Future degradation of the polar orbiting network

How will it affect Numerical Weather Prediction ?

Tony McNally
ECMWF

Future provision of operational polar satellites

- It is likely that in the future we will have fewer operational polar satellites than now.
- A scenario where the US and Europe each provide one polar satellite has been constructed
- The consequences of losing one or both of these satellites is tested in a real data impact study (3 months during winter 2009/2010)

Hypothetical EPS and USPS satellites

EPS=METOP-A USPS=NOAA18/AQUA

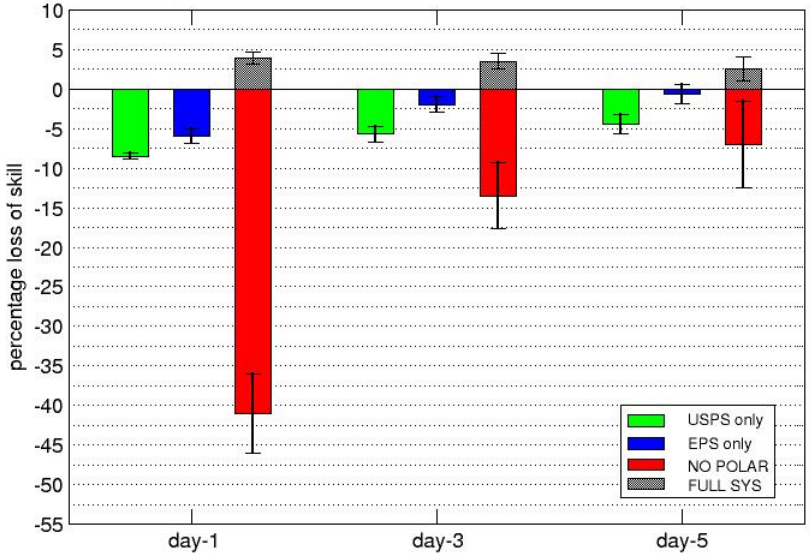
Observing system	Baseline (EPS+USPS)	EPS only	USPS only	No Polar sounders
Conventional	Yes	yes	yes	yes
GEO (RAD+AMV)	yes	yes	yes	yes
IRS	Yes (AIRS+IASI)	Yes (IASI)	Yes (AIRS)	**no**
MWS	Yes (AMSUA/B/MHS)	Yes (AMSUA/MHS)	Yes (AMSUA/B)	**no**
MWI	Yes (AMSRE)	**no**	Yes (AMSRE)	**no**
SCAT	Yes (ASCAT)	Yes (ASCAT)	**no**	**no**
GPSRO	Yes (GRAS)	Yes (GRAS)	**no**	**no**

Objective Forecast Evaluation

The impact of polar orbiting satellites on 1, 3 and 5 day 500hPa geopotential forecasts

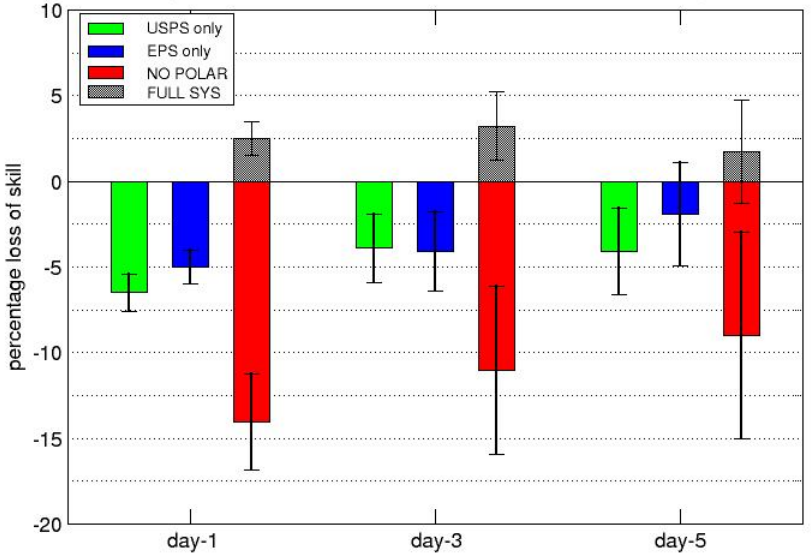
Northern Hemisphere

(loss of skill relative to baseline with one EPS + one USPS)



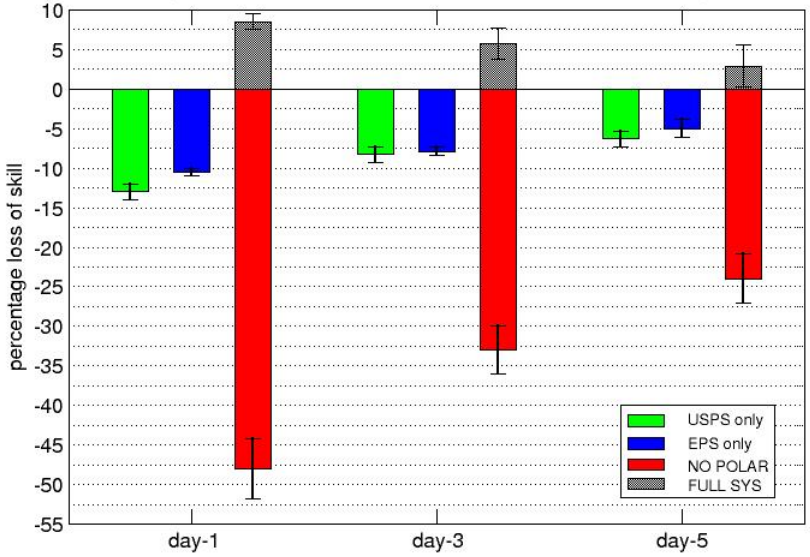
European Region

(loss of skill relative to baseline with one EPS + one USPS)



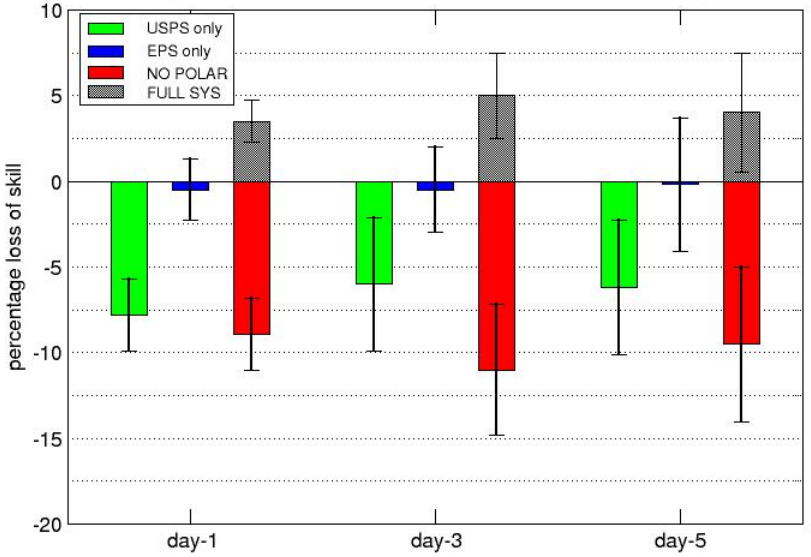
Southern Hemisphere

(loss of skill relative to baseline with one EPS + one USPS)



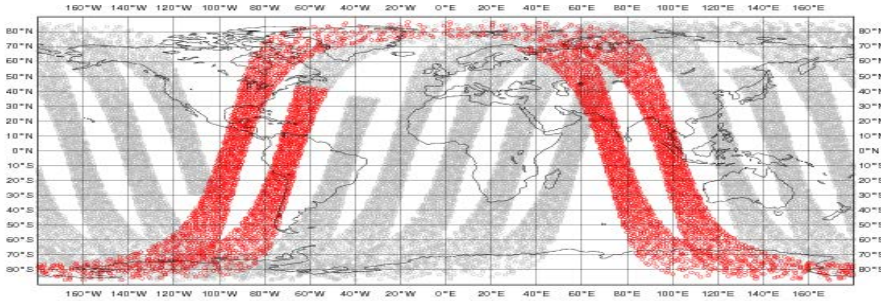
North American Region

(loss of skill relative to baseline with one EPS + one USPS)

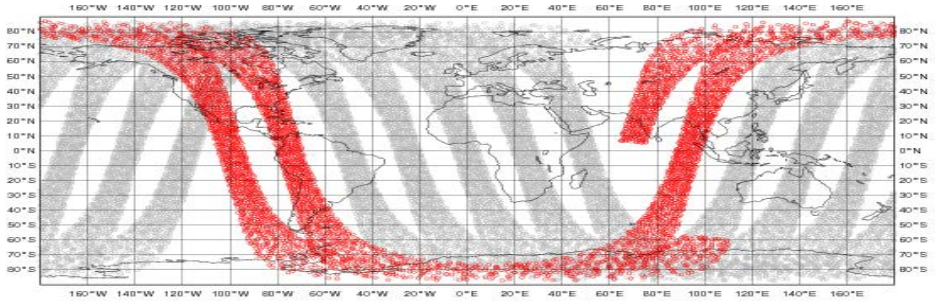


The geographical location of influential orbits in the 4D-Var window

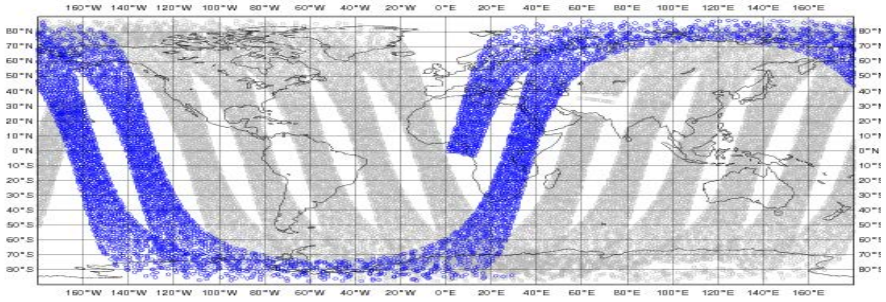
USPS 00z



USPS 12z



EPS 00z



EPS 00z

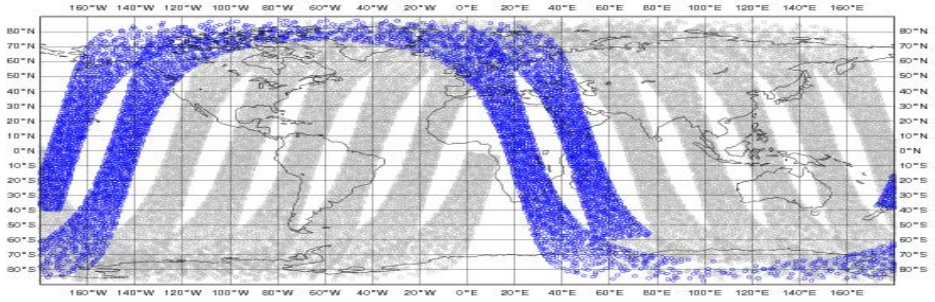


Figure 2*. Orbits of the EPS and USPS in the 00z (left) and 12z (right) 4DVAR 12 hour assimilation window. Those coloured red (for USPS) and blue (for EPS) are observed in the lattermost 3 hours of the assimilation window.*

Synoptic Case Study Evaluation

The impact of polar orbiting satellites on snowfall forecasts over North Eastern USA, 3 days in advance of the 19th December 2009 at 12z

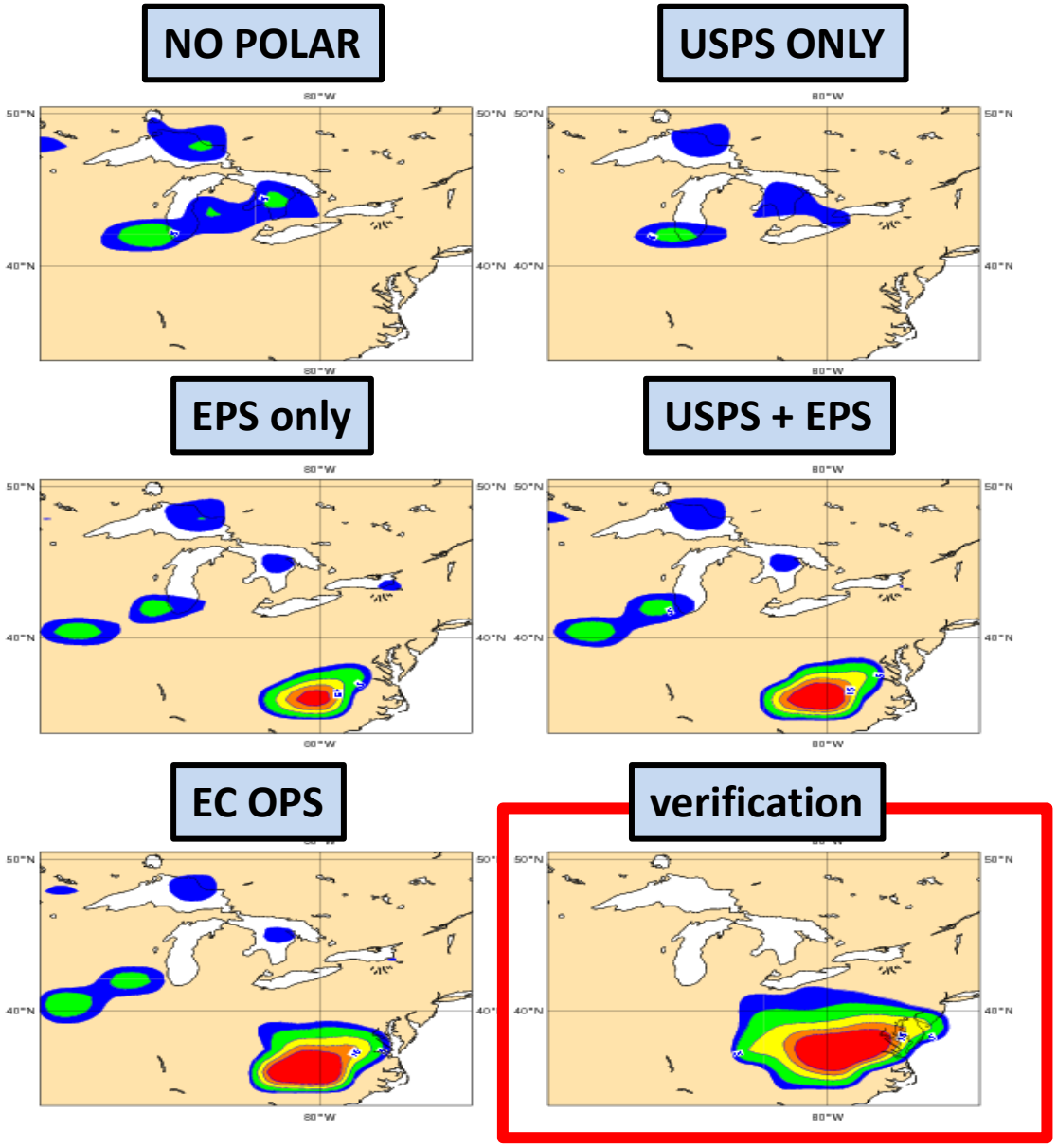


Figure 5 *Snowfall forecasts over North Eastern USA, 3 days in advance of the 19th December 2009 at 12z, from the assimilation system with no polar satellites (upper left), just USPS (upper right), just EPS (centre left), EPS + USPS (centre right), the data rich control (lower left) and verification from the ECMWF analysis (lower right). Contours start at 5cm and are at 5cm intervals. Red indicates more than 20cm.*

Observing system	Data Dense Control (ECMWF operations)
Conventional	Yes
GEO (RAD+AMV)	Yes
IRS	(AIRS+IASI)
MWS	(AMSUA x 4, AMSUB/MHS x 3 HIRS x 3)
MWI	(TMI + AMSRE + SSMI)
SCAT	(ASCAT + ERS)
GPSRO	(GRAS + COSMIC)