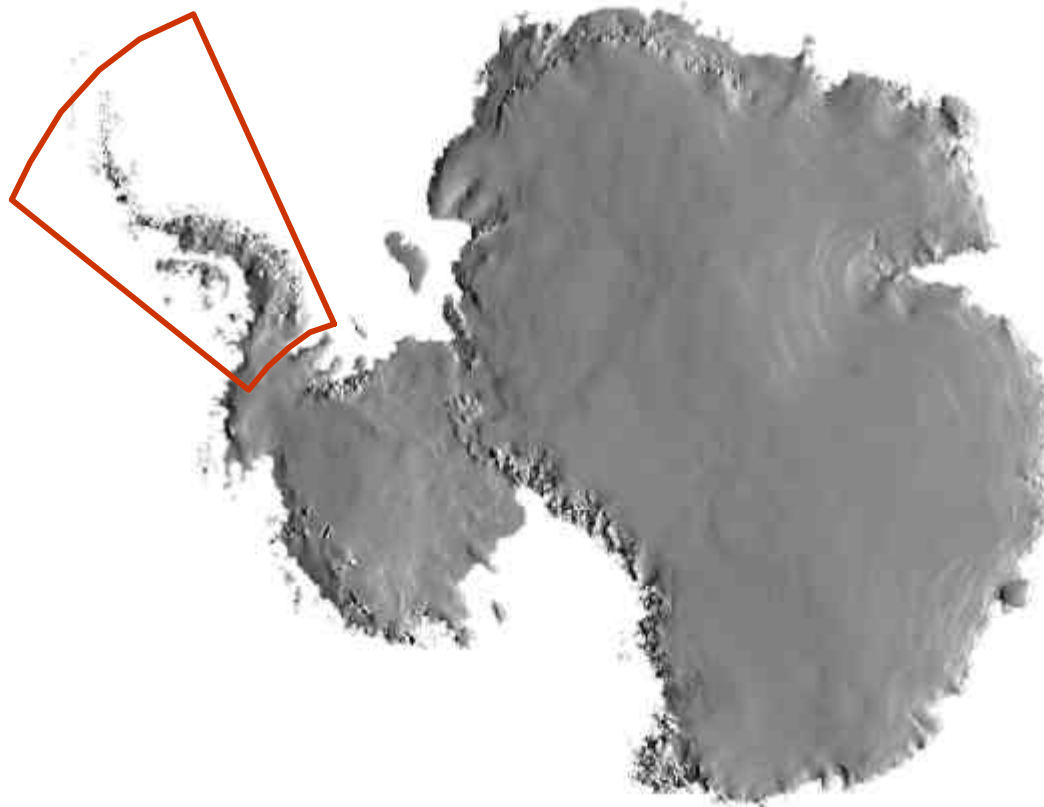


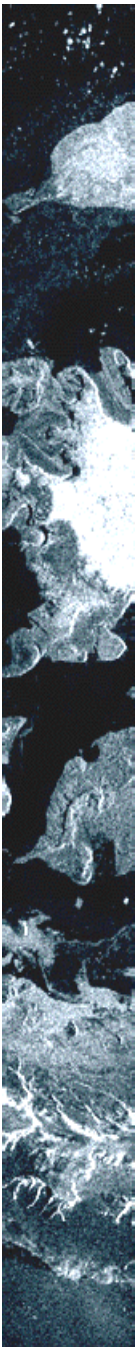


Potential Use of CryoSat SIRAL-Data on the Antarctic Peninsula



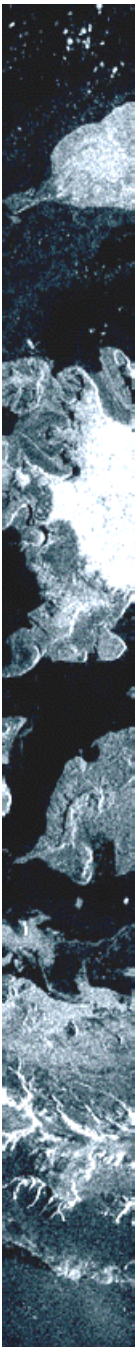
Steffen Vogt¹, Matthias Braun², Frank Rau¹, Helmut Saurer¹ & Hermann Gossmann¹

¹IPG Uni Freiburg, ²ZFL Uni Bonn



- **Motivation:**
Understanding recent climate change and associated process patterns on the Antarctic Peninsula
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- **What information might CryoSat SIRAL-Data provide?**
- **Potential study sites**
- **Conclusions**

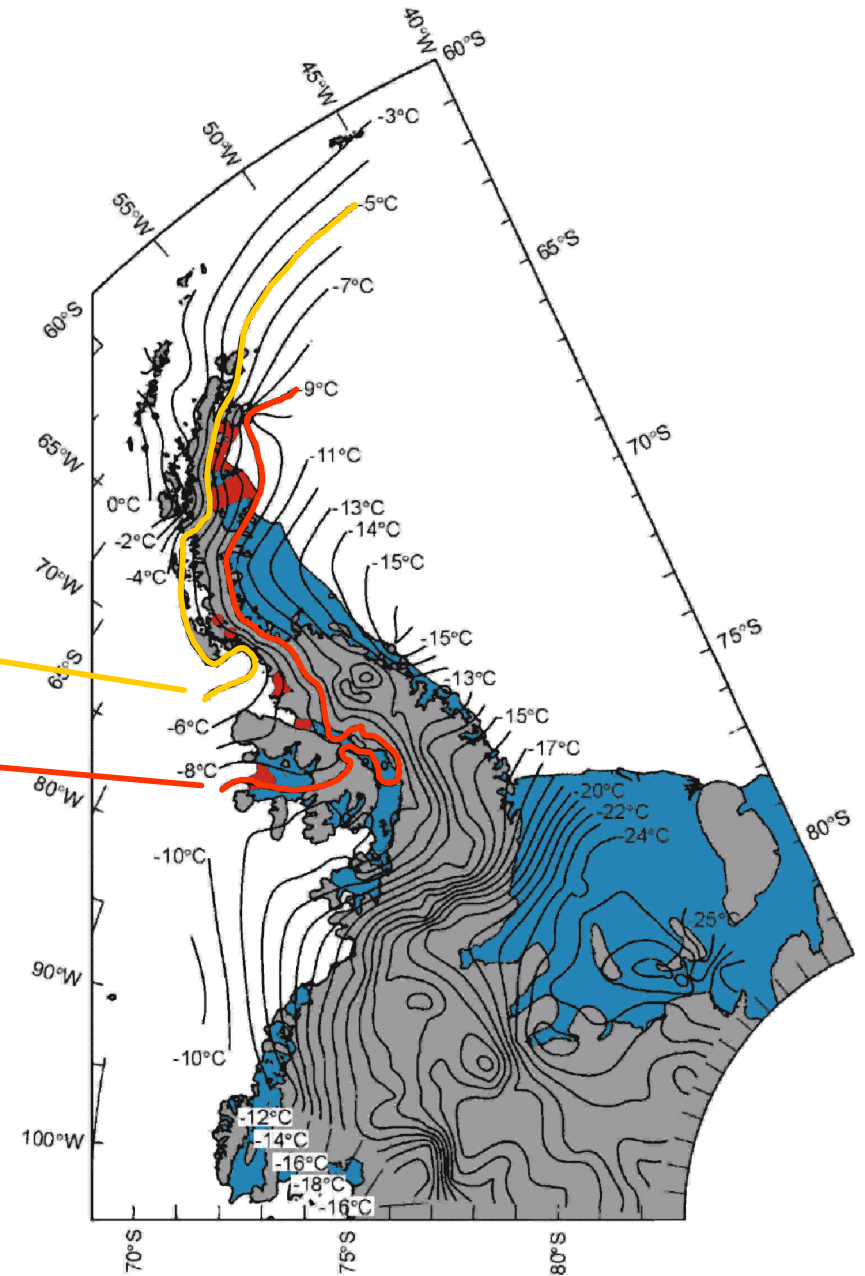




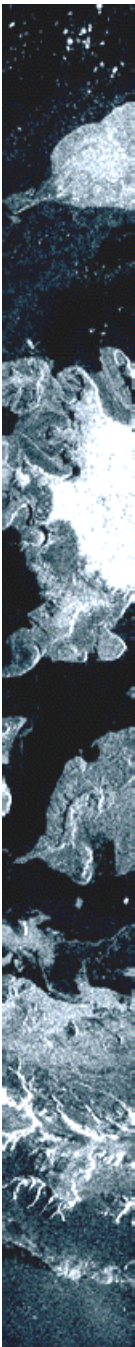
- **strong climatic gradients**
- **annual means ranging from 0°C to -17°C**

-5°C isotherm

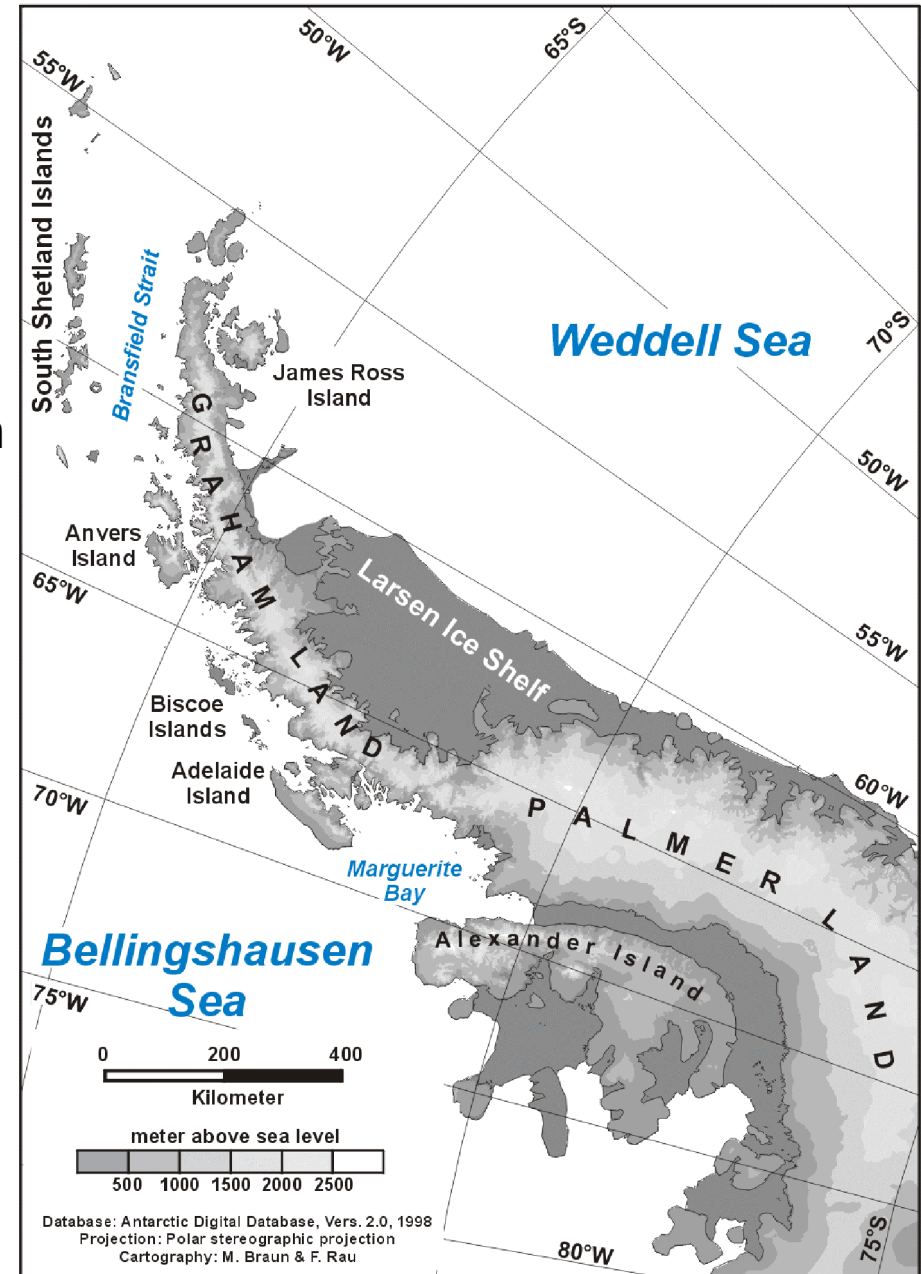
-9°C isotherm



(Isotherms corrected to sea level and epoch 2000 A.D.; after Morris & Vaughan, in press)

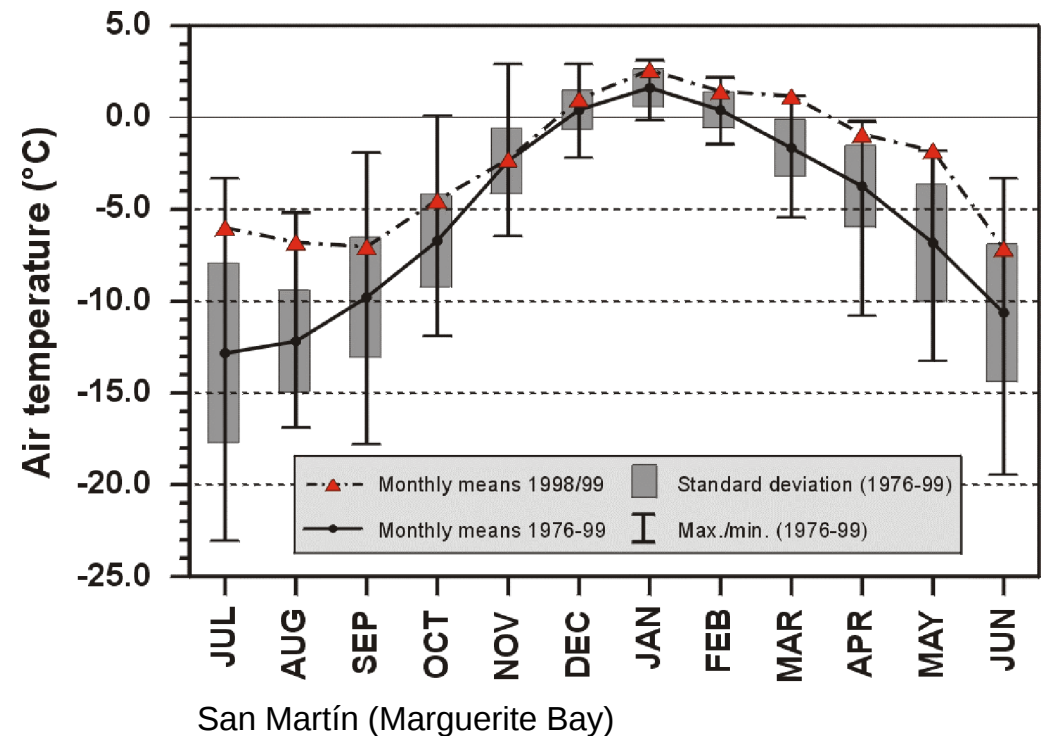


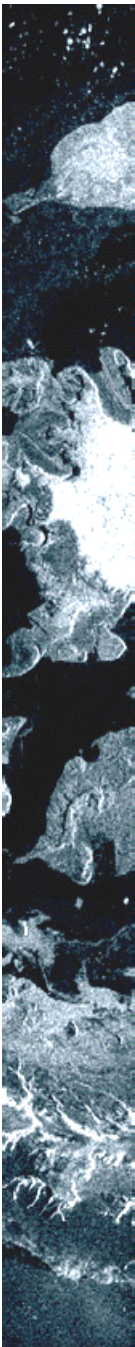
- alpine type glaciers (several hundreds)
- fed by a contiguous ice sheet on the spine
- mainly tide water glaciers



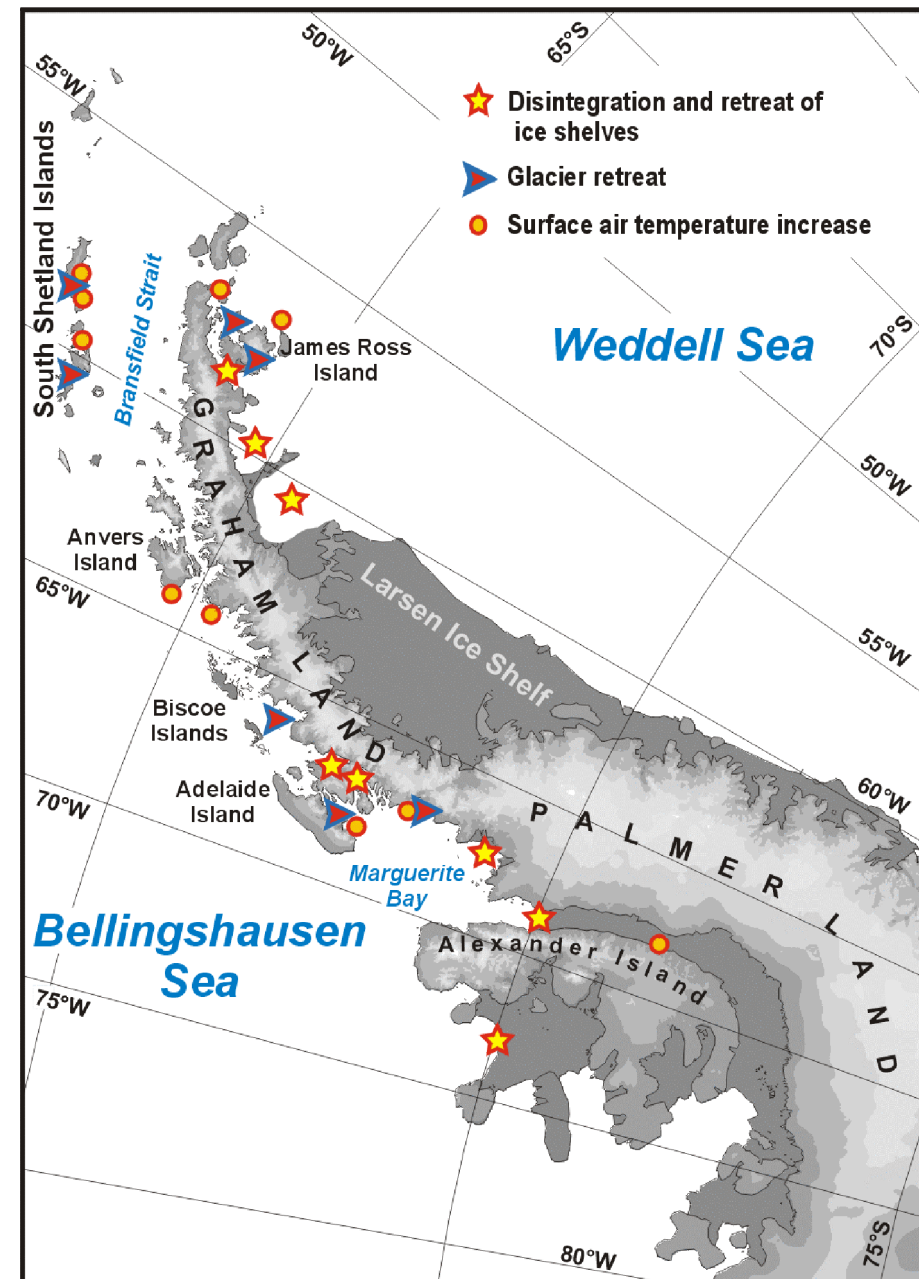
meteorological (point) measurements

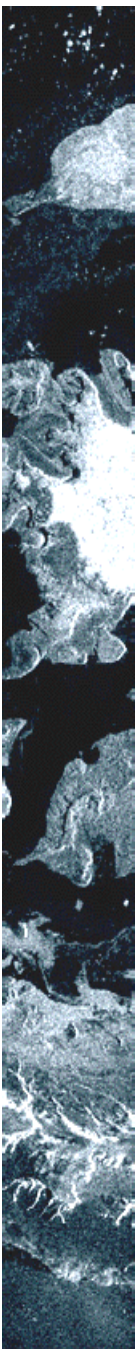
- significant increase of surface air temperatures
- lengthening of ablation season
- extension of areas affected by snow-melt
- increased melt-water production
- changing precipitation patterns
- changing accumulation and ablation patterns



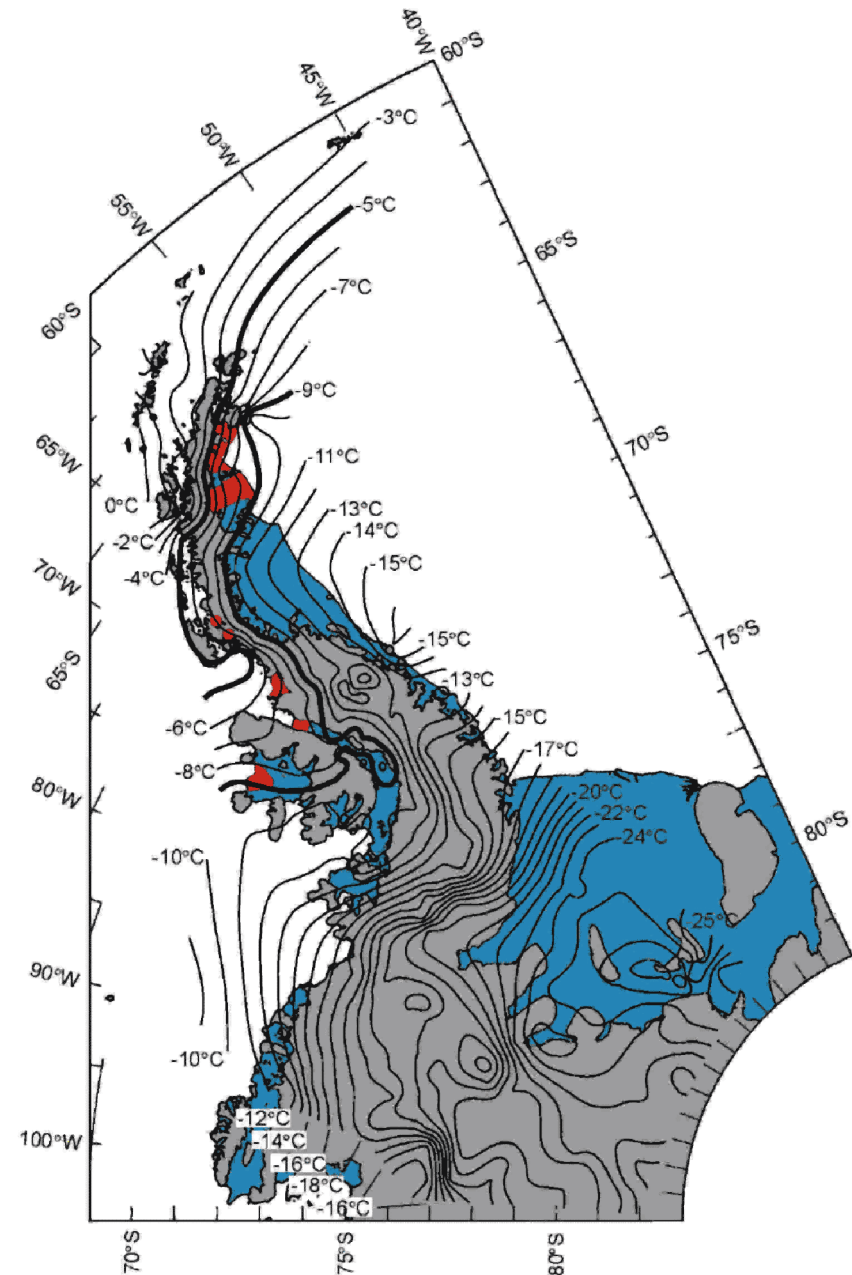


- ice shelves (retreat, disintegration)
- fast responding glacial systems
- retreat, advance, change in velocity



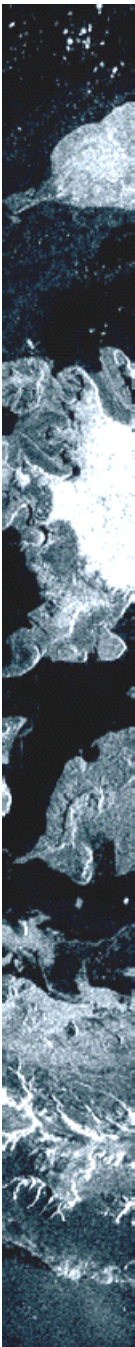


- there are maps of temperature distribution (e.g. Morris and Vaughan), or net surface accumulation (e.g. Turner et al., 2002)
- based on sparse data, data gaps identified e.g. on the spine
- GCMs and re-analysis data do not well represent the characteristics of the Peninsula



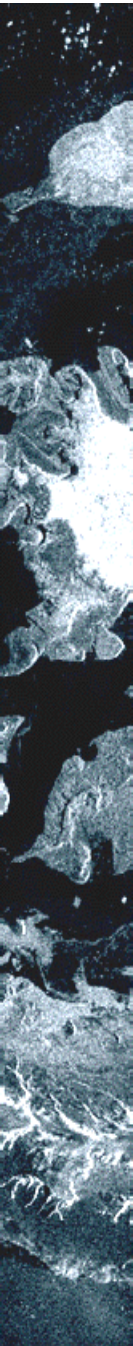
(Isotherms corrected to sea level and epoch 2000 A.D.; after Morris & Vaughan, in press)





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GLIMS

Global **L**and **I**ce **M**easurements from **S**pace

Coordination

- US Geological Survey (USGS), Flagstaff
- NASA Earth Observing System (EOS)
- EROS Data Center, Sioux Falls
- National Snow and Ice Data Center (NSDIC), Boulder

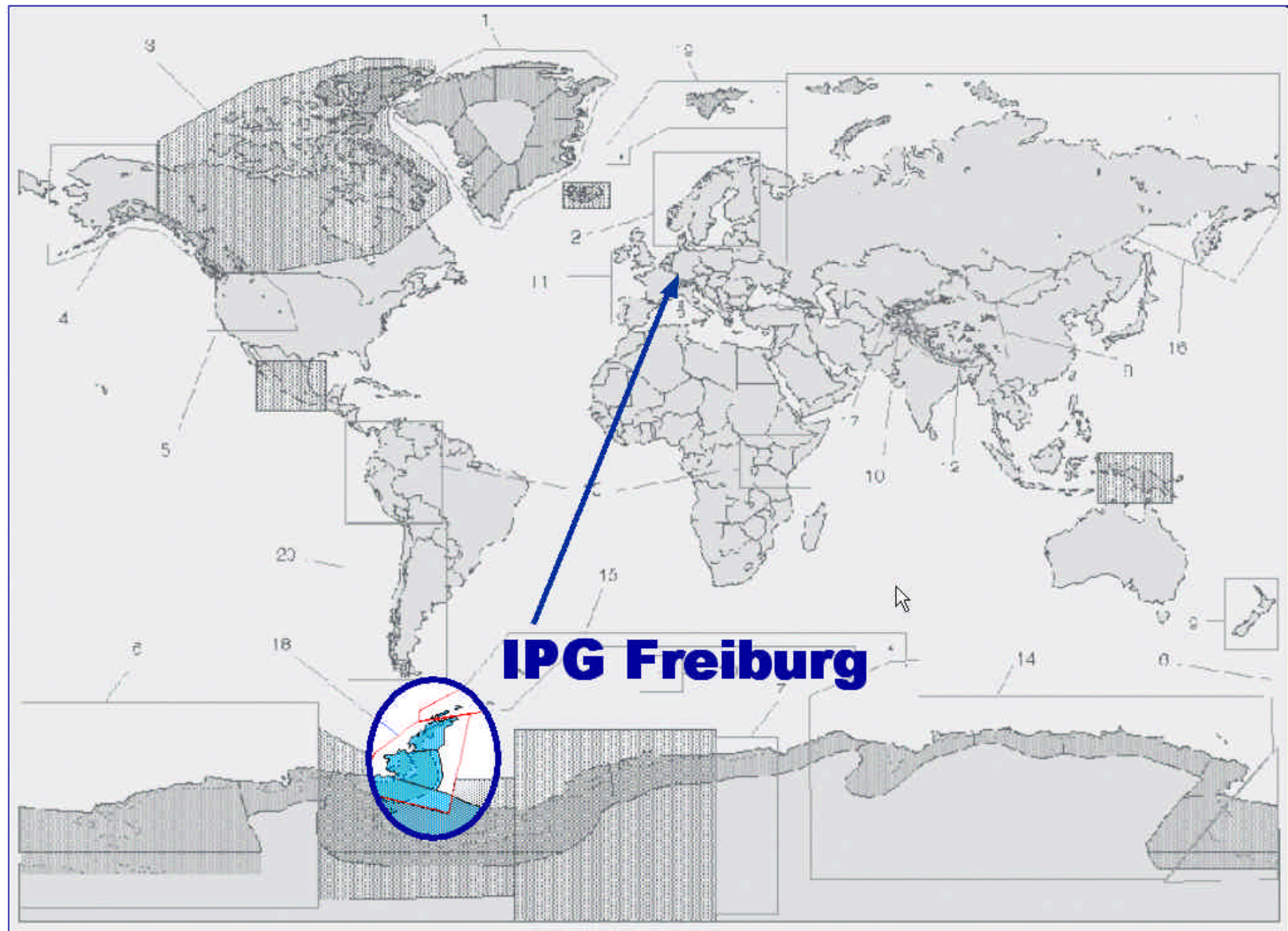


IPG

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GLIMS – Regional Center Antarctic Peninsula



GLIMS – Regional Center Antarctic Peninsula

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NASA / Goddard Space Flight Center, USA

Gino Casassa

Centro de Estudios Científicos, Chile

Helmut Rott

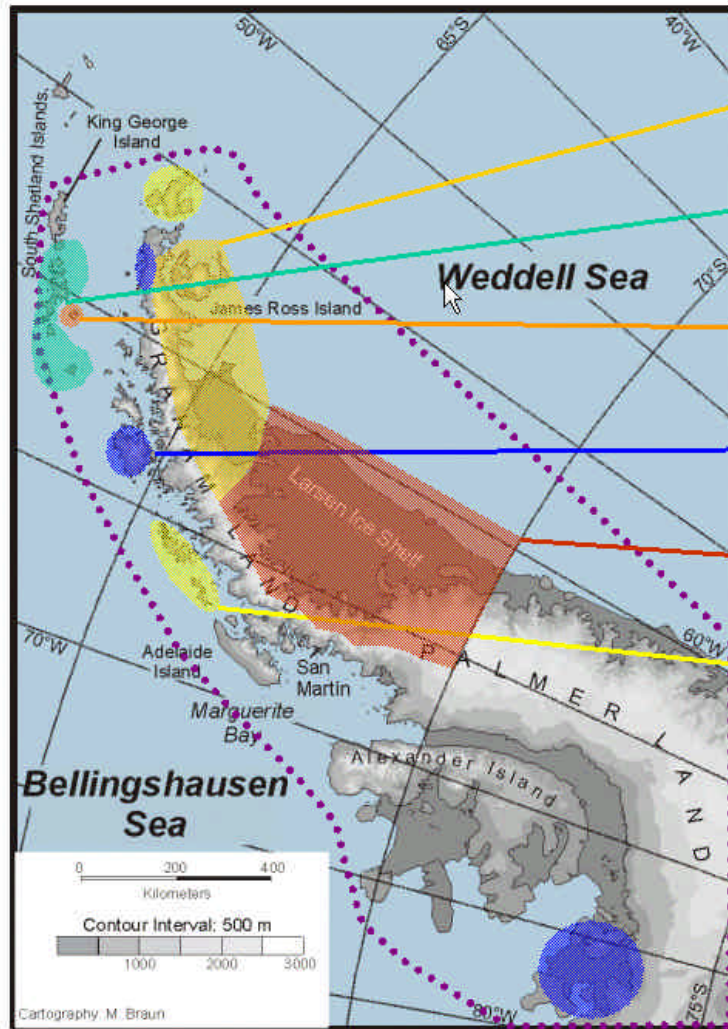
Institut für Meteorologie und Geophysik, Austria

Jefferson C. Simões

Universidade Federal do Rio Grande do Sul, Brasil

Franco Coren

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Italy



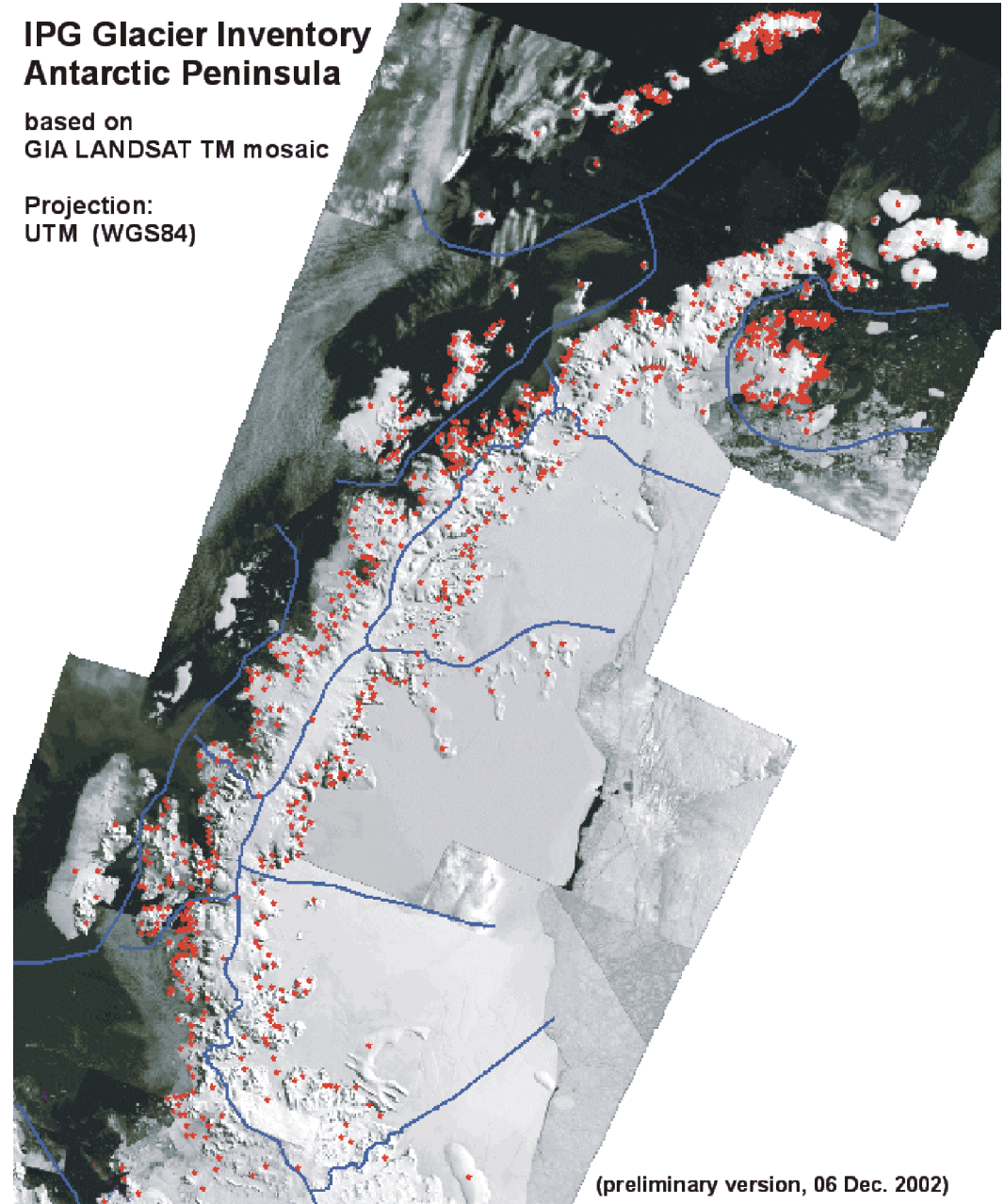
IPG Glacier Inventory Antarctic Peninsula

- Comprises more than 900 data-base entries for individual glaciers and major ice-masses on the Antarctic Peninsula north of 70° South
- Ongoing work: Extension to ~75° South

IPG Glacier Inventory Antarctic Peninsula

based on
GIA LANDSAT TM mosaic

Projection:
UTM (WGS84)



Glacier inventory Antarctic Peninsula



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matthias.braun@uni-bonn.de

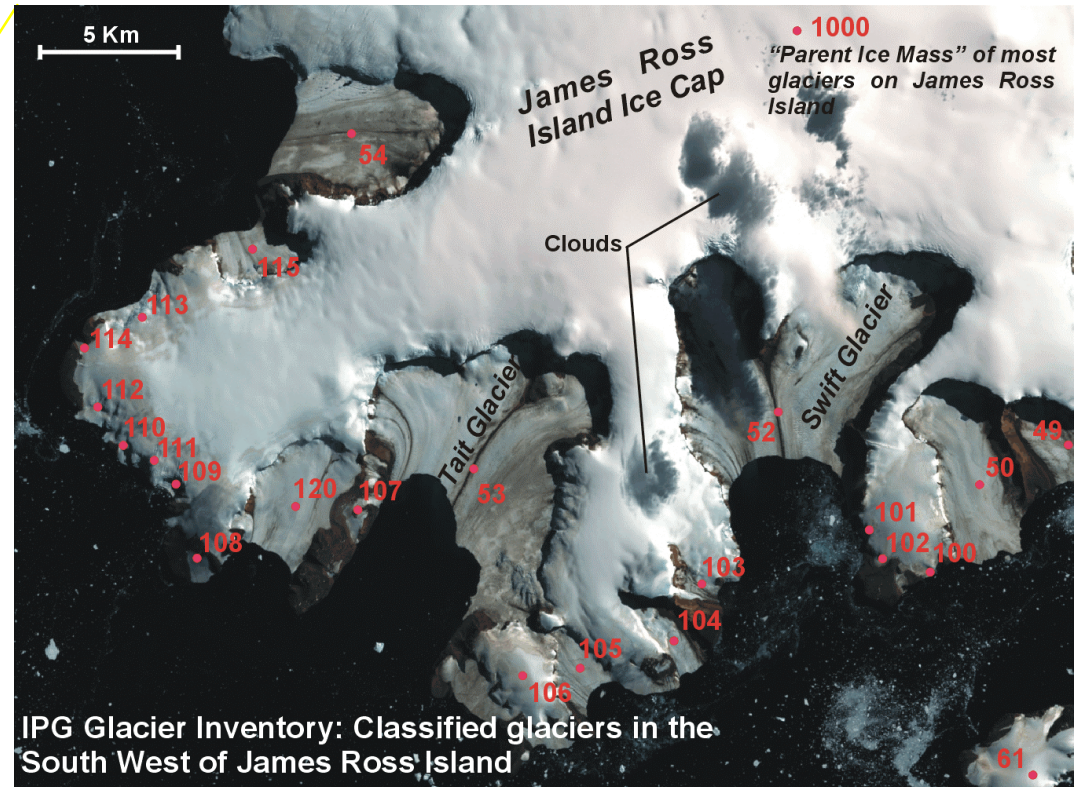
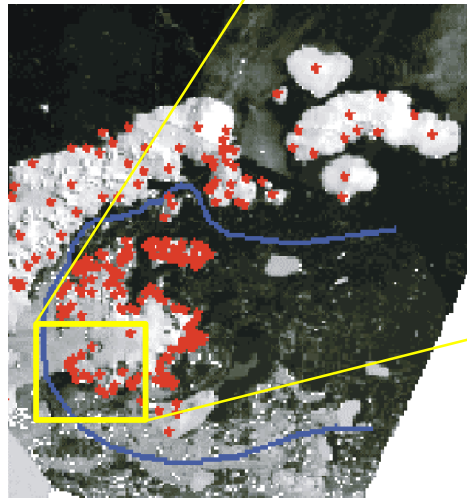


IPG Glacier Inventory Antarctic Peninsula

James Ross Island

GLIMS glacier-static parameters

- GLIMS Glacier Id
- Local_Glacier_Id
- Position UTM
- Position Lat / Long
- Glacier_Name
- Glacier_Name_Additional
- Parent_Ice_Mass_Flag
- Parent_Ice_Mass_Id



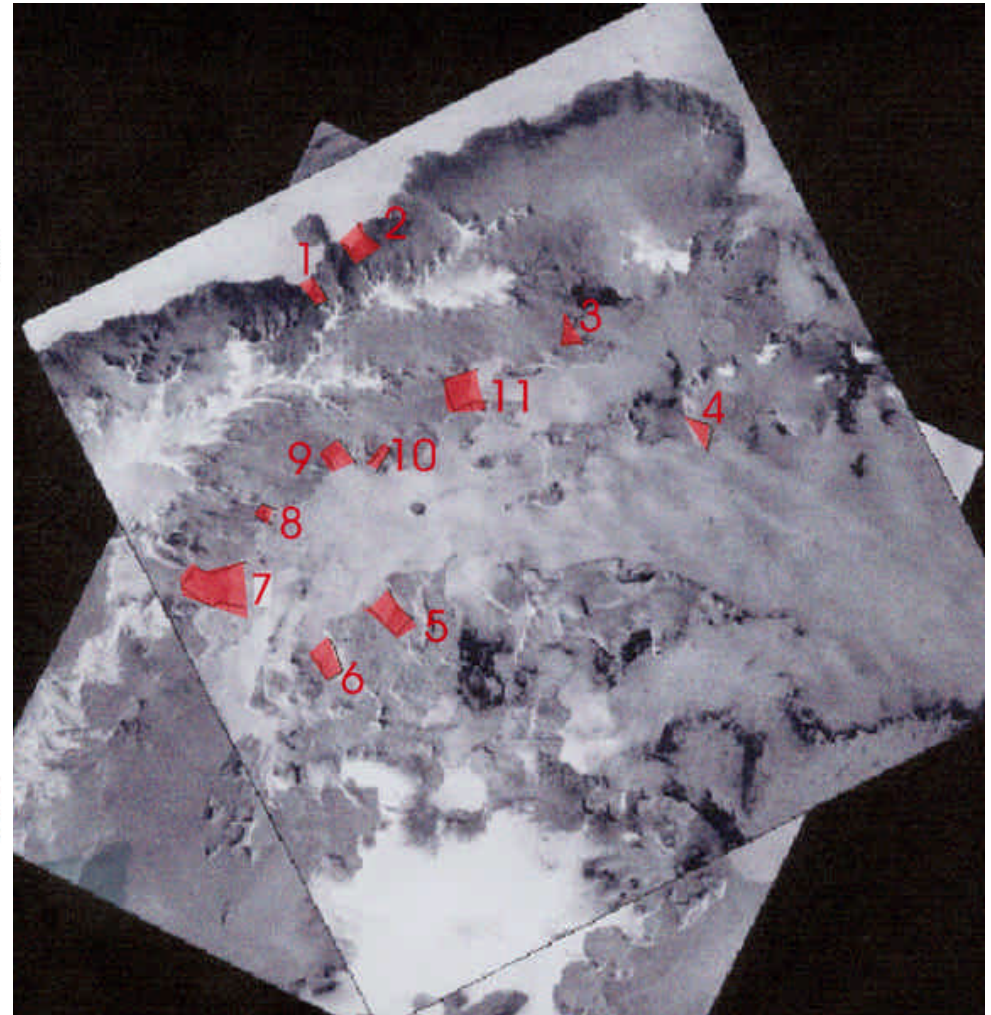
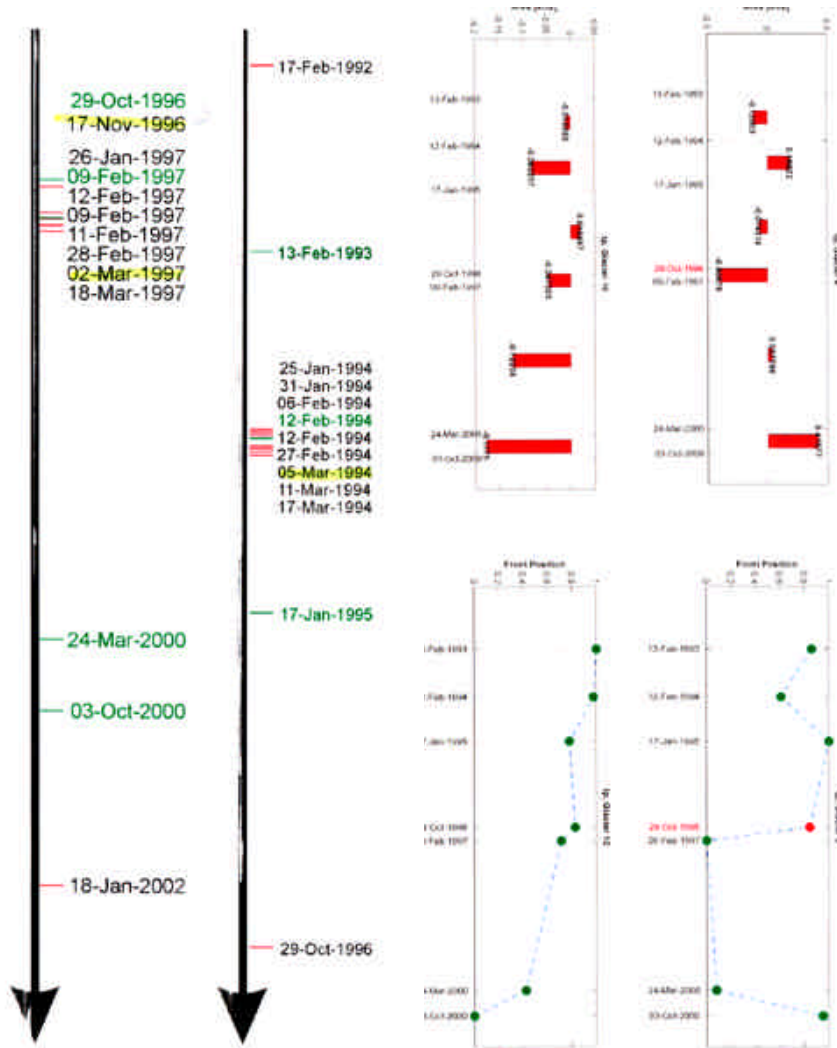
GLIMS glacier-dynamic parameters

- GLIMS Glacier Id
- Catchment boundaries
- Geometric parameters (centerline, length, width, area, etc.)
- Glacier Classification (Form; Frontal Characteristic; Longitudinal Characteristic; Dominant Mass Source; Tongue_Activity; etc.)
- Moraine Classification
- Frontal_Position_Change
- Snowline & ELA

Glacier inventory Antarctic Peninsula

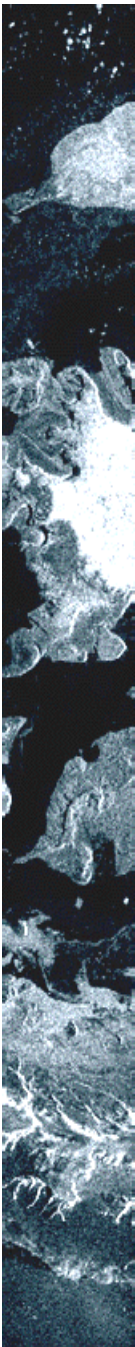


Example: seasonal / interannual variations of frontal positions based on SAR data



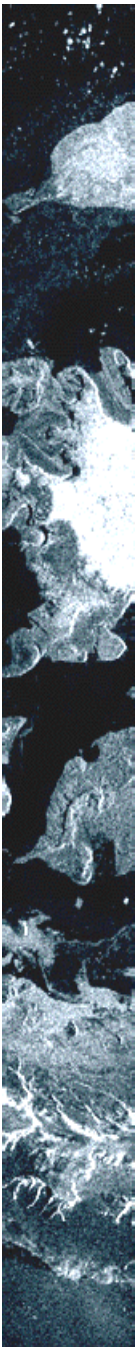
F. König, 2003





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- **Conclusions**





- **We can provide context to the interpretation of CryoSat data on the Peninsula (mainly based on SAR data and re-assessment of existing data sets including field surveys)**
- **CryoSat data might provide urgently needed information on spatial (and interannual) variation of accumulation on the spine**



IPG

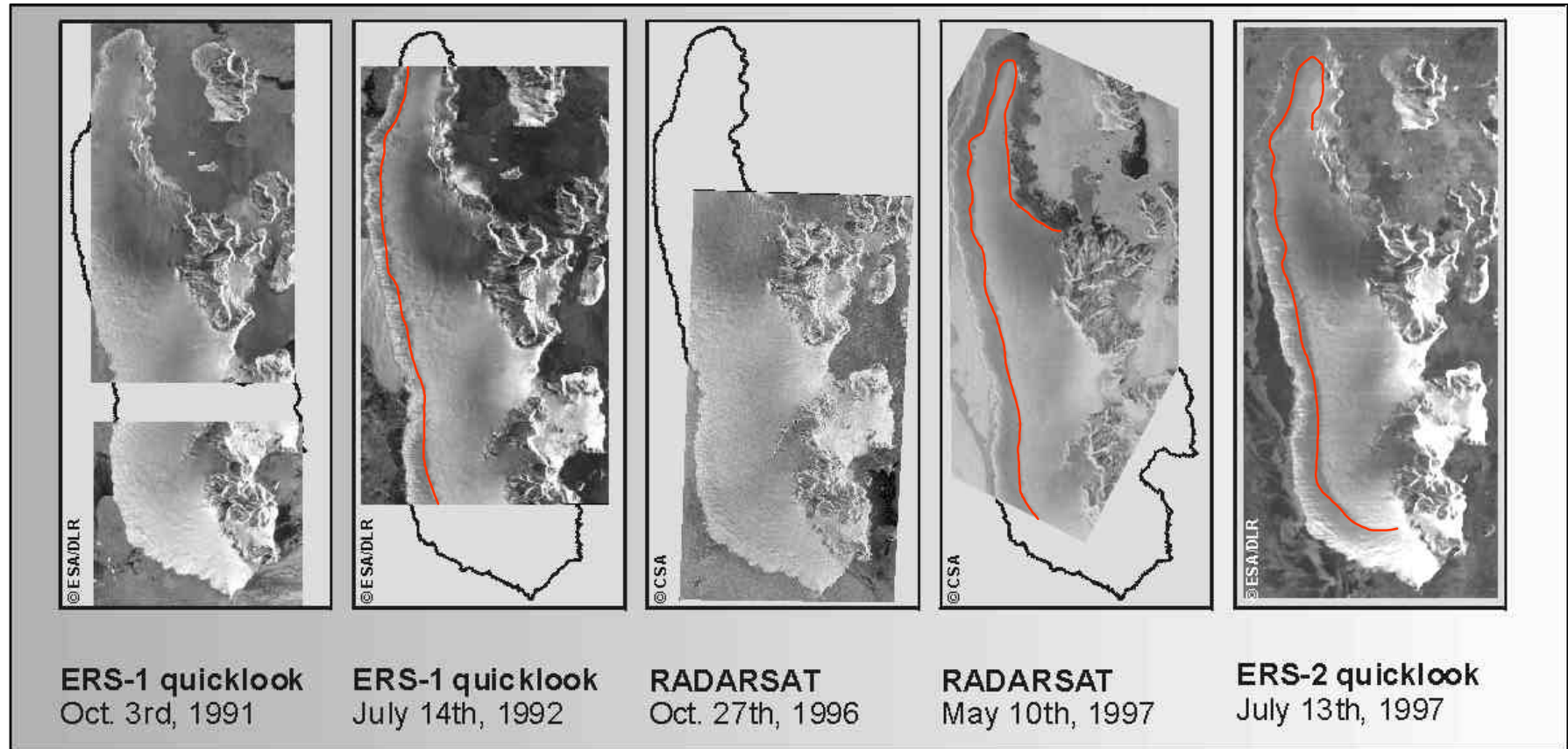
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matthias.braun@uni-bonn.de



Providing context to the interpretation of CryoSat data

Example Adelaide Island:



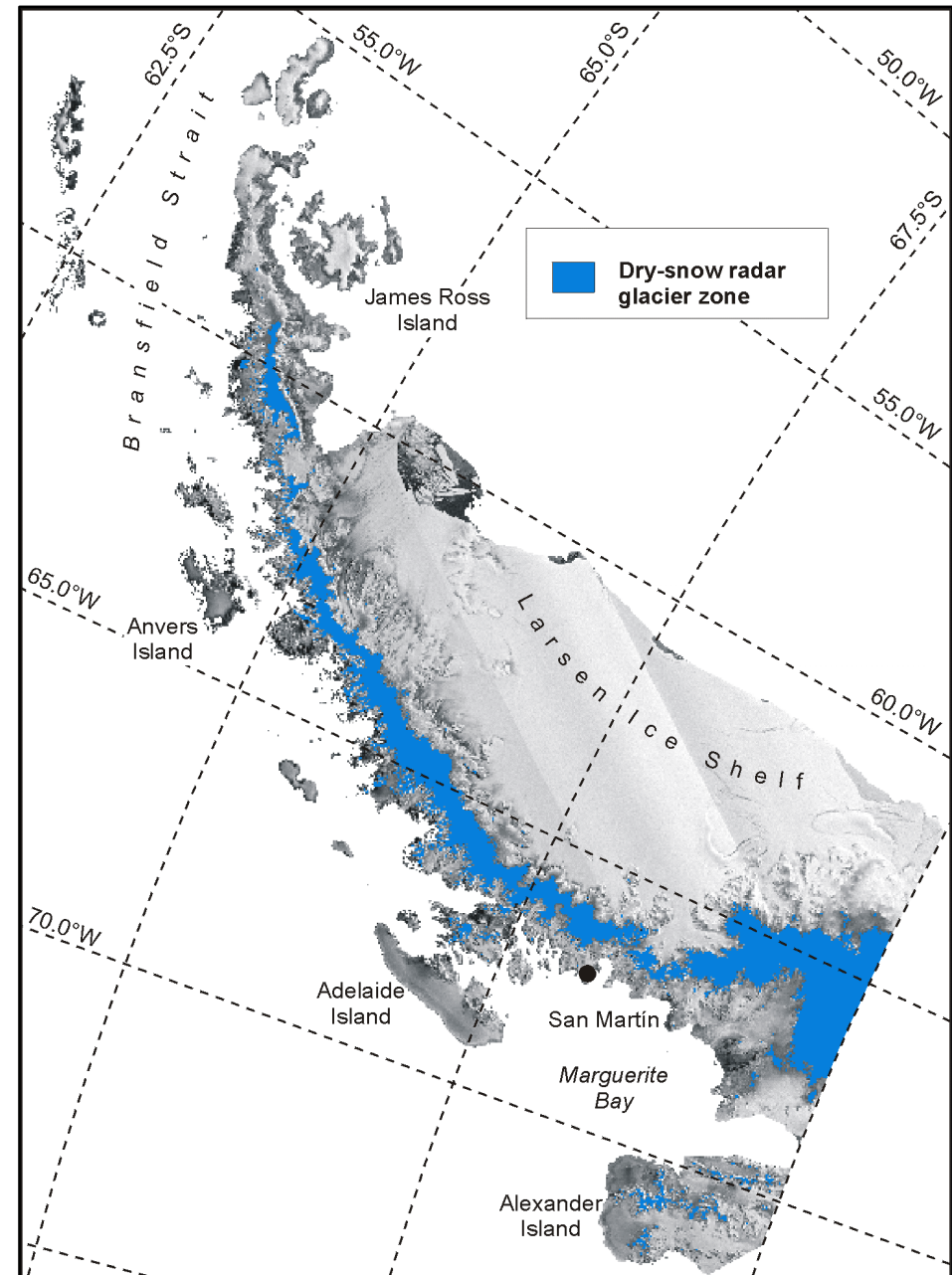
— firnline at the end of the ablation period



Providing context to the interpretation of CryoSat data

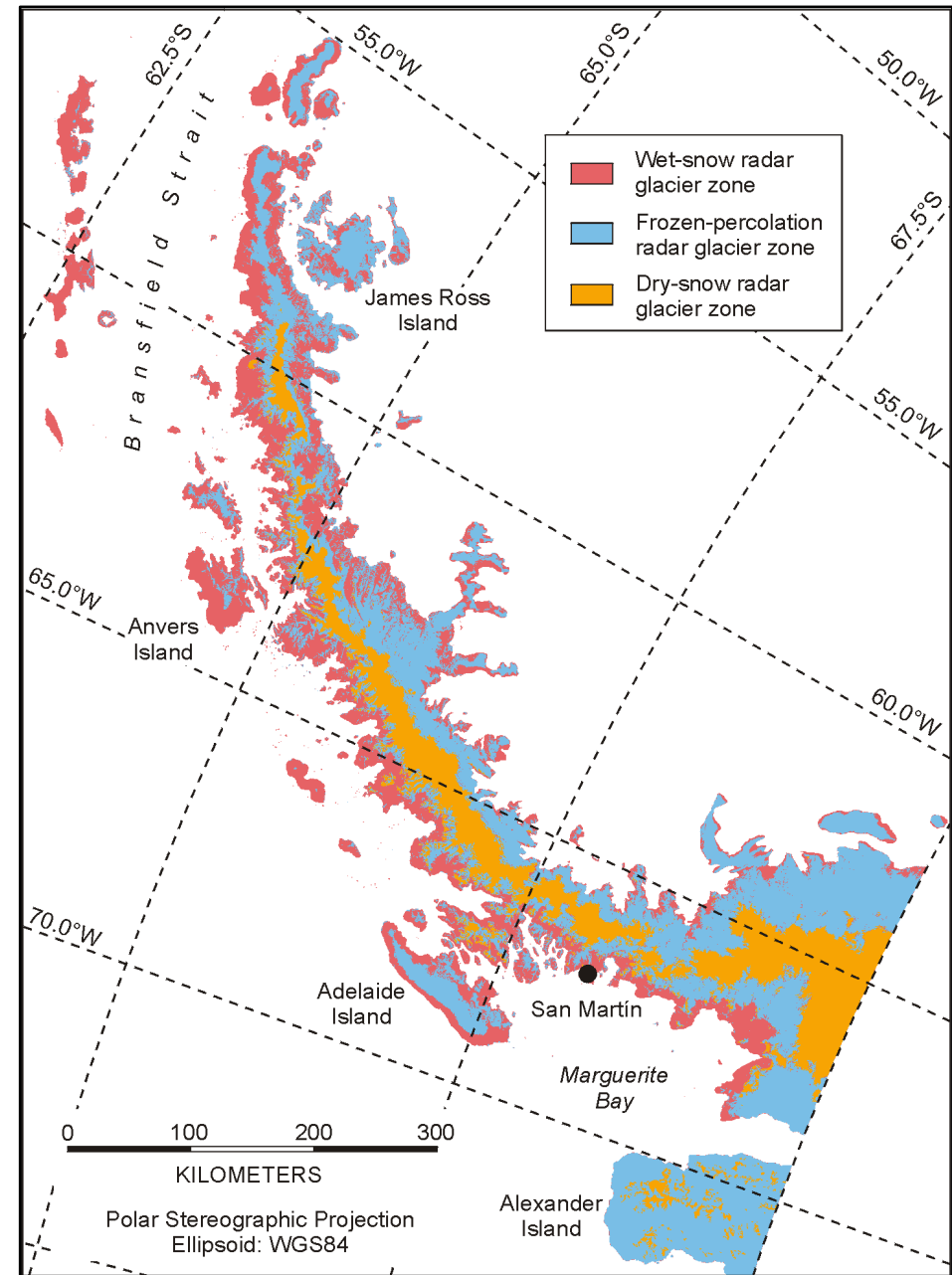
Exaple: Dry Snow Radar Zone

Radar Glacier Zone	Area	
	(km ²)	(%)
Dry snow radar zone (18 th November 1998)	21254	18.0
Dry snow radar zone (12 th December 1998)	22833	19.3
Superposition	23300 ± 2000	19.7 ± 1.7
Antarctic Peninsula north of 70°S without ice shelves	118185	100.0



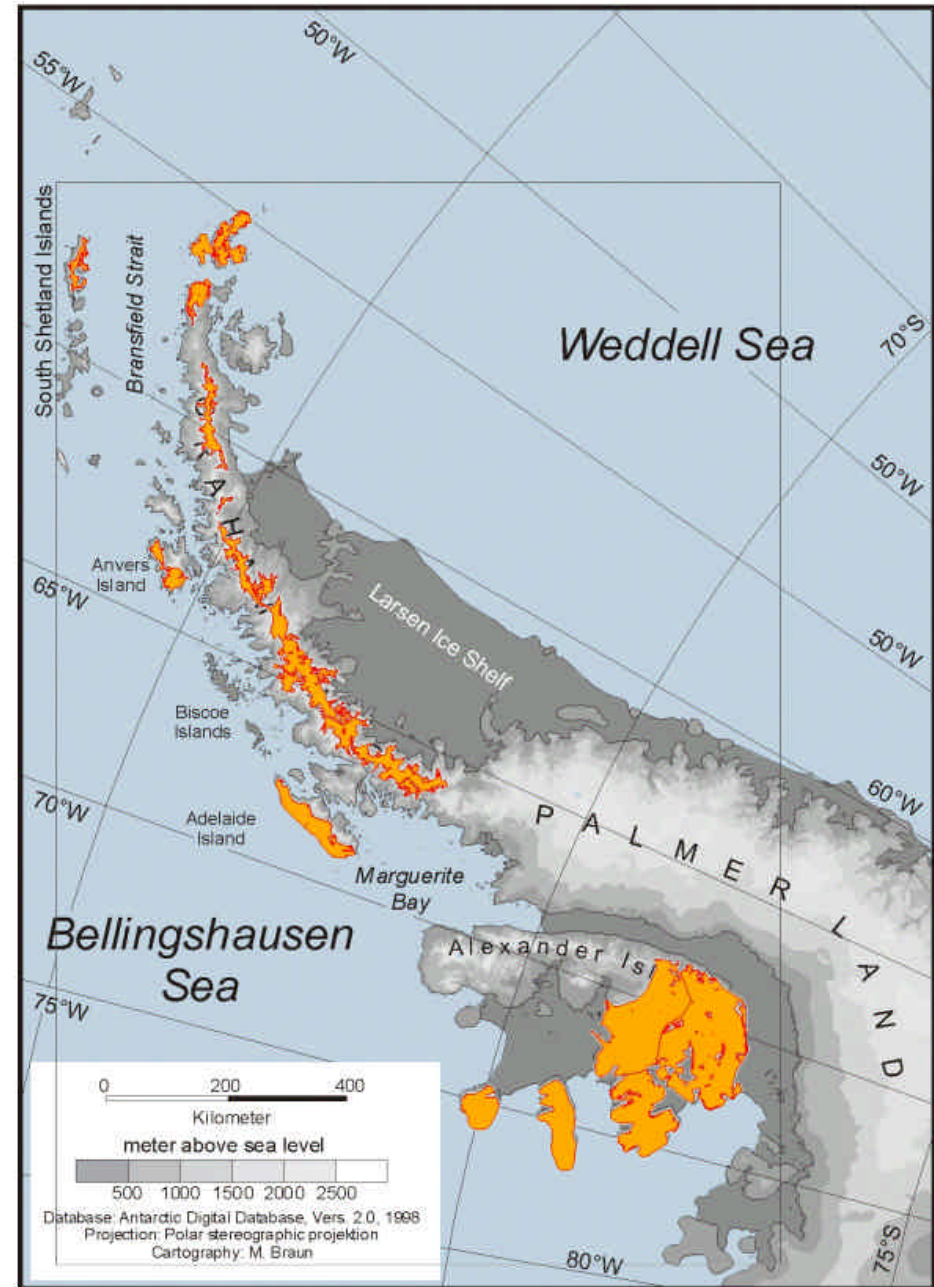
SAR data allows assessment of snow surface properties on a regular temporal scheme

Radar Glacier Zone	Area	
	(km ²)	(%)
Dry snow radar zone	23300	19.7
Frozen percolation radar zone (5 th January 1999)	56685	48.0
Wet snow radar zone (5 th January 1999)	38200	32.3
Potential areas of snow melt	94885	80.3
Potential areas of snow melt corrected for relief / snowfree areas	85000	71.9
<i>Antarctic Peninsula north of 70°S without ice shelves</i>	<i>118185</i>	<i>100.0</i>



potential SIRAL target areas

- KGI (600km²)
- Joinville Island (1200km²)
- Mott Snowfield (800 km²)
- Detroit Plateau (1300km²)
- Anvers Island (850km²)
- Bruce Plateau N (2300km²)
- Bruce Plateau S (4400km²)
- FIP (2400km²)
- Dyer Plateau
- Charcot Island (1800km²)
- Latady Island (3300km²)
- Lewis Snowfield (9200km²)
- Beethoven Penins. (5400km²)
- Monteverdi Penins. (9000km²)



orange slope < 4°



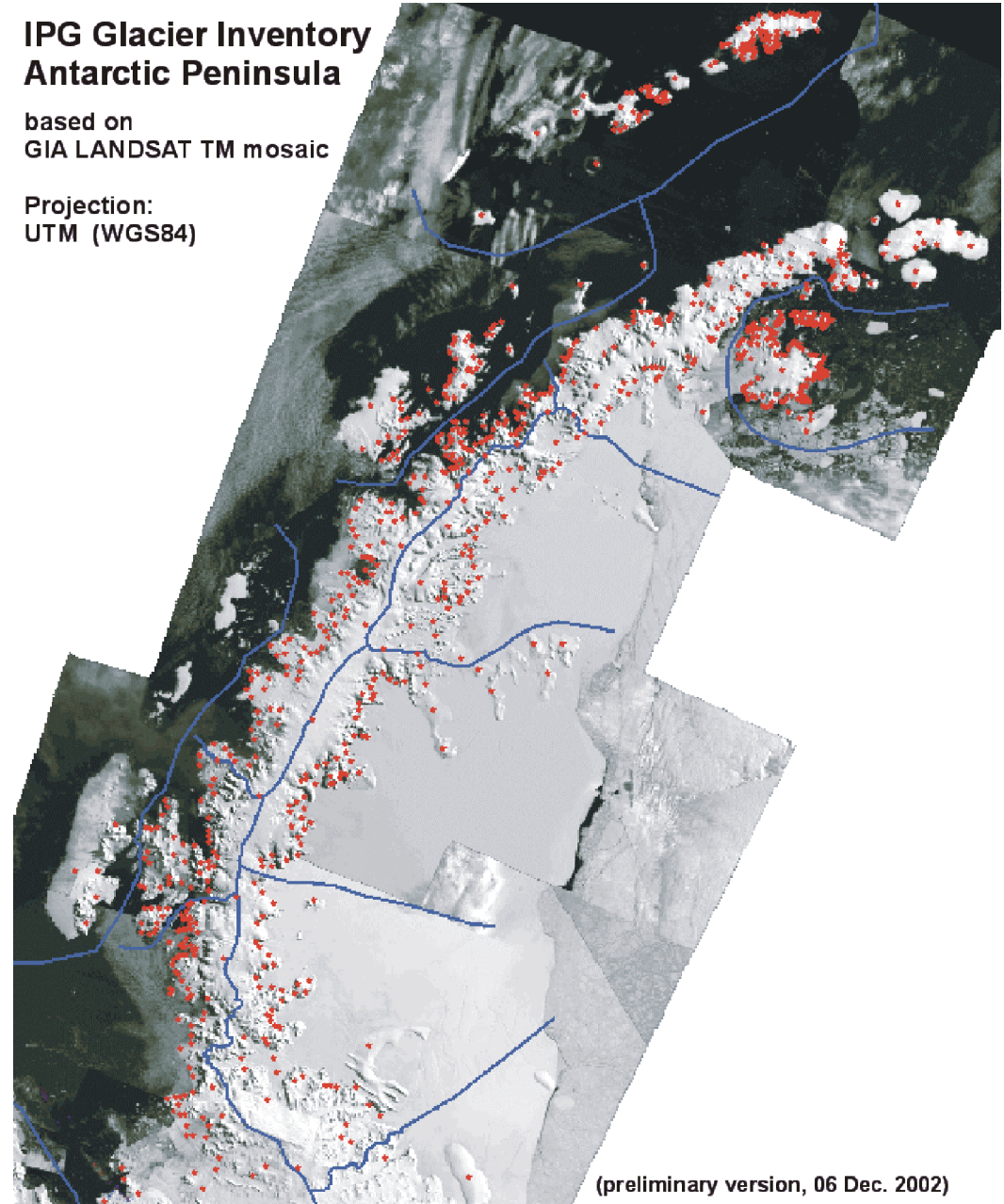
Putting the jigsaw together...

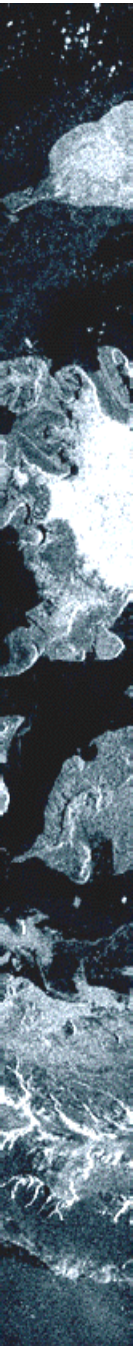
- **Statistical analysis** should yield knowledge on the frontal behaviour related to location and glacier type
- **Cryosat** might yield knowledge on spatial variation of accumulation on the spine
- **InSAR** would yield knowledge on glacier velocities
- **Meteorological information** supports the explanation of observed patterns
- this knowledge would be a substantial improvement towards understanding (and modelling) the behaviour of the Antarctic Peninsula Ice sheet

IPG Glacier Inventory Antarctic Peninsula

based on
GIA LANDSAT TM mosaic

Projection:
UTM (WGS84)





Conclusions

- we propose to use SAR data to provide context for the interpretation of Cryosat data
- we want to assess spatial (and temporal) fluctuations in accumulation on the spine
- combining statistical analysis of the behaviour of the low lying areas, flow velocities and surface mass balance in the accumulation area we hope to substantially improve understanding of the AP glacial system



Open Questions

- Can we expect to get reasonable measurements in the proposed test sites (in terms of geometry and number of data points)?
- What would the Level 2 data look like?
- How accurate would the positioning be?
- Is it overly optimistic to expect to be able to assess interannual fluctuations of accumulation on the spine of the Peninsula?
- What are the validation activities of the CVRT on the Peninsula?

