

# A 40-year accumulation dataset for Adelie Land, Antarctica and its application for model validation

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## Surface mass balance (SMB) observations in coastal Adelie Land

### IPEV

French polar institute archives

From the coast to 17 km inland  
 22 accumulation stakes

Measured annually  
 (stakes height)

Dec. 1970 → Dec. 1991 : 21 years

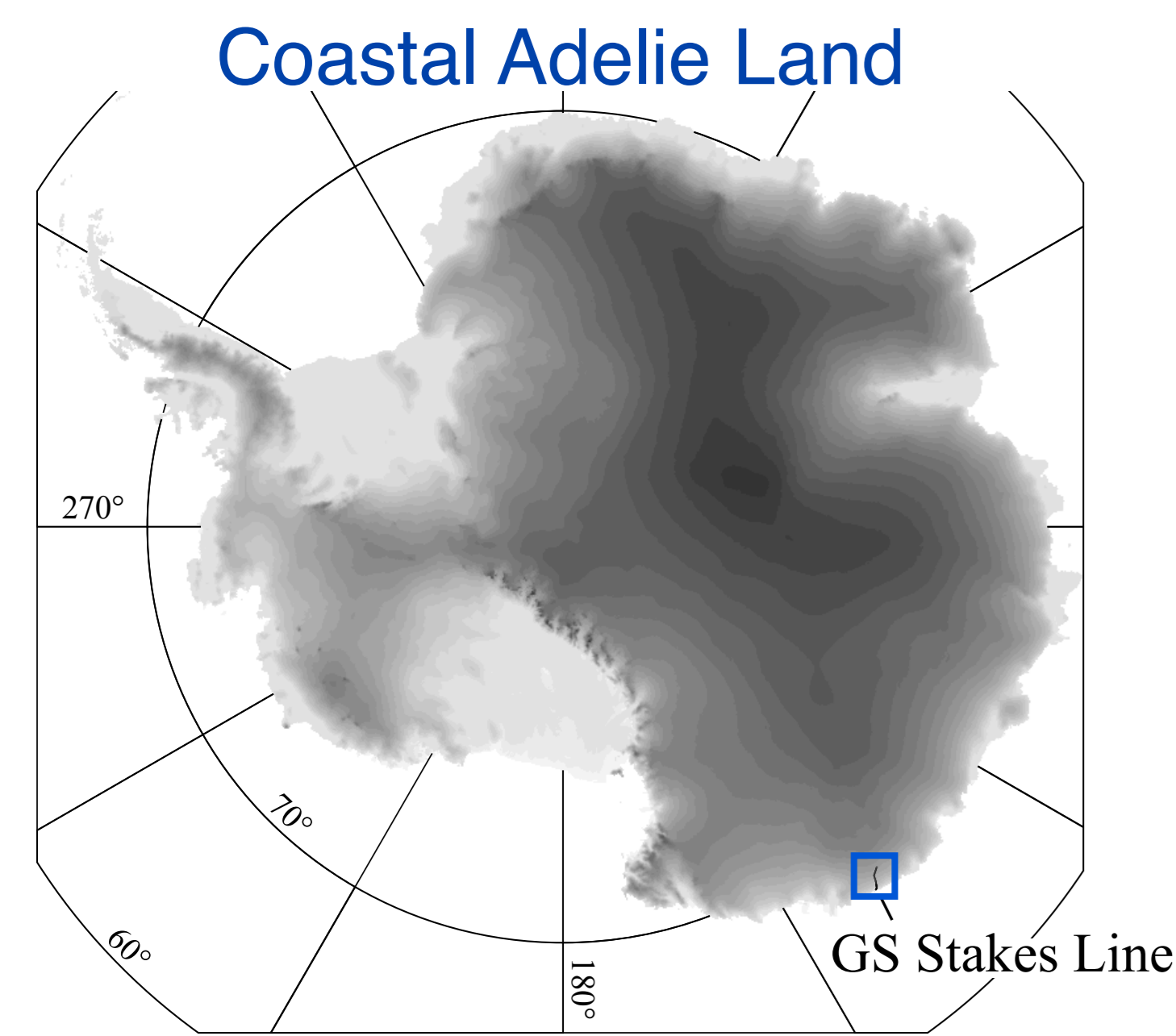
### GS

GLACIOCLIM-SAMBA stake-line

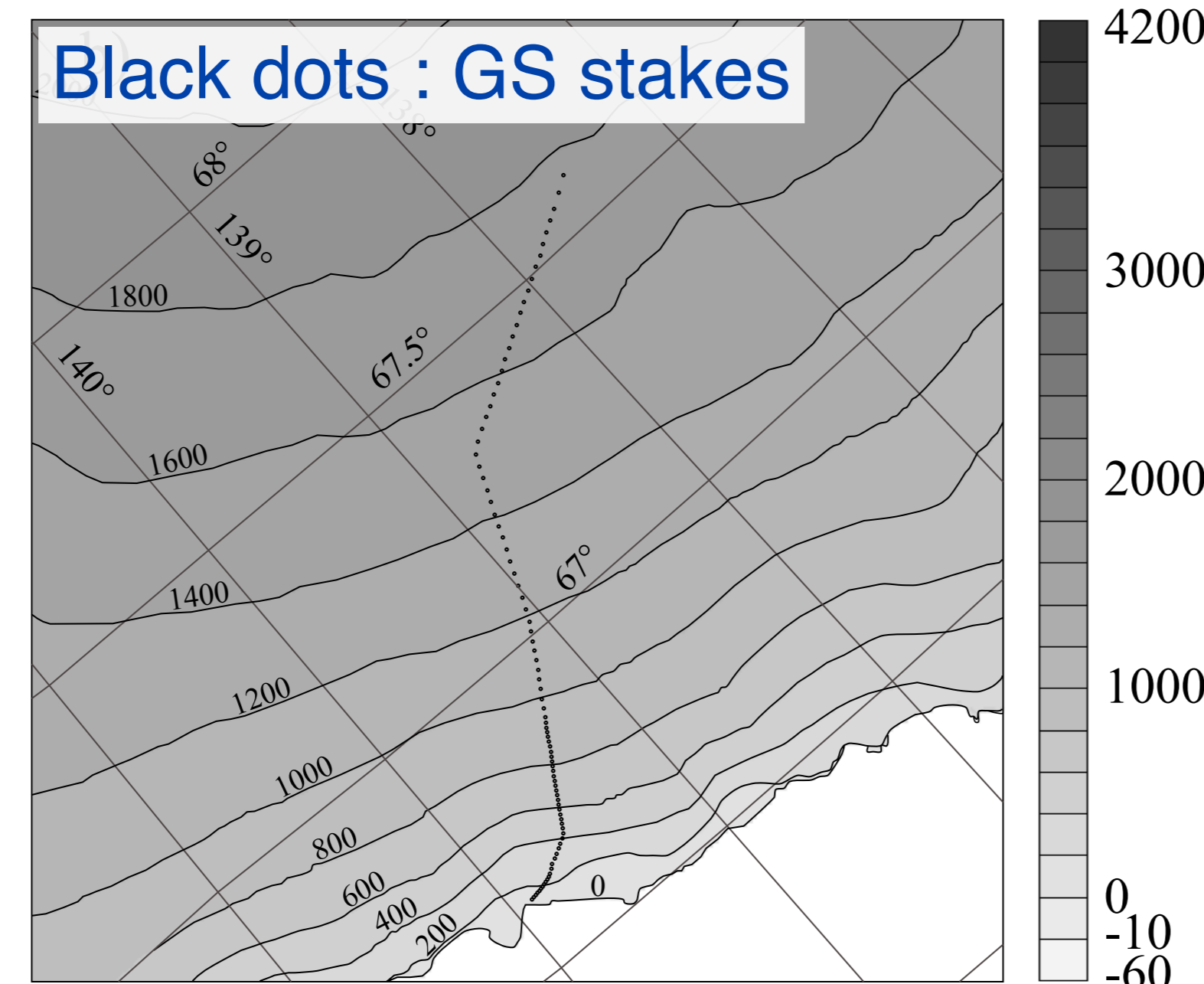
From the coast to 156 km inland  
 91 accumulation stakes

Surveyed annually  
 (height + snow density on each stake)

Dec. 2003 → Dec. 2011 : 8 years and more ...



Surface elevation in m from Bamber et al. (2009)



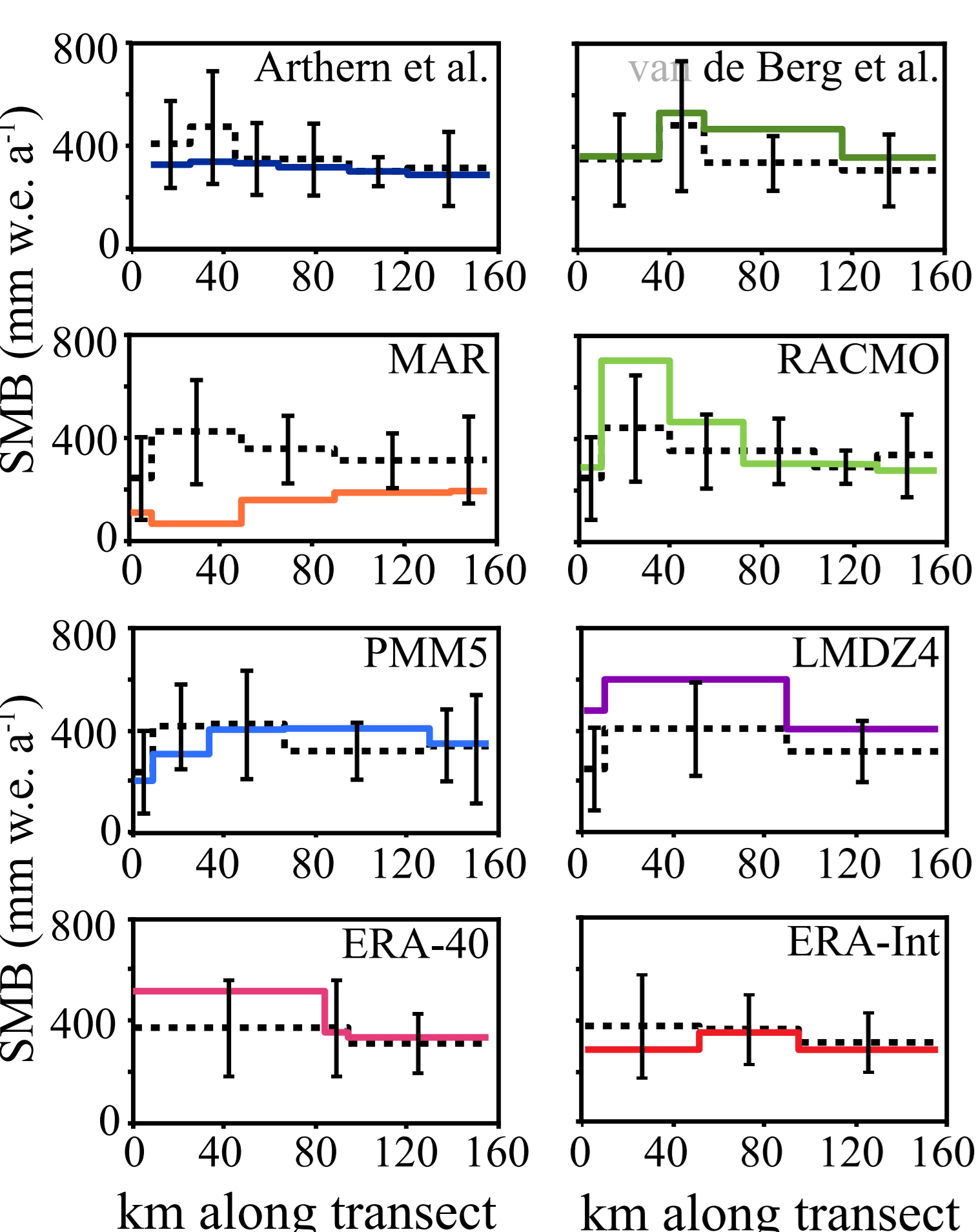
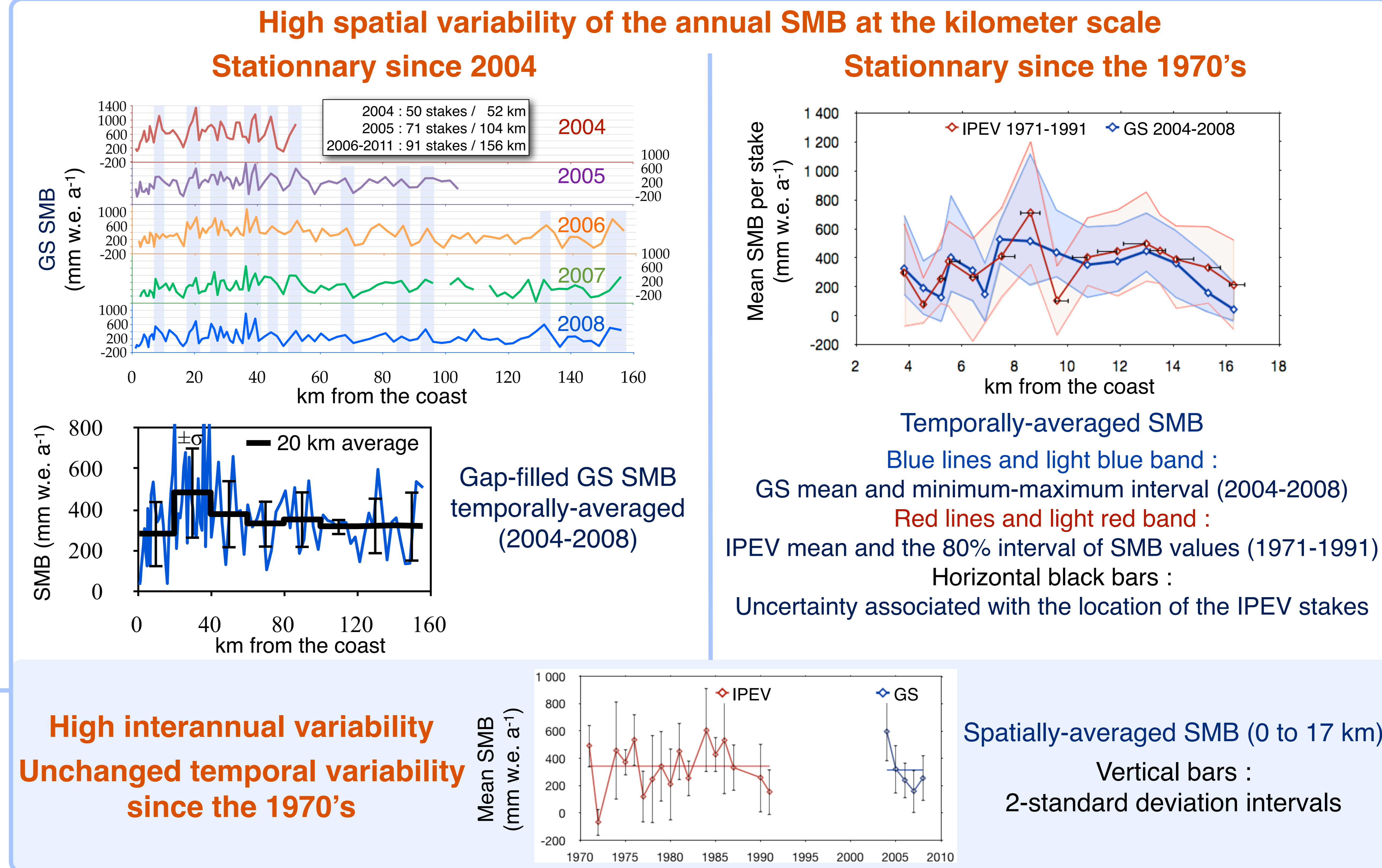
## Evaluation of Antarctic SMB climatologies for the end of the 20th c.

Observation-based climatologies : Arthern et al. (2006) and van de Berg et al. (2006)

Re-analyses : ERA-40 and ERA-Interim

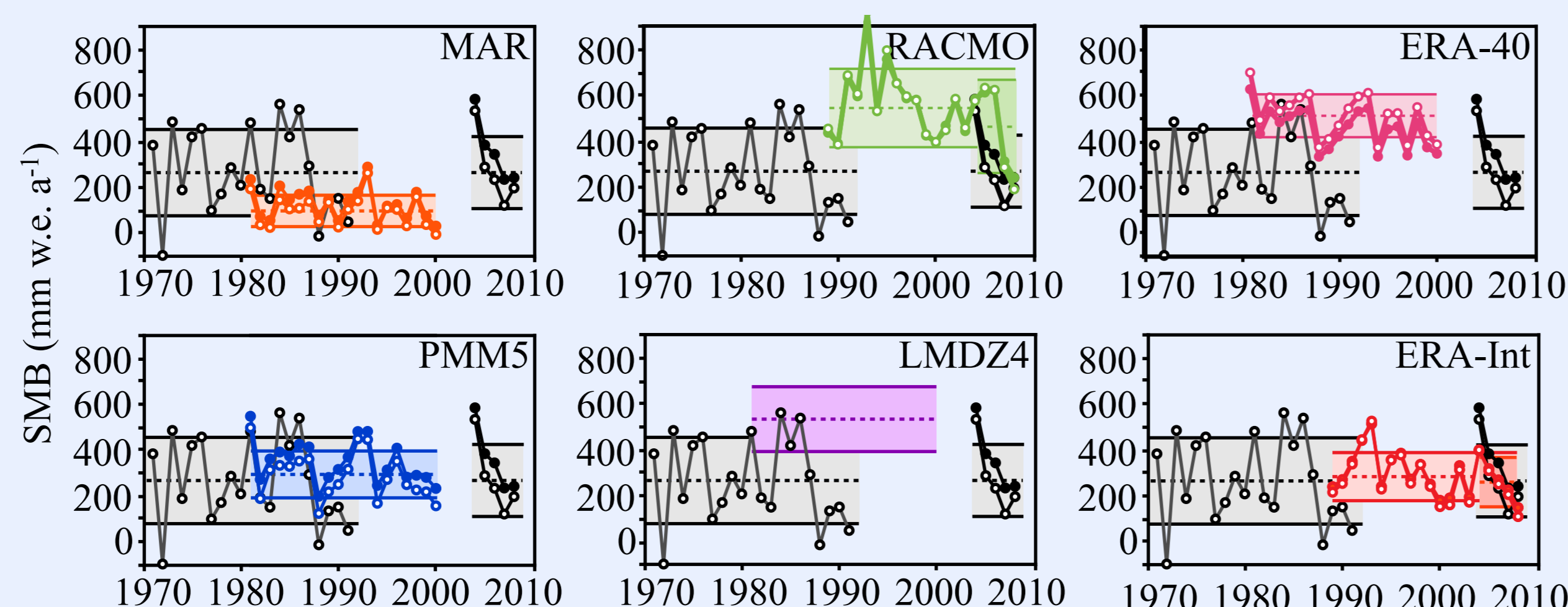
Atmospheric global circulation model : LMDZ4

Atmospheric regional circulation models : MAR, PMM5 and RACMO2



→ **Spatial patterns (temporally-averaged SMB)**  
 Colored lines : Model  
 Black lines : GS stakes SMB averaged on each model grid box (2004-2008)

**Interannual variability (spatially-averaged SMB)**  
 Spatial mean over 17 km-IPEV (empty circles) / 156 km-GS (full circles)  
 Colored lines : Model / Black lines : Observations (IPEV or GS)  
 Boxes : length = period of computation/measurement, middle dashed line = mean SMB, width = two standard deviation intervals



## Conclusions

No significant accumulation trend over the last 40 years in Coastal Adelie Land

### GLACIOCLIM-SAMBA stake line, SMB observatory :

- Representative of the climatology of coastal Adelie Land from the 1970's to present
- Designed to evaluate and validate climate models at the mesoscale and at interannual time scales :
- Adequately sample small-scale spatial variability to be properly averaged out
- Large spatial extent to fit the scales resolved by the models
- Annual resolution over a multi-year time span (to be continued)

At the periphery of the ice sheet where present accumulation and predicted change are largest  
 Distributed data : <http://www-igge.ujf-grenoble.fr/ServiceObs/SiteWebAntarc/background.html>

### SMB climatologies evaluation :

- The meso-scale spatial pattern of the annual-mean accumulation is qualitatively reproduced (except MAR)
- MAR model underestimated significantly the mean SMB : corrected now
- Reanalyses and models forced by reanalyses correctly represent the chronological variability (good large-scale circulation)

The magnitude of the SMB interannual variability is underestimated