

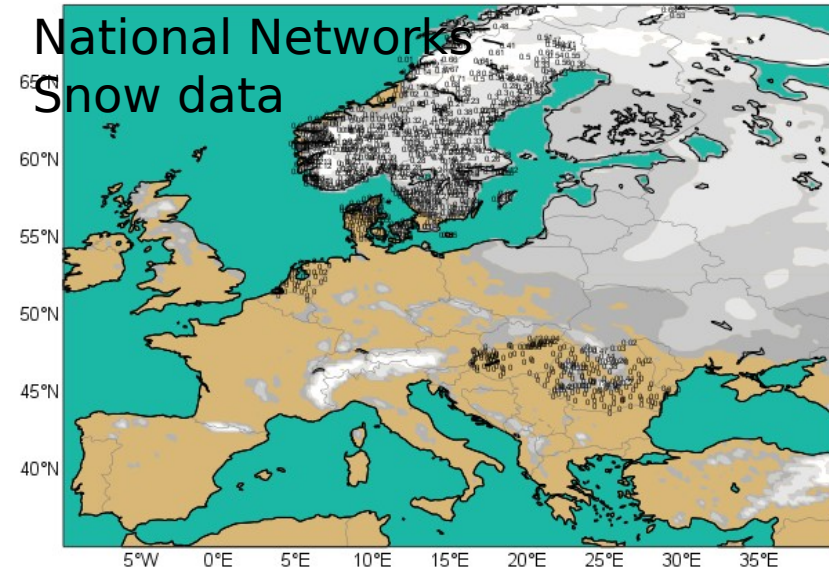
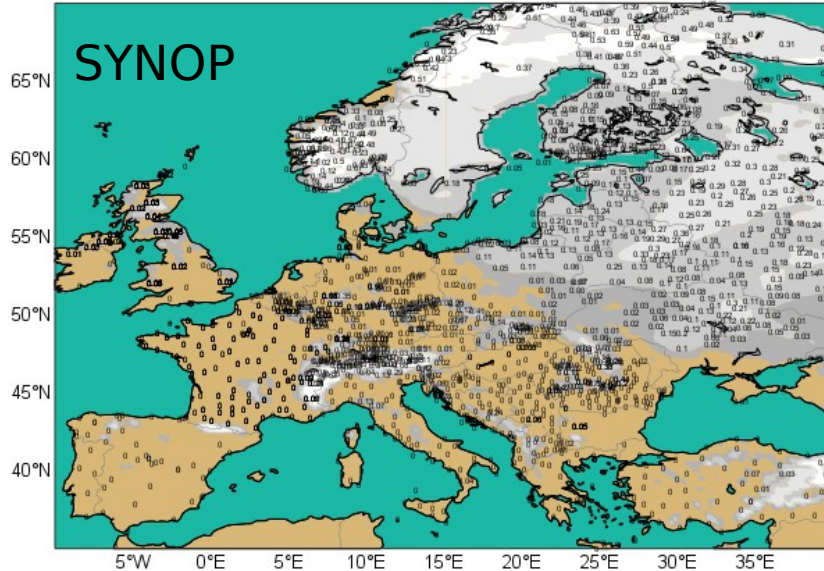
# **Snow Depth Reports Availability on the GTS**

# Snow Observations

## Snow SYNOP and National Network data in Europe



Available on the GTS  
(Global Telecommunication System)  
2016 01 15 at 06UTC



Additional data from national networks (7 countries):  
Sweden (>300), Romania(78), The Netherlands (33), Denmark (43), Hungary (61), Norway (183), Switzerland (-).

(de Rosnay et al. ECMWF Res. Memo, R48 3/PdR/1139, 2011)

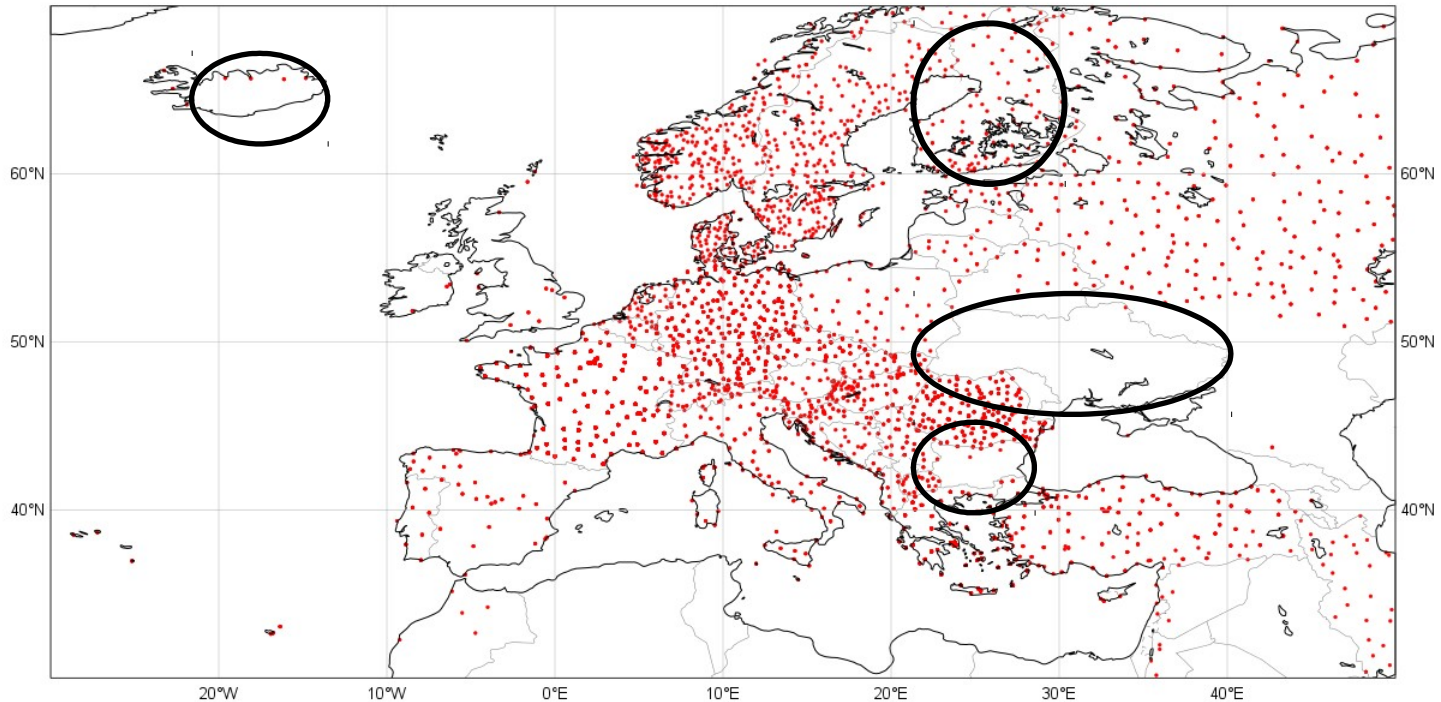
➤ Dedicated BUFR for additional national data

# Snow Observations in Europe

## GTS Snow depth availability

SYNOP TAC + SYNOP BUFR + national BUFR data

Status on 1 March 2016



In general, good coverage in Europe, but ...

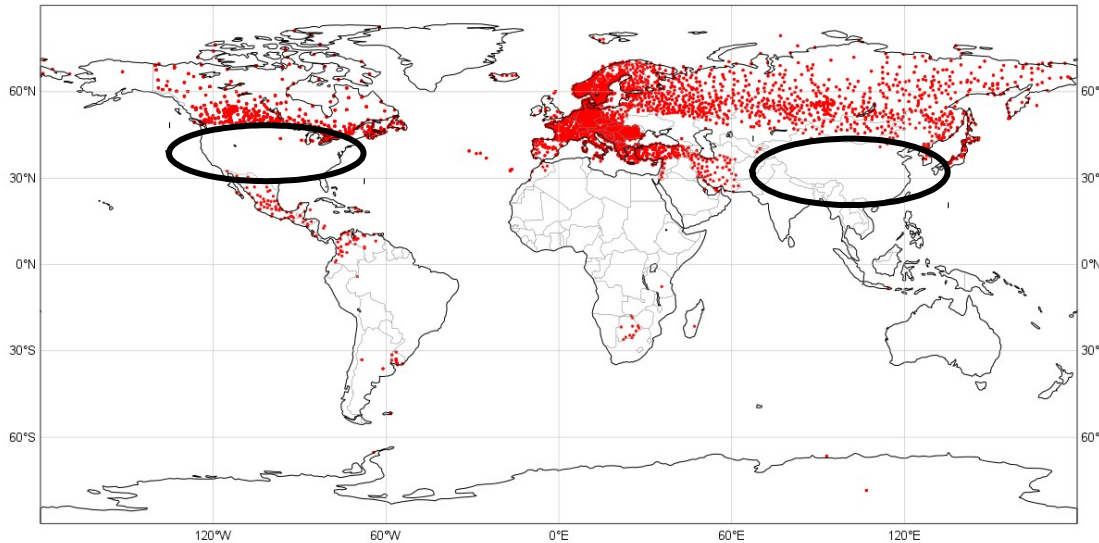
- Bulgaria and Iceland : only few snow depth reports on the GTS compared to what is used by NIMH
- Finland: similarly, more data available (SYKE) for national weather service not on the GTS
- Ukraine: Reports in snow covered conditions (see previous slide), but no reports in snow free conditions — see zero snow depth reporting issue (Sam Bullen)

# Snow Observations

## GTS Snow depth availability

SYNOP TAC + SYNOP BUFR + national BUFR data

Status on 1 March 2016



Gap in USA, China and southern hemisphere

NRT data exist and is available (more than 20000 station in the US)

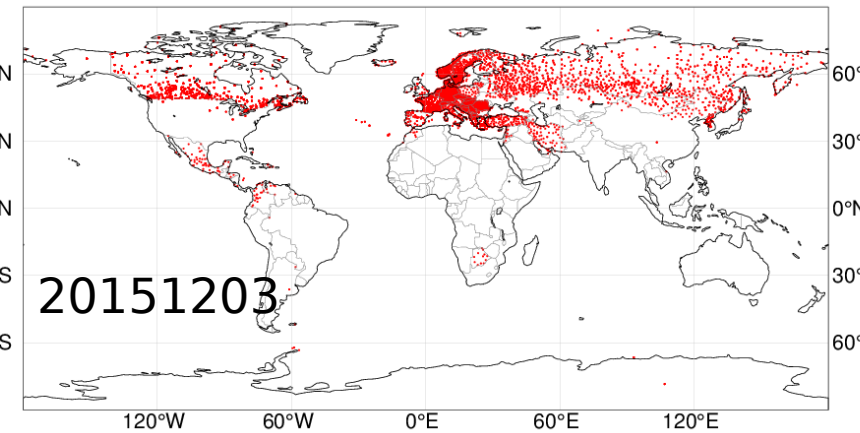
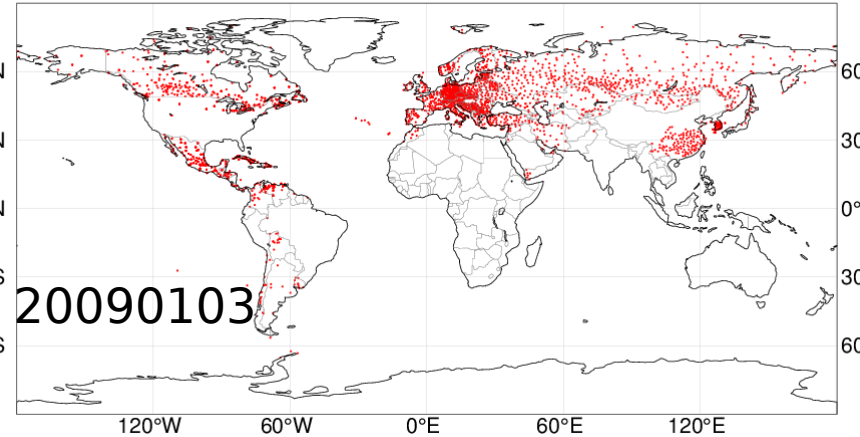
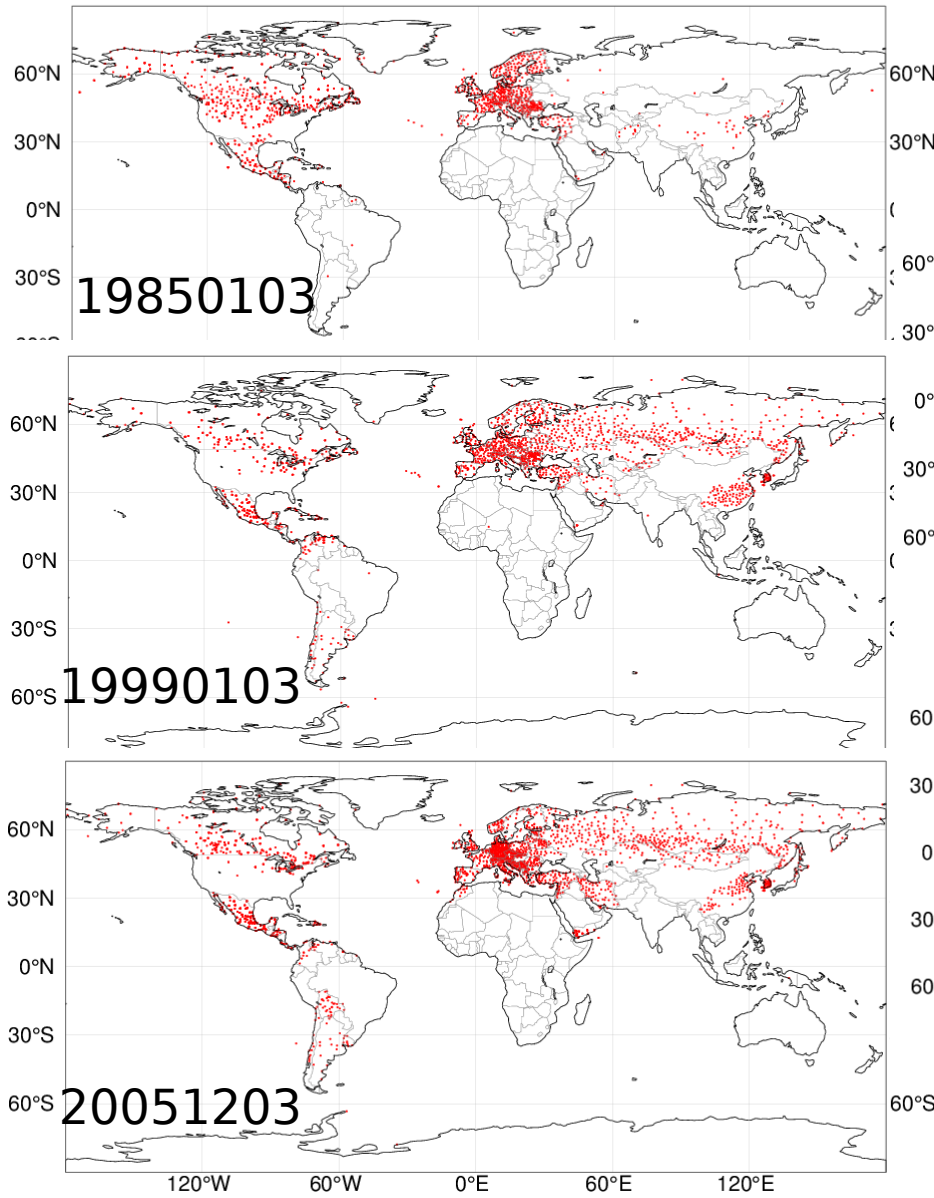
But it is not on the GTS for NWP applications.

WMO Members States encouraged to put their snow depth data on the GTS

➤ BUFR template for national data approved by WMO in April 2014

➤ WMO GCW Snow Watch initiative on snow reporting, (Bruijn et al 2013)

## Evolution of the snow depth observations availability on the GTS



**Less snow depth observations on the GTS than in 1985!**

# Initiatives relevant to address snow observations availability on the GTS

## GCW Snow Watch Activity



Snow Watch reporting Handout 2015 (ECMWF/UKMO)

<http://globalcryospherewatch.org/reference/documents>

## NAEDEX (North America Europe data exchange)

Meeting Oct 2015 -> discussion NOAA/NCEP to improve availability of snow depth on the GTS - status ?

## COST action on Snow: HarmoSnow

“A European network for a harmonised monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction”



[http://www.cost.eu/COST\\_Actions/essem/Actions/ES1404](http://www.cost.eu/COST_Actions/essem/Actions/ES1404)

<http://costsnow.fmi.fi/>

## OSCAR Observing Systems Capability Analysis and Review Tool

- New section for in situ surface data
- Would be relevant to use it to monitor snow depth data availability

# Europe: ongoing action in Bulgaria

Contribution of the COST action to improve snow depth data exchange

- Action from ECMWF and NIMH following November 2015 meeting
- Tested in the ECMWF data Assimilation (1 month test in oper config)
- Suitable for operational use
- Recommendation to NIMH to make the data available on the GTS

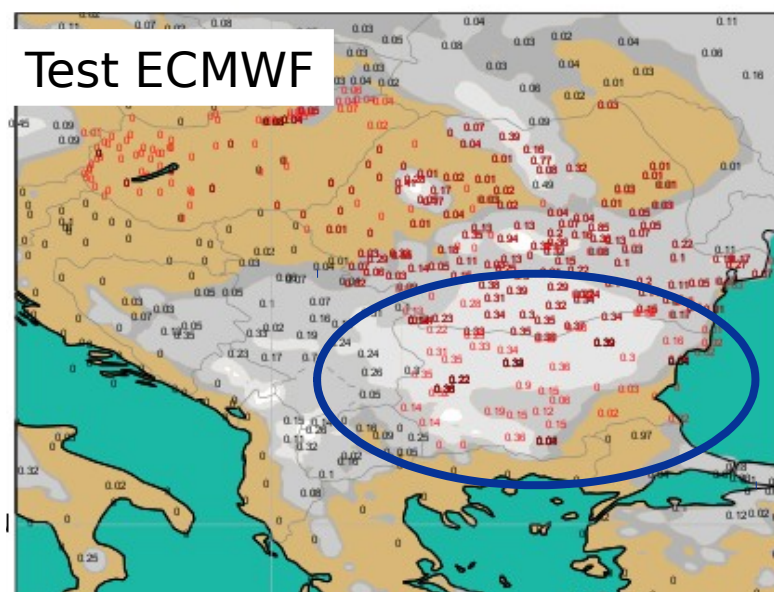
de Rosnay et al.,  
ECMWF Res Memo  
No 16-178, June 2016

19 January 2016  
Snow depth in m

0.05 0.2



Lack of observations in Bulgaria



39 more stations provided by NIMH, in the dedicated BUFR (more red obs value)

# Snow data on the GTS

- Snow Data Assimilation (DA) crucial for NWP
- In the absence of dedicated satellite mission, in situ snow depth is by far the most relevant information for snow DA

**Gaps:** in snow reports availability on the GTS:

- Areas with sparse reports: USA, China, Southern Hemisphere and some countries in Europe (Bulgaria, Iceland)
- Areas with seasonal reporting (Ukraine) because only report in snow covered

**Issues:**

- For some countries the data exist in NRT and is freely available
- need to put the data on the GTS in BUFR (e.g. USA); the issue is related to decision and

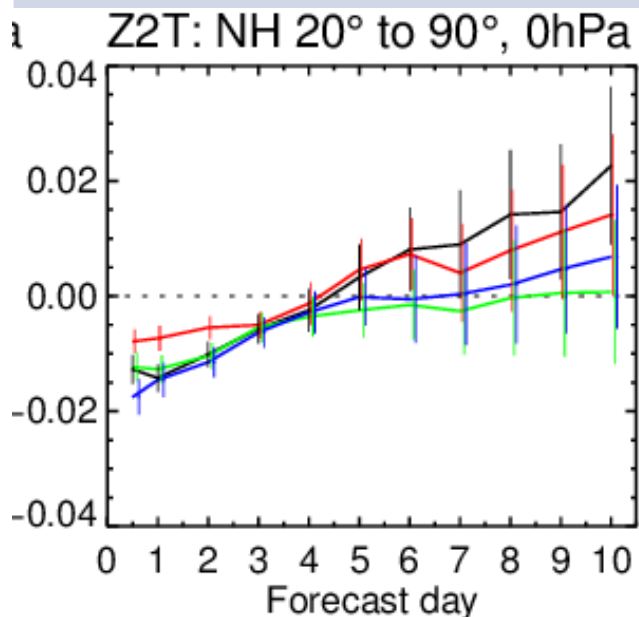


# **Snow OSEs at ECMWF**

# Observing System Experiments

Winter 2014-2015 (December to April) - Assess the impact of the snow observing system

Expts	SYNOP	National Data	IMS snow cover
0 reference OL (no assimilation)			
1 SYNOP+IMS	☐		☐
2 SYNOP+Nat (all in situ)	☐	☐	
3 SYNOP+Nat+IMS	☐	☐	☐

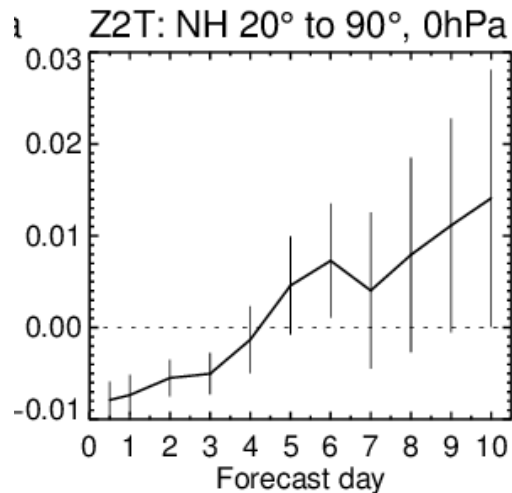


**Impact on T2m Forecasts:  
Normalized RMSE for T2m FC difference  
(compared to reference with no DA)**

- SYNOP+IMS (1-0)
- SYNOP+Nat (2-0)
- SYNOP+Nat+IMS (3-0) -> oper

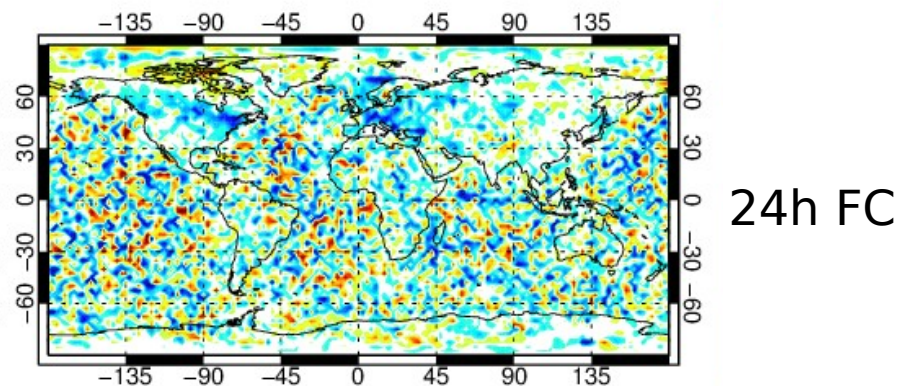
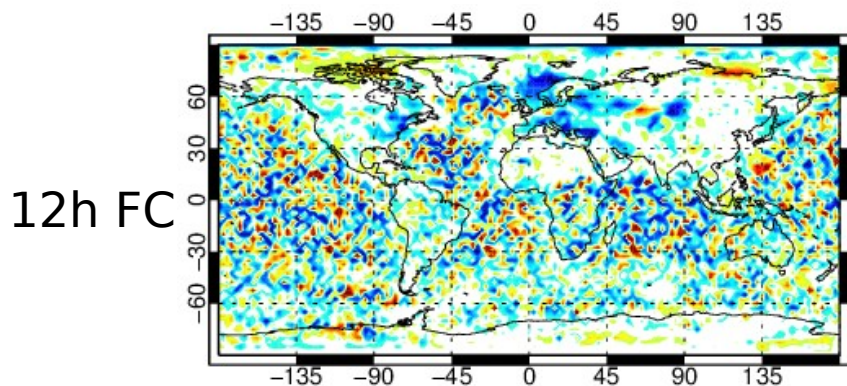
Best T2m Forecast when all observations, combining in situ and IMS, are assimilated.

# Impact of in situ only snow data assimilation on T2m Forecasts(case 2-0)



All in situ data assimilated (SYNOP+Nat)

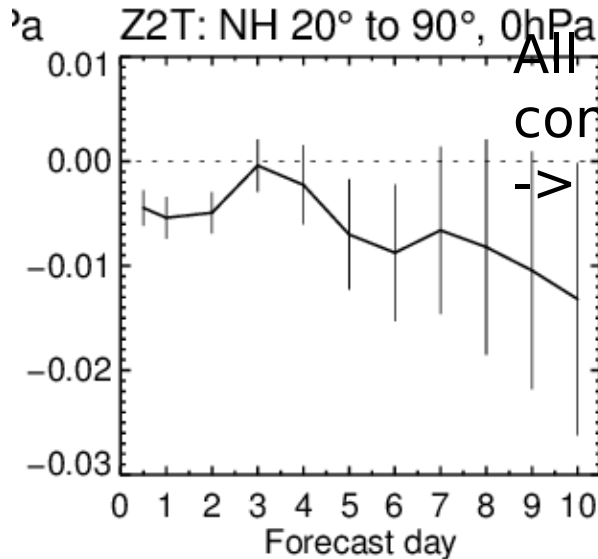
Compared to open loop, significant error reduction (NA, Europe) of short range T2m forecasts, but neutral at medium range



# Summary

- Major developments in the ECMWF data assimilation (DA) in the past few years; large impact on NWP
- OSEs shows that combined DA of in situ snow depth and IMS snow cover significantly improve T2m forecasts
- Gaps in in situ SD reporting, but additional National data contribute to improve near surface weather forecasts
- Nat. Met services encouraged to report snow depth on the GTS
- Contributions from Snow Watch(WMO BUFR), HarmoSnow COST action (Questionnaire, inventory), NAEDEX (US issue), OSCAR (great potential for monitoring SD report availability), ...

# Impact of IMS snow cover (case 3-2)

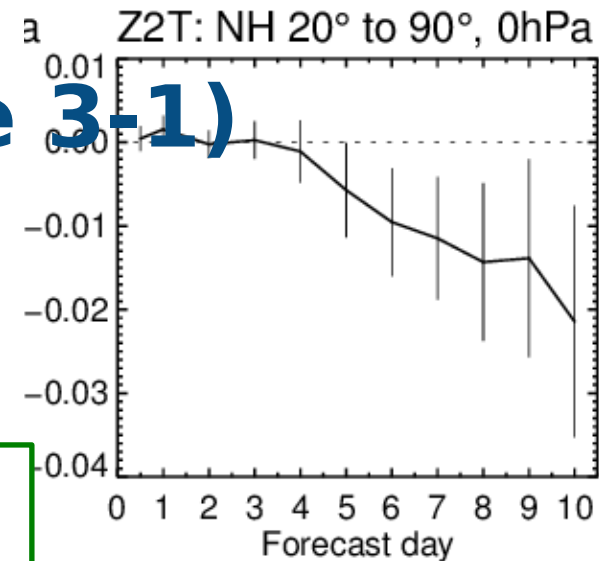


All data assimilated (Synop+Nat+IMS)  
compared to all in situ data assimilated (SYNOP+  
-> Further T2m forecasts error reduction,  
significant at short range

Impact additional network  
(case 3-1)

# Impact of National data (case 3-1)

All data assimilated (SYNOP+Nat+IMS)  
compared to SYNOP+IMS assimilation  
-> Further T2m forecasts error reduction at  
medium range



Contribution & complementarities of each  
observation types to improve T2m forecasts at  
short and medium ranges