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Reprocessing of aeromagnetic data under consideration of satellite data for interpretation and modelling

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EGU 2020

Aeromagnetic data in a Gondwana framework

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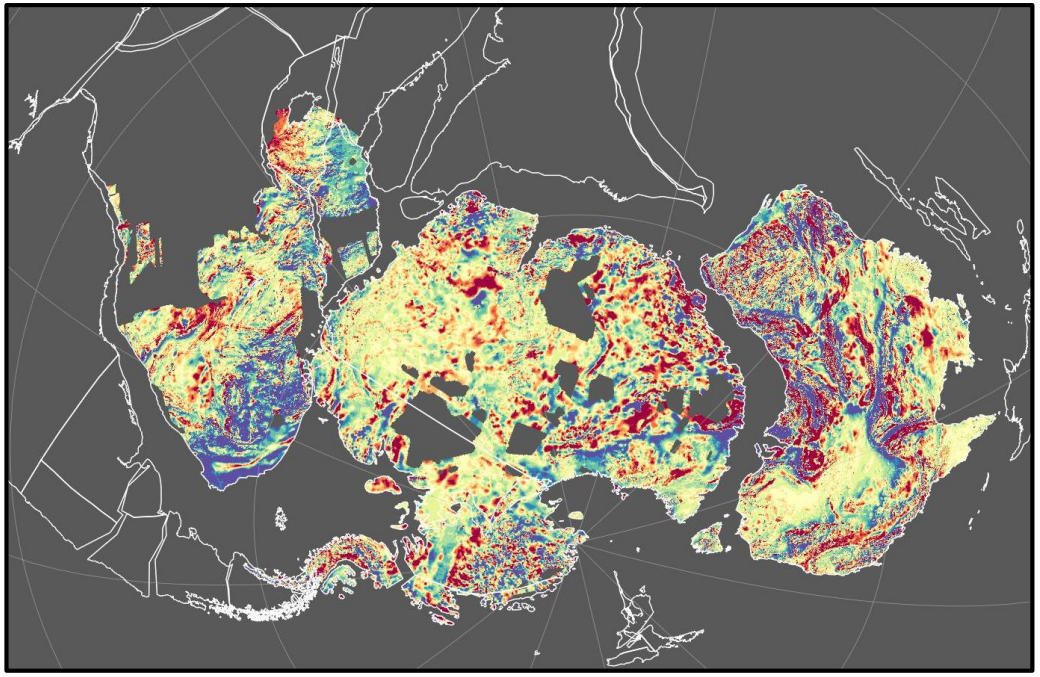
Reconstruction showing high resolution aeromagnetic compilation for South Africa (1999), Antarctica (ADMAP-2, 2018) and Australia (2015)



Please note, the shift between South Africa and its surroundings, both towards the north and towards Antarctica.

Correcting the long-wavelength part in aeromagnetic surveys using satellite data

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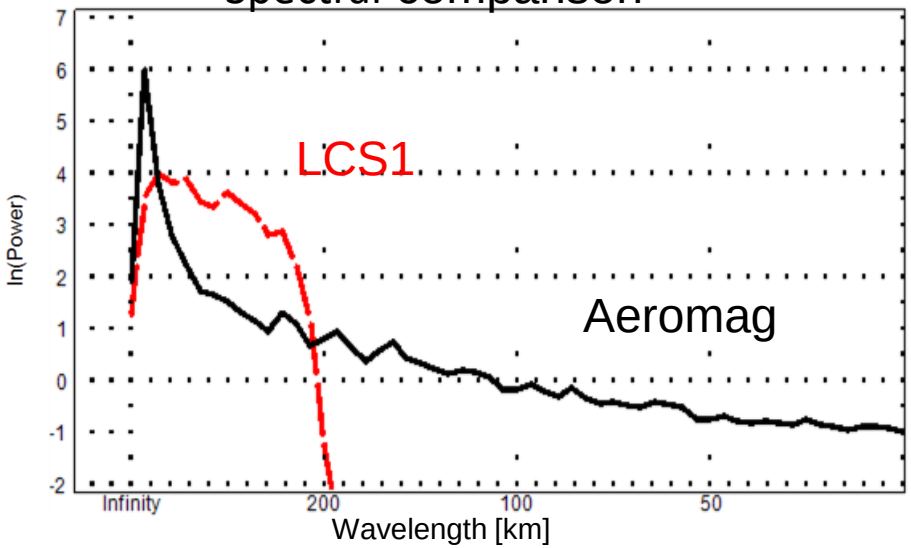
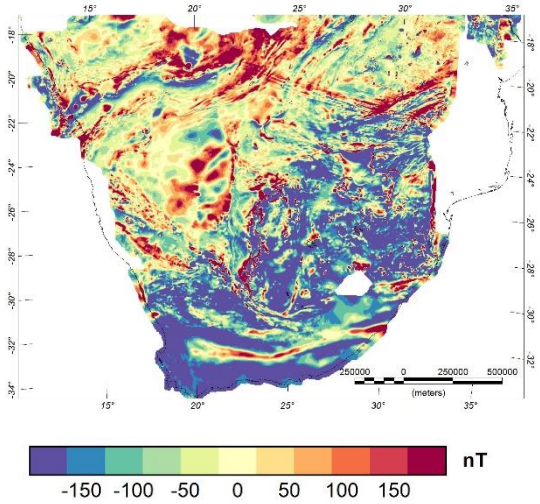
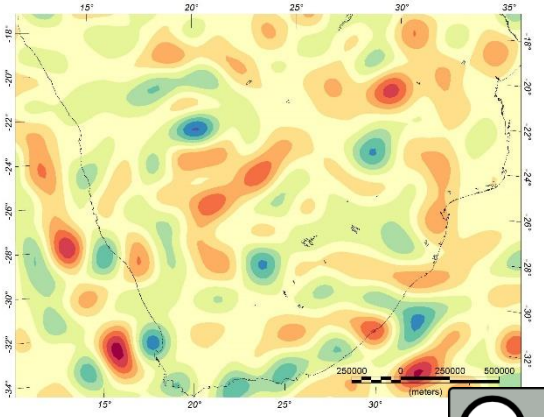
Spectral comparison



Aeromag (Stettler et al. 1999)



LCS1



The satellite model only LCS-1 features only wavelength >220 km (~spherical harmonic degree 185)
Stable solution only to degree 135 (~300 km wavelength)

Olsen et al. 2017

Combing satellite and aeromagnetic data

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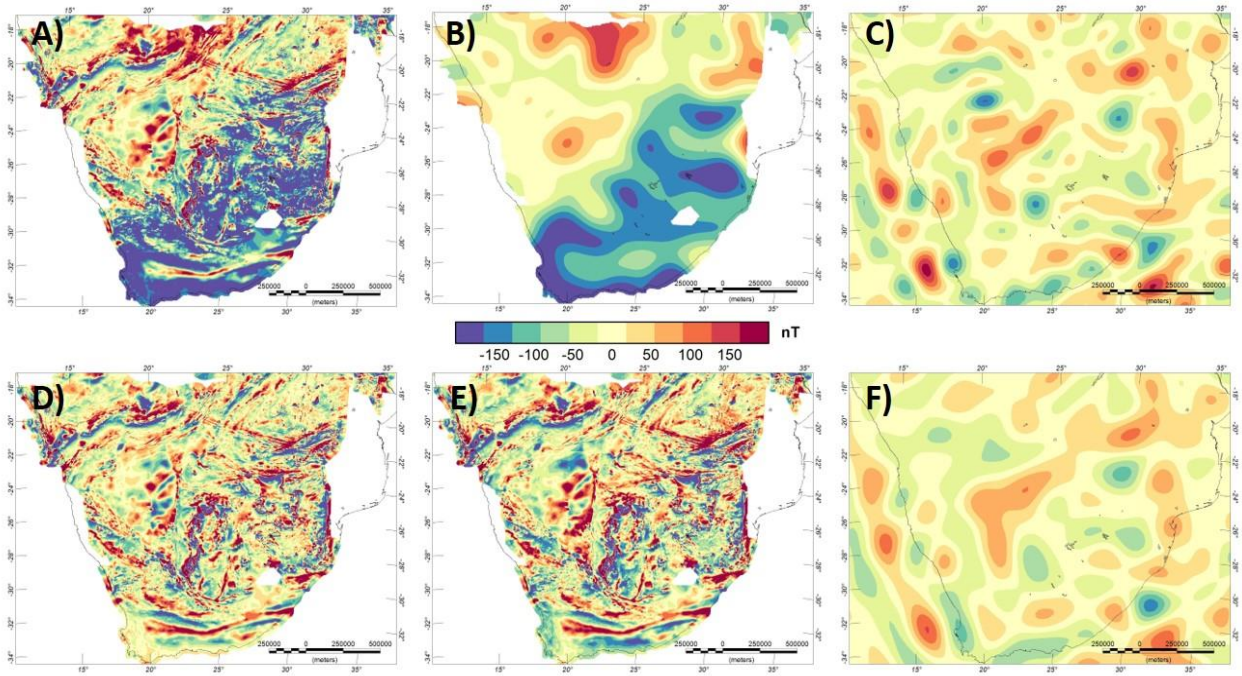

A) Original aeromagnetic compilation (Stettler et al., 2000),
B) Long-wavelength (>300km) component of aeromagnetic compilation (A)
C) Satellite-derived model LCS-1
D) Short-wavelength (<300 km) component of aeromagnetic compilation,
E) Combined aeromagnetic (D) and satellite model (F),
F) Long-wavelength (>300km) component of satellite model (C),

Combined data in Gondwana framework

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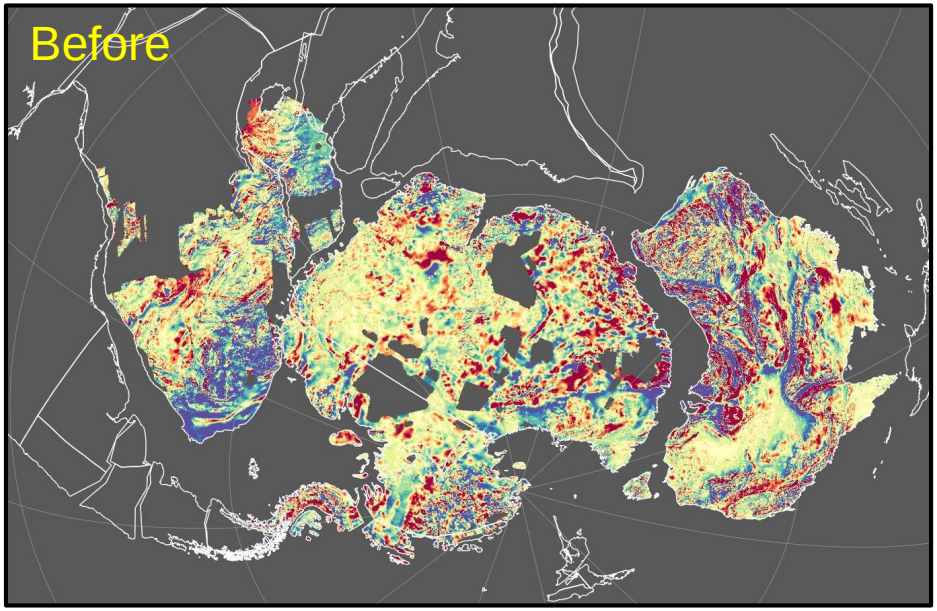

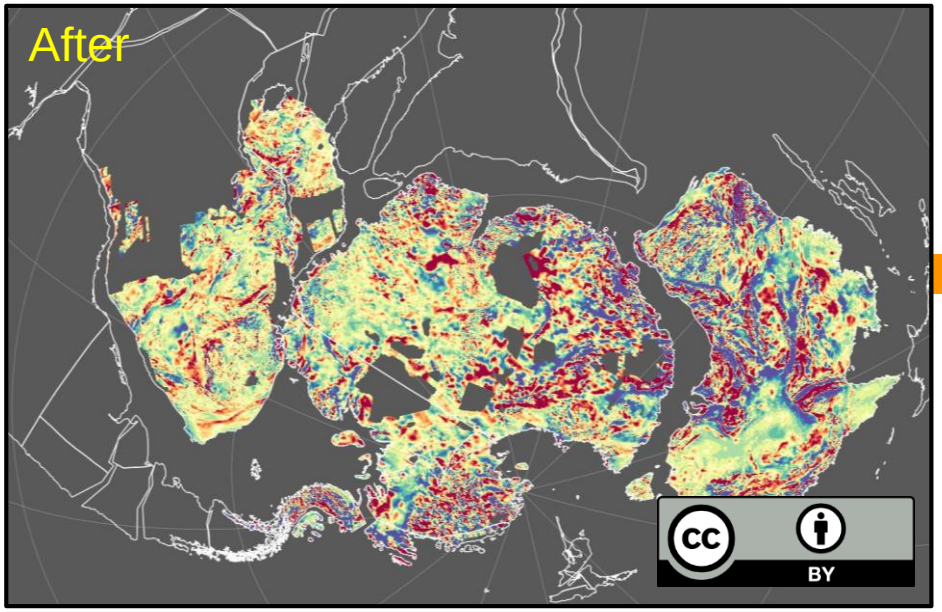

The data sets for Southern Africa, Australia and Antarctica are all processed in a similar way.

Comparison of results

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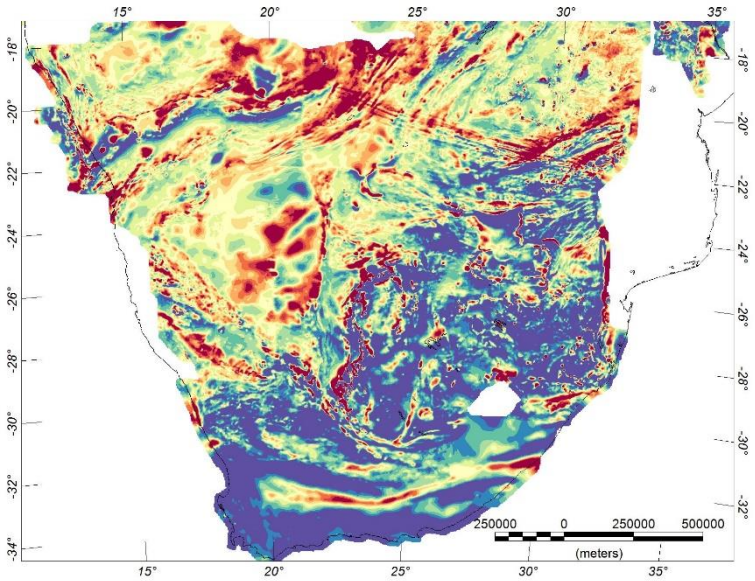
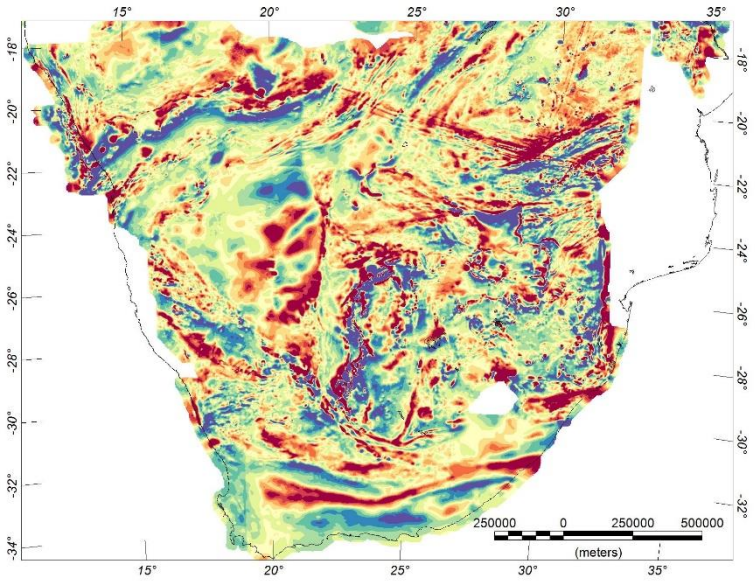
But: *„ I am not sure, if this makes sense. Geologically speaking the unprocessed data fit much better to my understanding of the tectonics*“

Geologist from Cambridge.

Original compilation



Combination of aeromag and satellite data



And: *„You used an old compilation. By now the data are much better reprocessed. I do not see the need for satellite data“*

Geophysicist from Namibia

Spectral link between satellite and modern aeromagnetic data – 2nd try

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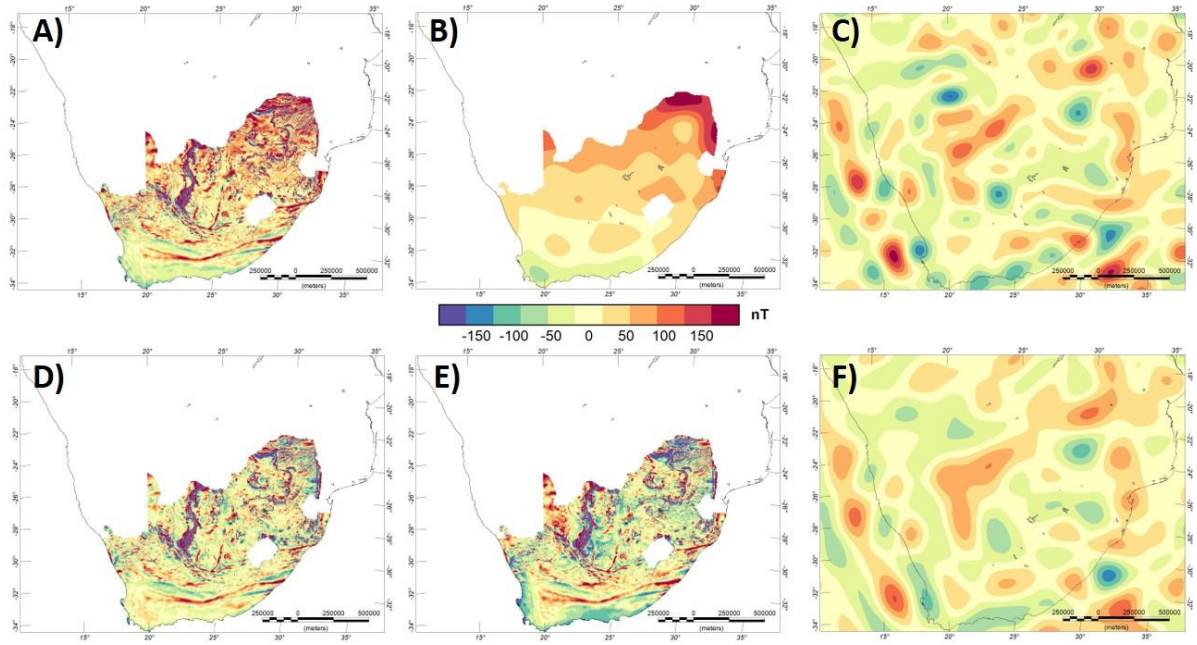

A) Original aeromagnetic compilation (Council of Geosciences, 2019),
B) Long-wavelength (>300km) component of aeromagnetic compilation (A),
C) Satellite-derived model LCS-1,
D) Short-wavelength (<300 km) component of aeromagnetic compilation,
E) Combined aeromagnetic (D) and satellite model (F),
F) Long-wavelength (>300km) component of satellite model (C).

Comparison of results

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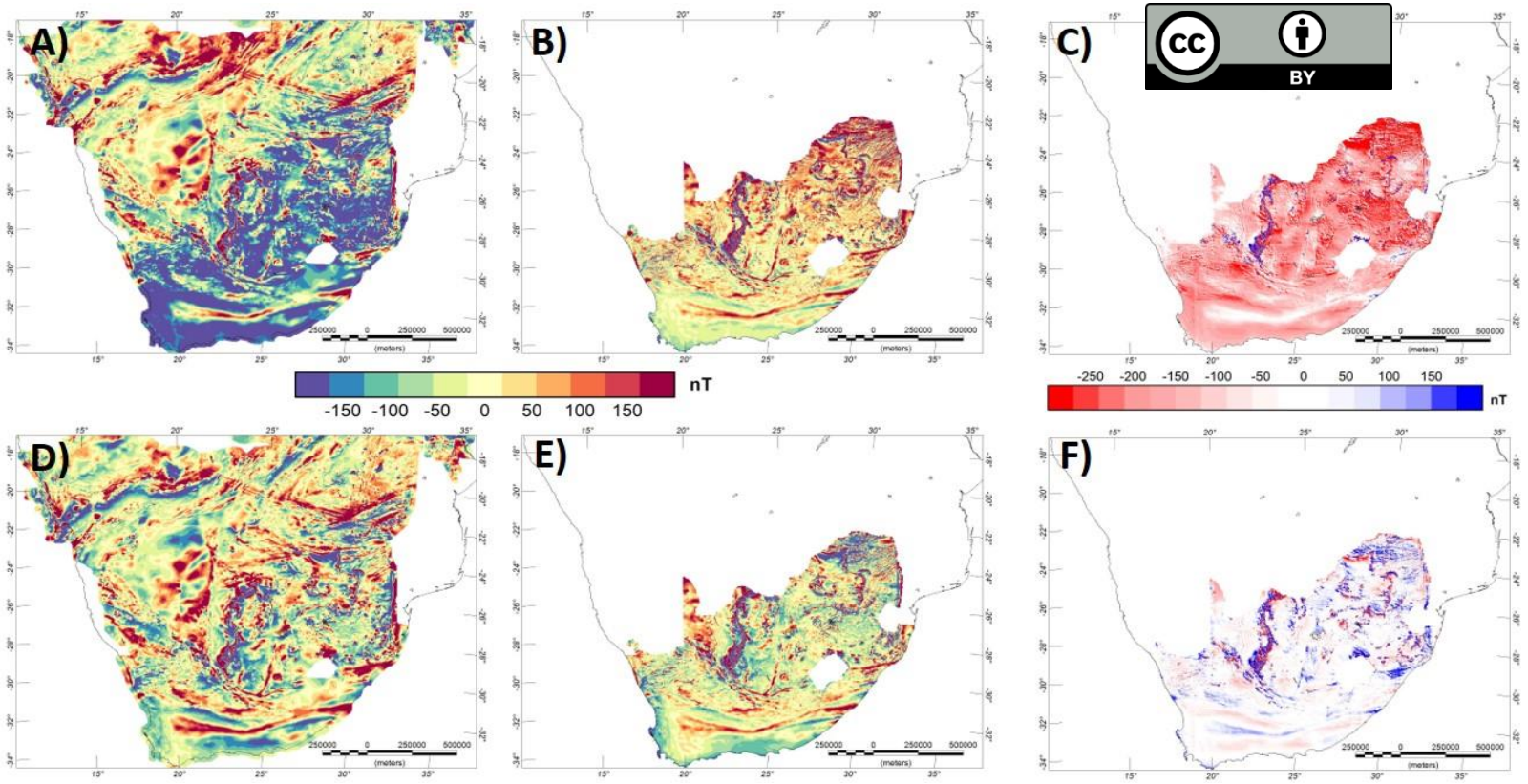

A) Original aeromagnetic compilation(Stettler et al., 2000), B) Original aeromagnetic compilation (Council of Geosciences, 2019), C) Difference between compilations in (A) and (B).
(D) and (E) Compilation after replacing long-wavelength part with Swarm derived lithospheric field model LCS-1, F) Difference between compilations in (D) and (E).

Summary and conclusion

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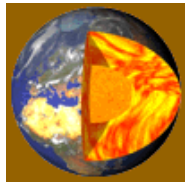
Consistent processing of aeromagnetic data using satellite data helps to compare the structure of Southern Africa, Australia and Antarctica in a Gondwana framework

Vintage and modern South African data compilations are shifted compared to surrounding -> this step should not be interpreted as geological signal

Data homogenisation is required to link properties of lithospheric magnetisation between the continents, e.g. as input to analyse geothermal heat flux beneath the Antarctic ice

esa
European Space Agency
Agence spatiale européenne



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