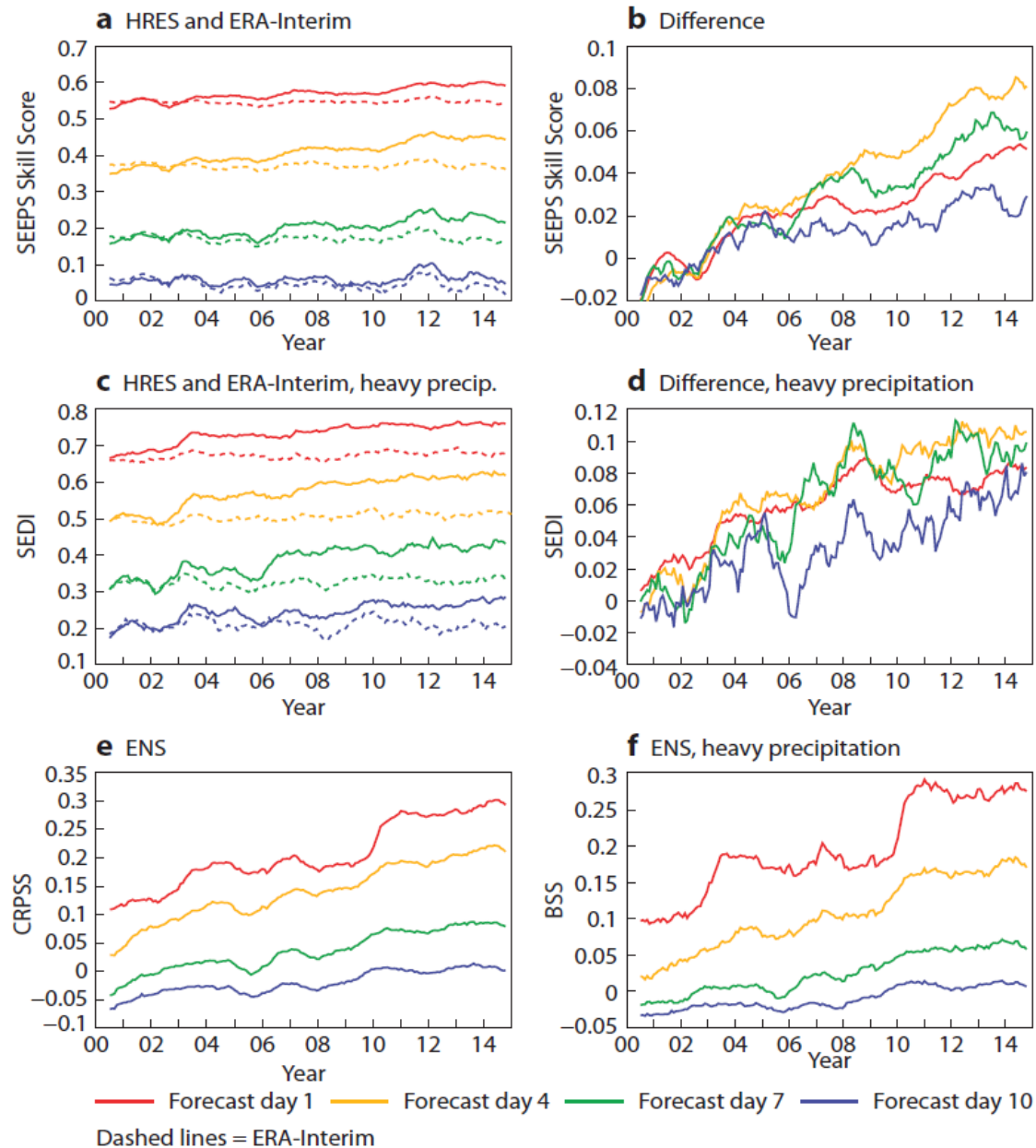


10m wind speed



24-h precipitation

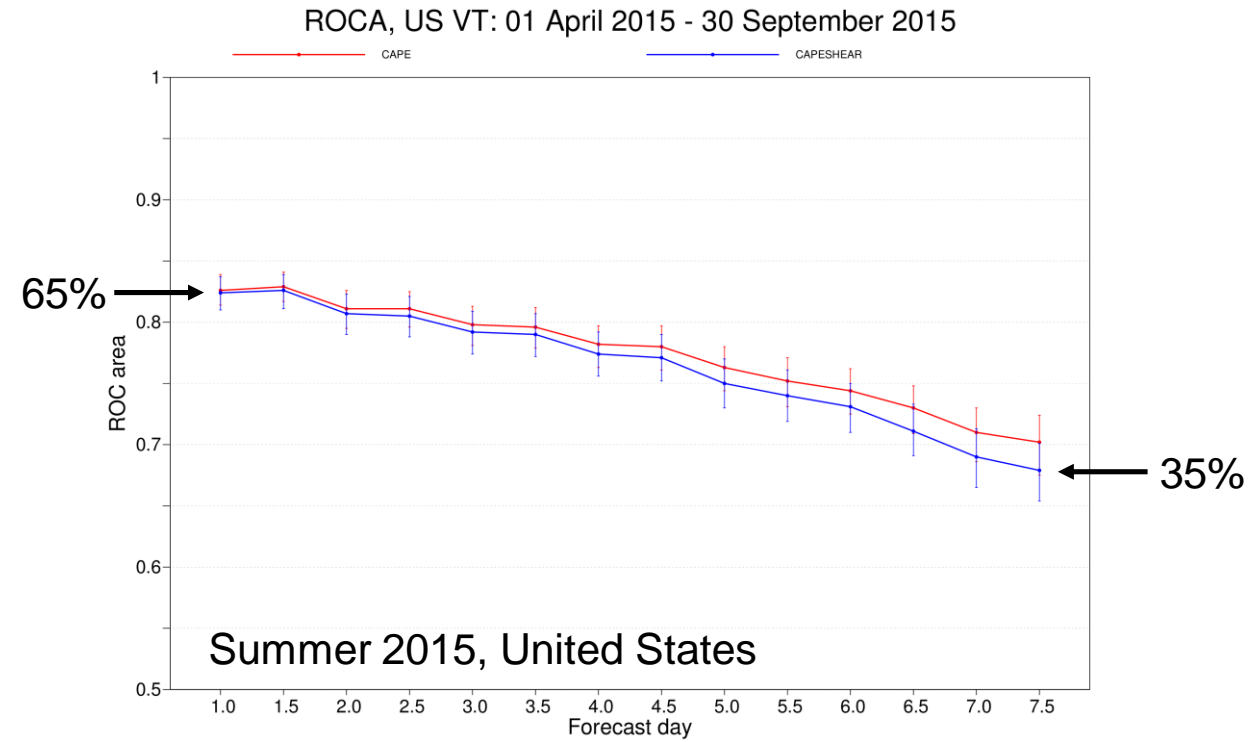
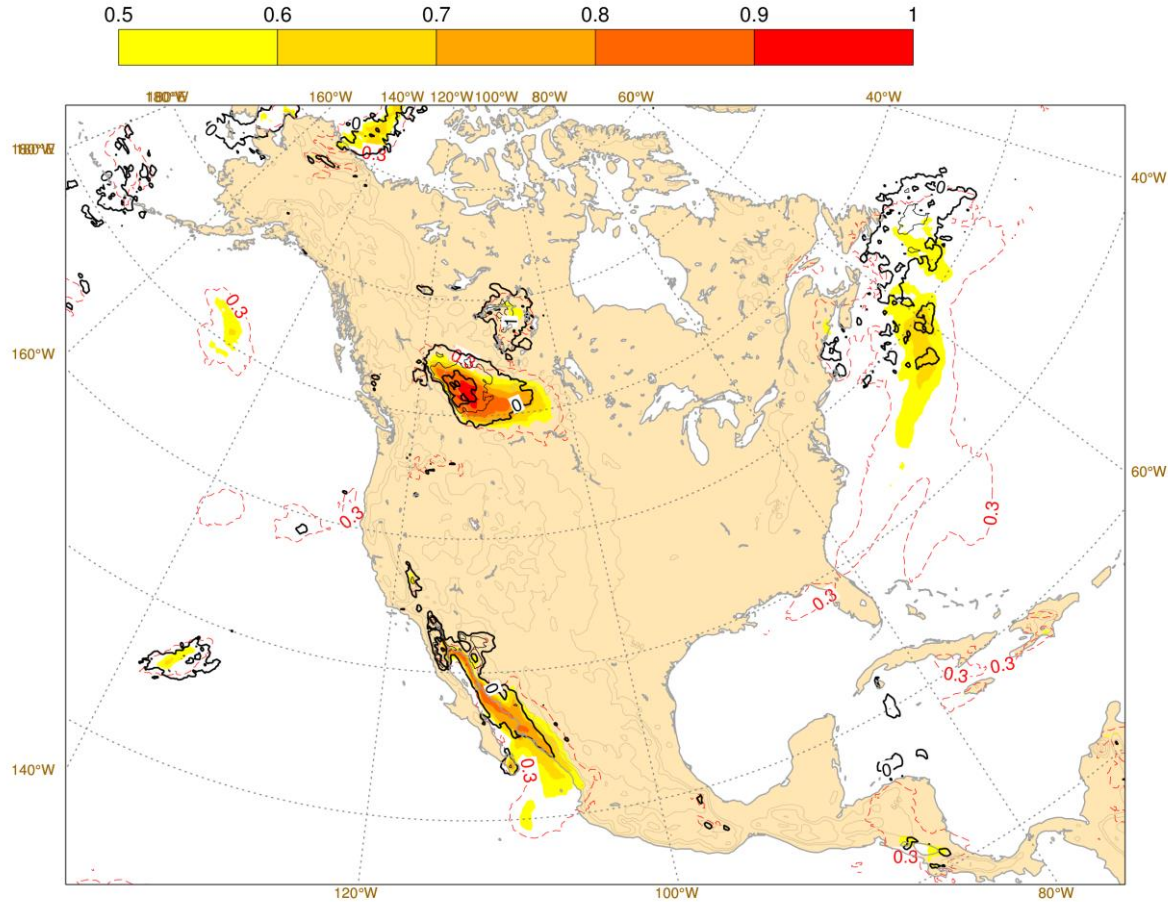
# Heavy precipitation



Largest gains in skill at days 4-7

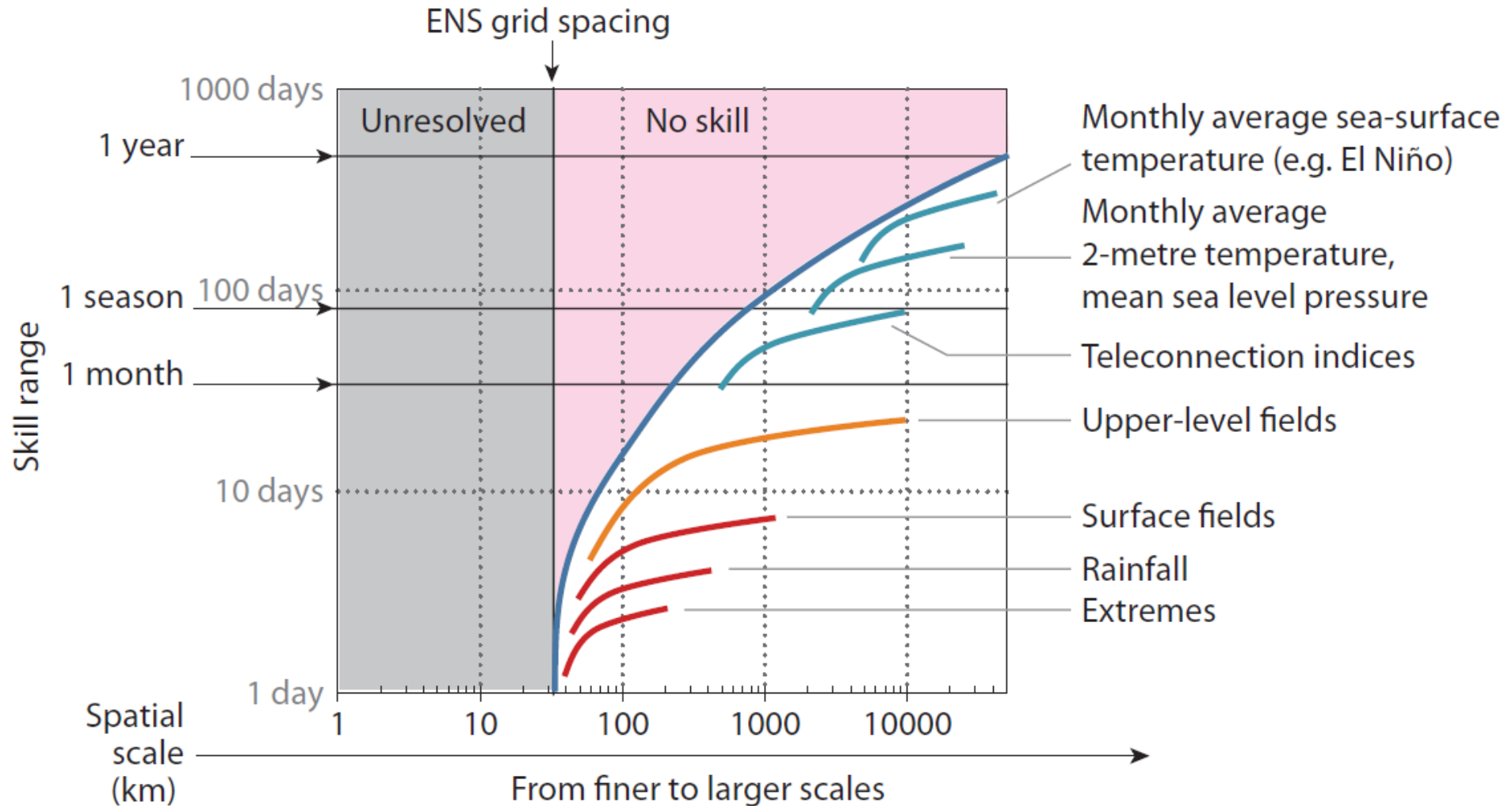
# EFI for severe convection (CAPE, CAPESHEAR)

Mon 06 Jun 2016 00UTC ©ECMWF t+48-72h VT: Wed 08 Jun 2016 00UTC - Thu 09 Jun 2016 00UTC  
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for CAPESHEAR

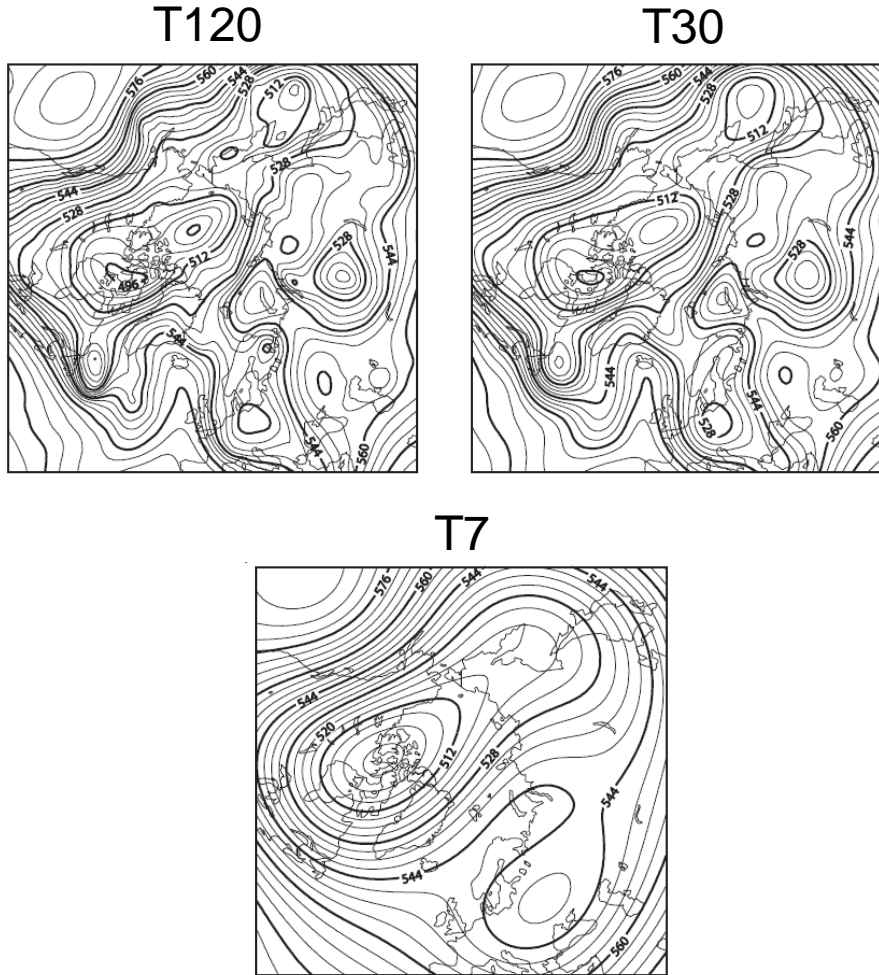


Verification against severe weather reports  
(tornadoes, large hail, severe wind gusts)

# Forecast skill horizon (schematic)



# Forecast skill horizon: 500 hPa geopotential



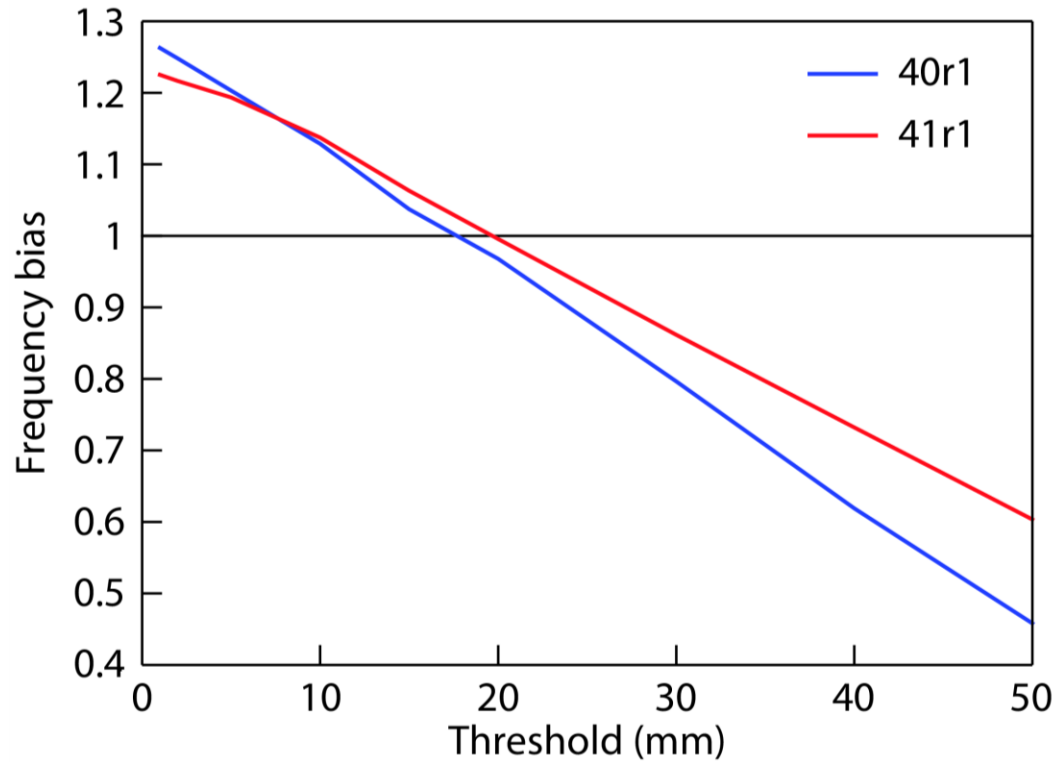
Temporal averaging →

Z500	H0		H24		H96	
	NH	SH	NH	SH	NH	SH
T120	21.0	19.0	22.0	20.5	26.0	21.5
T30	22.0	19.0	22.0	20.5	26.0	21.5
T7	23.0	21.0	24.0	21.0	> 28.0	22.5

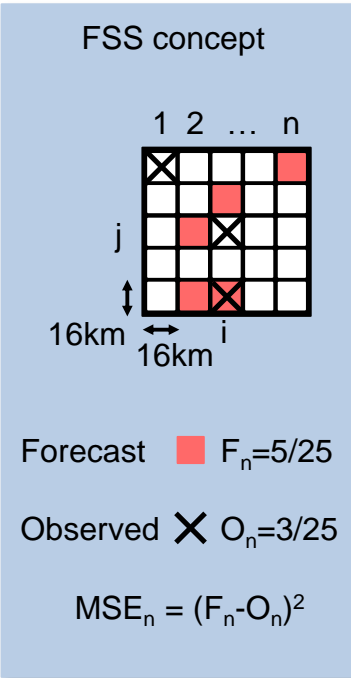
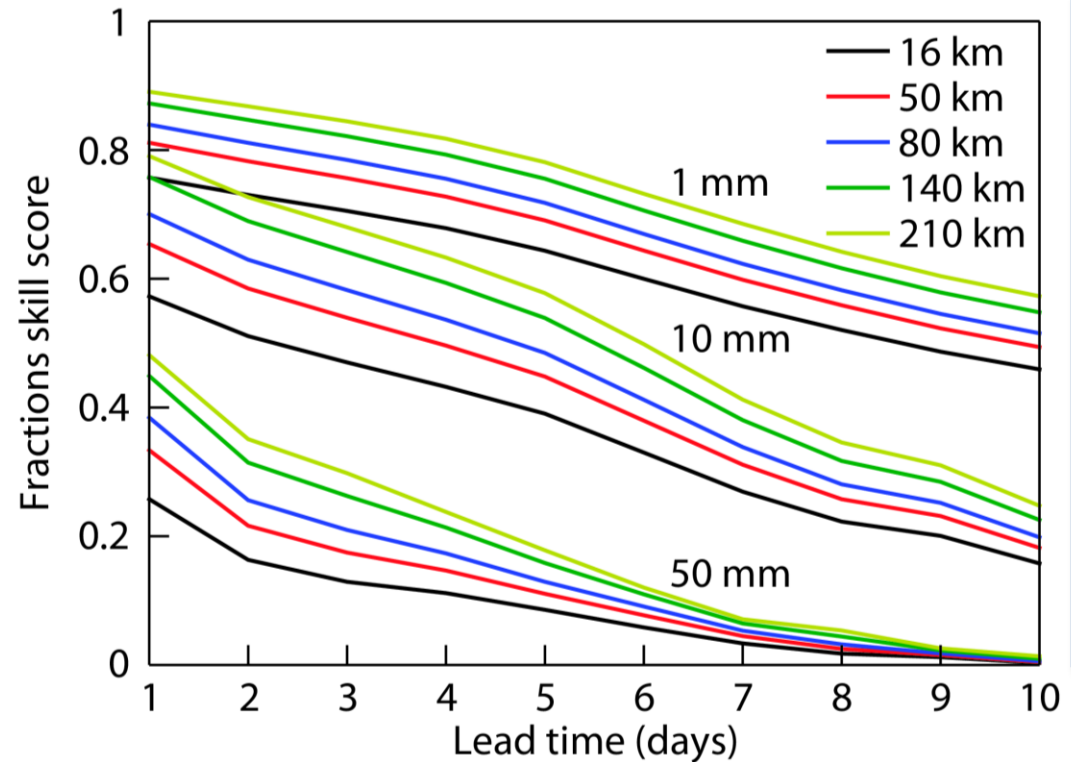
Buizza and Leutbecher (2015)

# Precipitation verification against gridded data (NEXRAD)

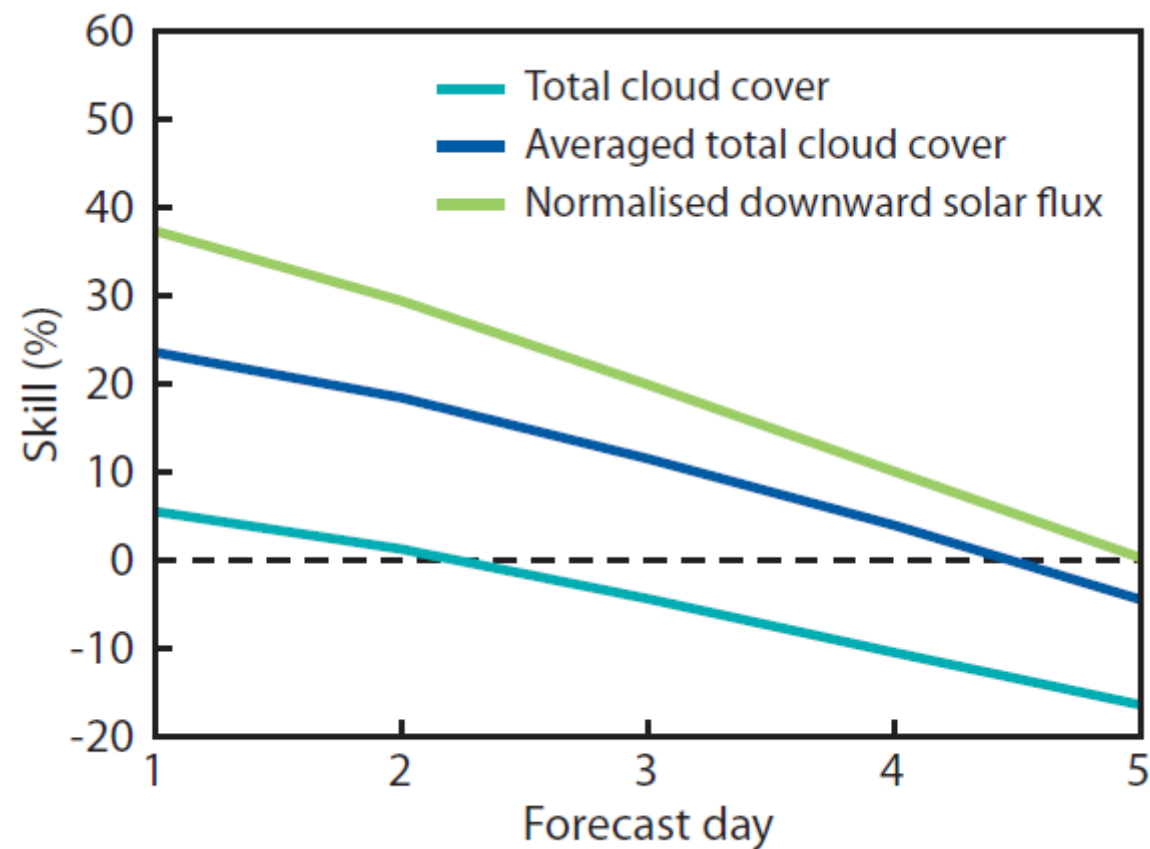
Frequency bias (Oct 2014 – April 2015)



Fractions skill score FSS (April - Aug 2014)



# Total cloud cover forecast skill



ECMWF Newsletter No. 143 (2015)



# Summary

- Upper-air performance continues to increase
- ECMWF maintains overall lead among global centres
- Challenge of 2 m temperature biases
- Significant improvements from Cycle 41r2
- Increased focus on verification of high-impact weather
- Forecast skill horizon: scale-dependent predictability



Home

- Strategic planning
- Monitoring and Evaluation
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Search ...

## World Weather Research Programme (WWRP)

Programmes > WWRP > FvR > NEWS > MEMBERS > MEETINGS > PUBLICATIONS >



Forecast  
Verification  
Research



### WWRP

- WWRP SSC
- 2014 Calendar
- 2013 Calendar
- 2012 Calendar
- 2011 Calendar
- 2010 Calendar
- Publications



### Challenge to Develop and Demonstrate the Best New User-Oriented Forecast Verification Metric

**Deadline: 31 October 2016**

Criteria for judging the best new metric include:

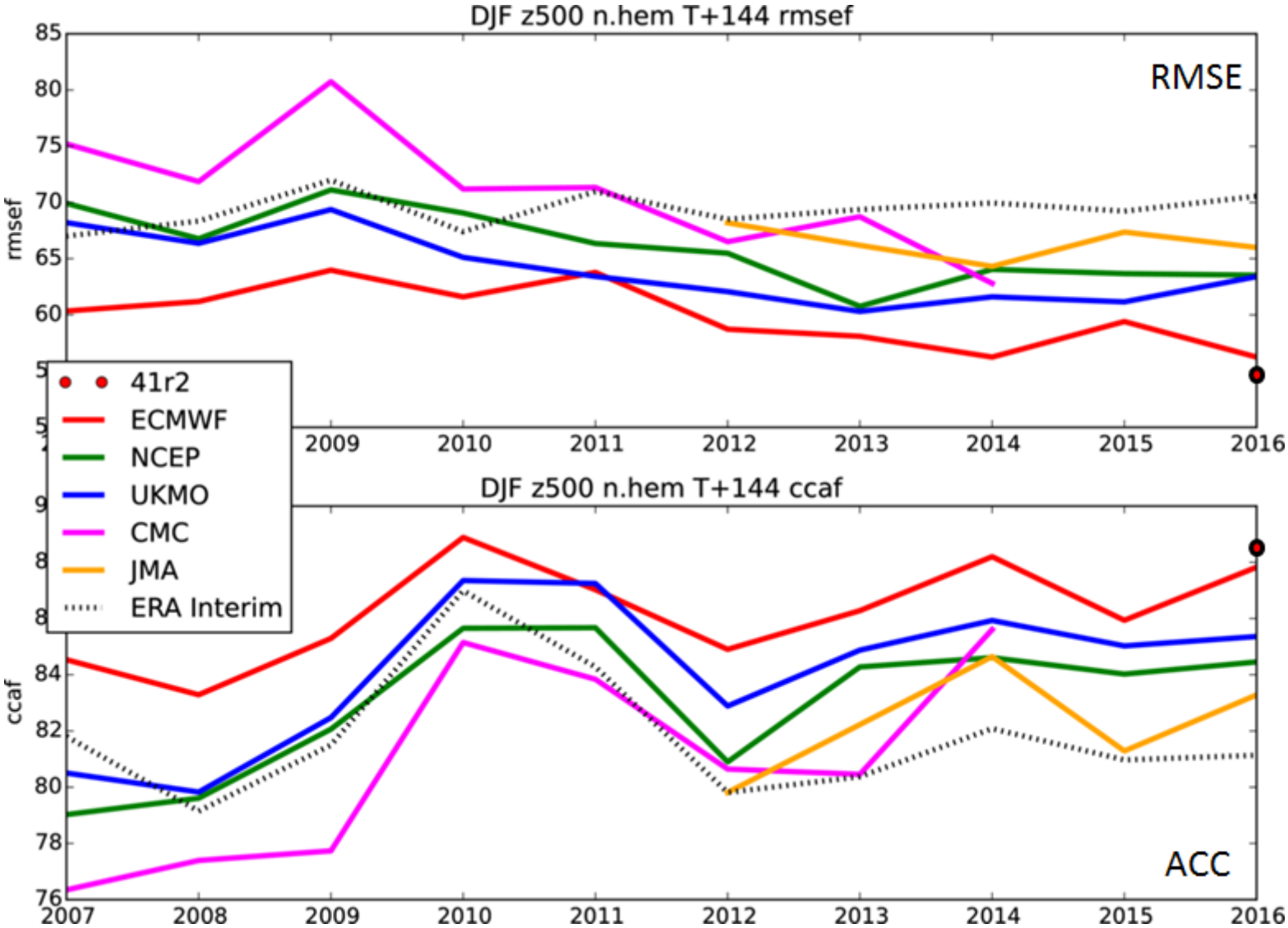
- originality
- user relevance
- intuitiveness
- simplicity and ease of computing
- robustness
- resistance to hedging

Verification Challenge Organizing Committee

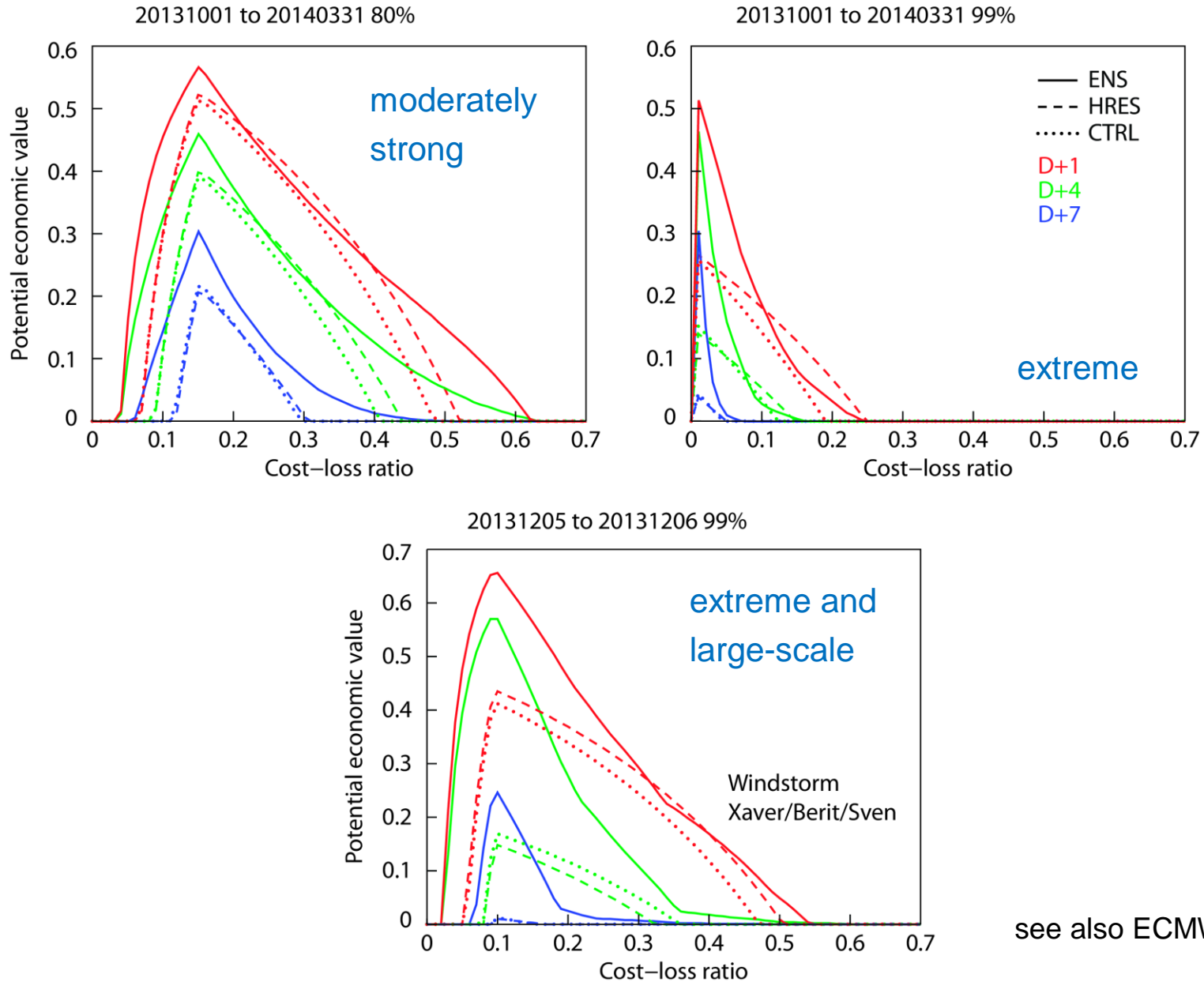
- Beth Ebert, chair, BOM
- Barbara Brown, NCAR
- Martin Göber, DWD
- Thomas Haiden, ECMWF
- Nanette Lomarda, WMO
- Marion Mittermaier, Met Office
- Pertti Nurmi, FMI

**Price: Invited keynote and paid attendance at the  
7th International Verification Methods Workshop in  
May 2017 (Berlin, Germany)**

# Model intercomparison DJF

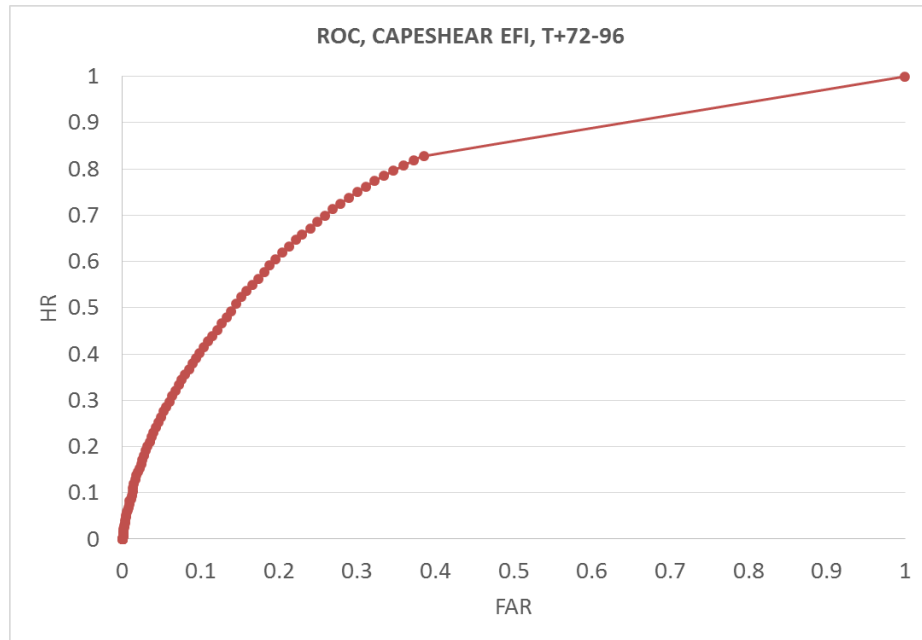


# Potential economic value of extreme wind forecasts

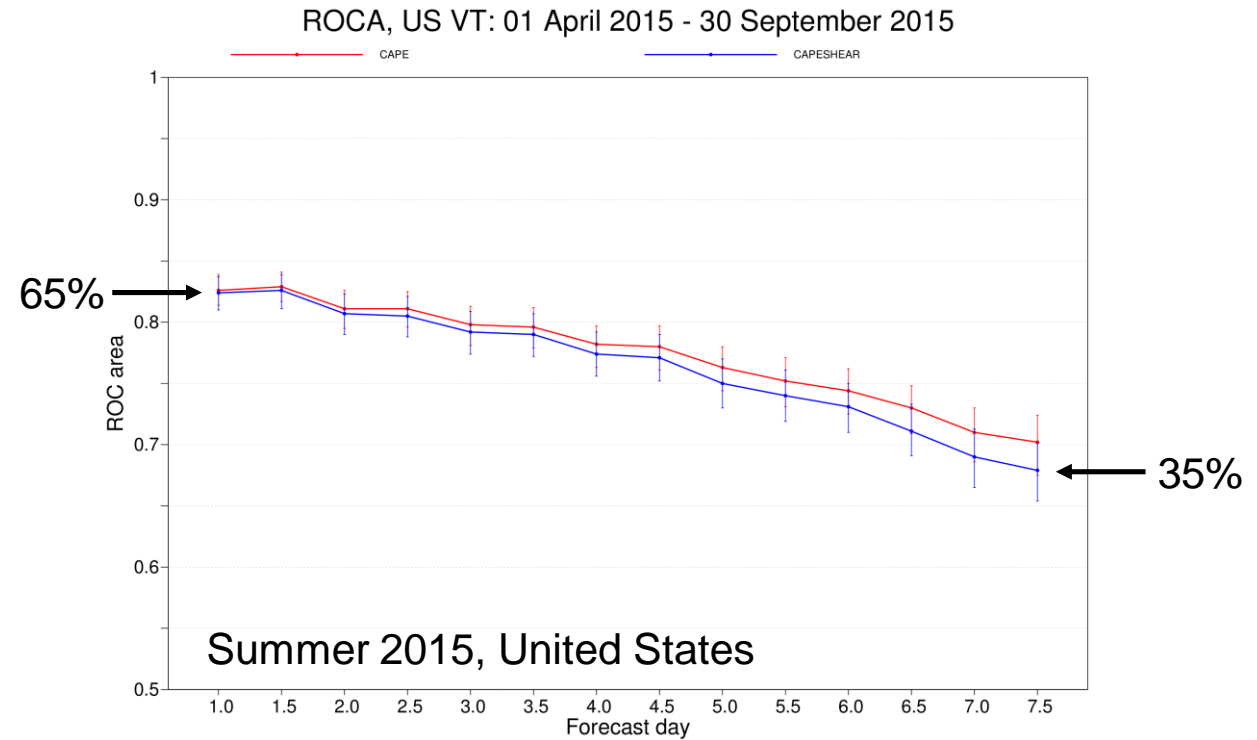


see also ECMWF Newsletter No. 139 (2014)

# EFI for severe convection (CAPE, CAPESHEAR)



I. Tsonevsky (2016)



Verification against severe weather reports  
(tornadoes, large hail, severe wind gusts)