The contribution of a Geophysical Data Service: the International Service of Geomagnetic Indices

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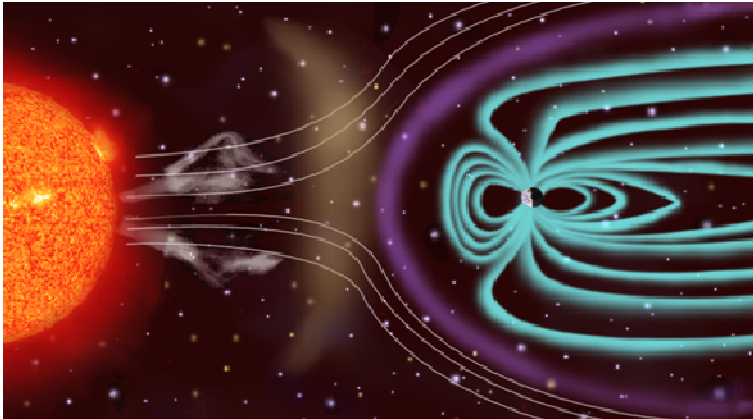CENTRE NATIONAL D'ETUDES SPATIALES

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Outline

- Geomagnetic activity and geomagnetic indices

- The International Service of Geomagnetic Indices

- Digital data + Internet $\Rightarrow$ on-line data dissemination policy needed

- The IAGA policy for on-line dissemination of geomagnetic indices

- Conclusions

The Sun and the Earth
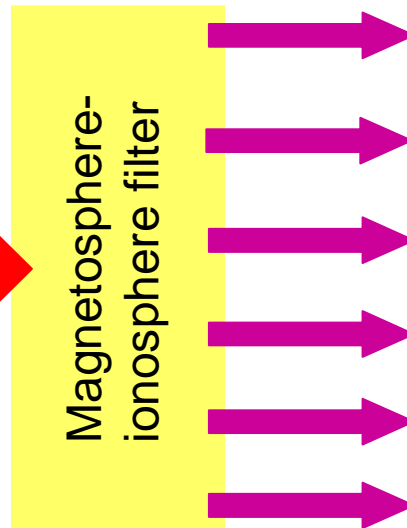

Magnetic signatures
at the Earth surface

Solar wind parameters
at the magnetosphere
boundaries

Values measured
in situ at L1

Magnetosphere-ionosphere filter

auroral latitudes:
currents, convection…

AE, PC indices

sub-auroral latitudes

K-derived indices

low latitude:
ring current, …

Dst, SYM indices
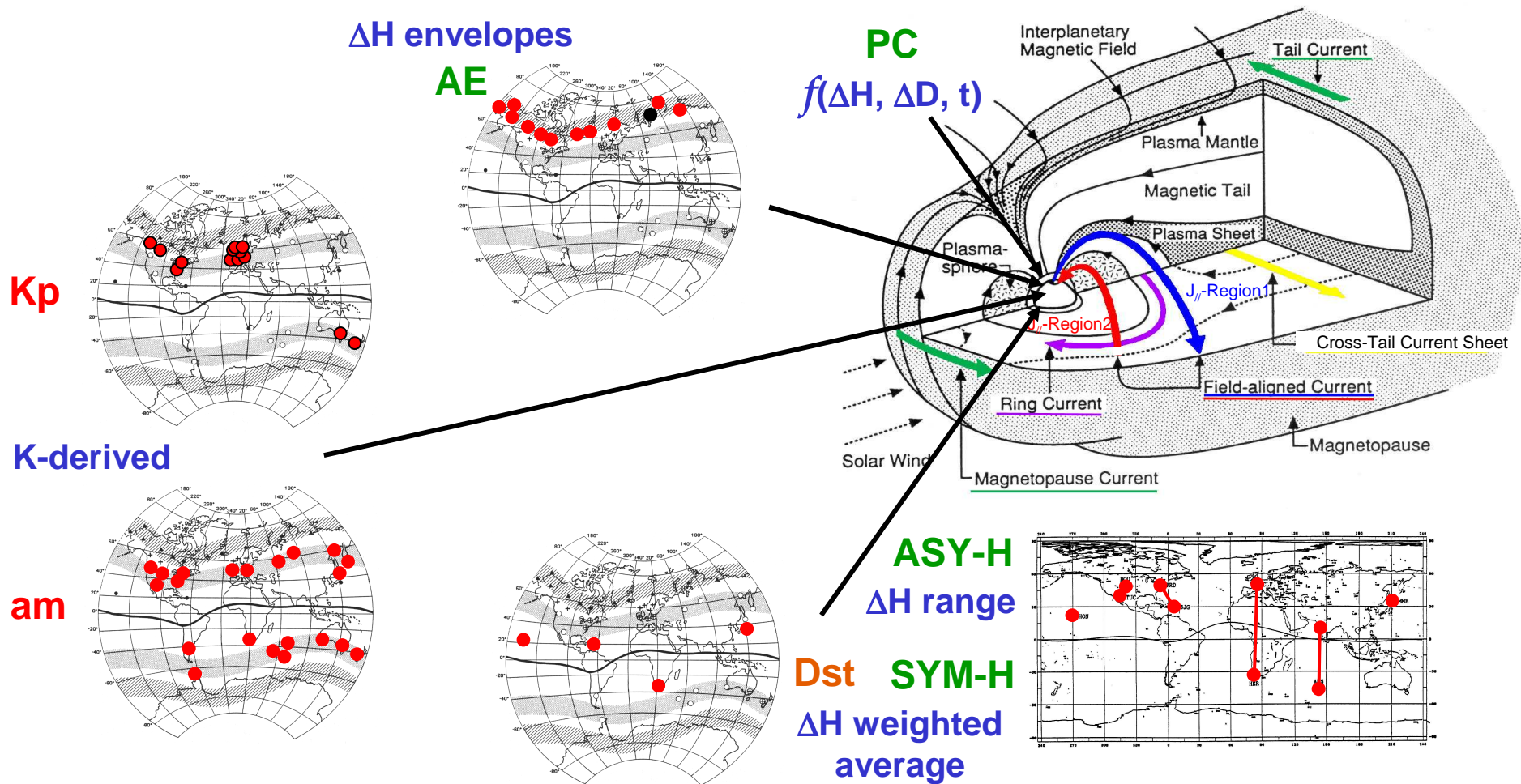
Pulsations

S_R variation

…

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The geomagnetic indices

ΔH envelopes

AE

PC

$f(\Delta H, \Delta D, t)$

Kp

K-derived

am

ASY-H

ΔH range

Dst   SYM-H

ΔH weighted average

Interplanetary Magnetic Field

Tail Current

Plasma Mantle

Magnetic Tail

Plasma Sheet

Plasma-sphere

$J_{//}$-Region1

$J_{//}$-Region2

Cross-Tail Current Sheet

Field-aligned Current

Ring Current

Magnetopause

Solar Wind

Magnetopause Current

IAGA recognized indices: AE, aa, am, Kp, Dst

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Geomagnetic indices: summary

- **Geomagnetic indices** are "added value products"
- Geomagnetic indices are basic data:
  - in Solar-Terrestrial physics $\Rightarrow$ need for long homogeneous data series.
  - for operational Space Weather activities $\Rightarrow$ the shortest possible dissemination delay.
- The derivation of reliable geomagnetic indices requires:
  - To get data from a worldwide network of stations;
  - To assess the quality of these data;
  - To use these data to derive new products – in the present case geomagnetic indices – using the 'official' published derivation schemes;
  - To assess the quality of the new products before their on-line dissemination.

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The International Service of Geomagnetic Indices

- ISGI is a "consortium" of institutes – the ISGI Collaborating Institutes – each of them being:
  - In charge of the derivation, dissemination, and archiving of IAGA recognized indices, using the 'official' published derivation schemes;
  - Responsible for the quality of the geomagnetic indices it is in charge of; it pays particular attention to the long term homogeneity of the indices data series;
  - Entrusted to propose any initiative whenever it finds it necessary to ensure the highest possible quality level for the geomagnetic indices it is in charge of.

- ISGI was a FAGS service, and will apply to become part of WDS.

  The ISGI Collaborating Institutes are: GFZ (Potsdam, Germany), LATMOS (Guyancourt, France), Observatori de l'Ebre (Roquetes, Spain), WDC-C2 for Geomagnetism (Kyoto, Japan)
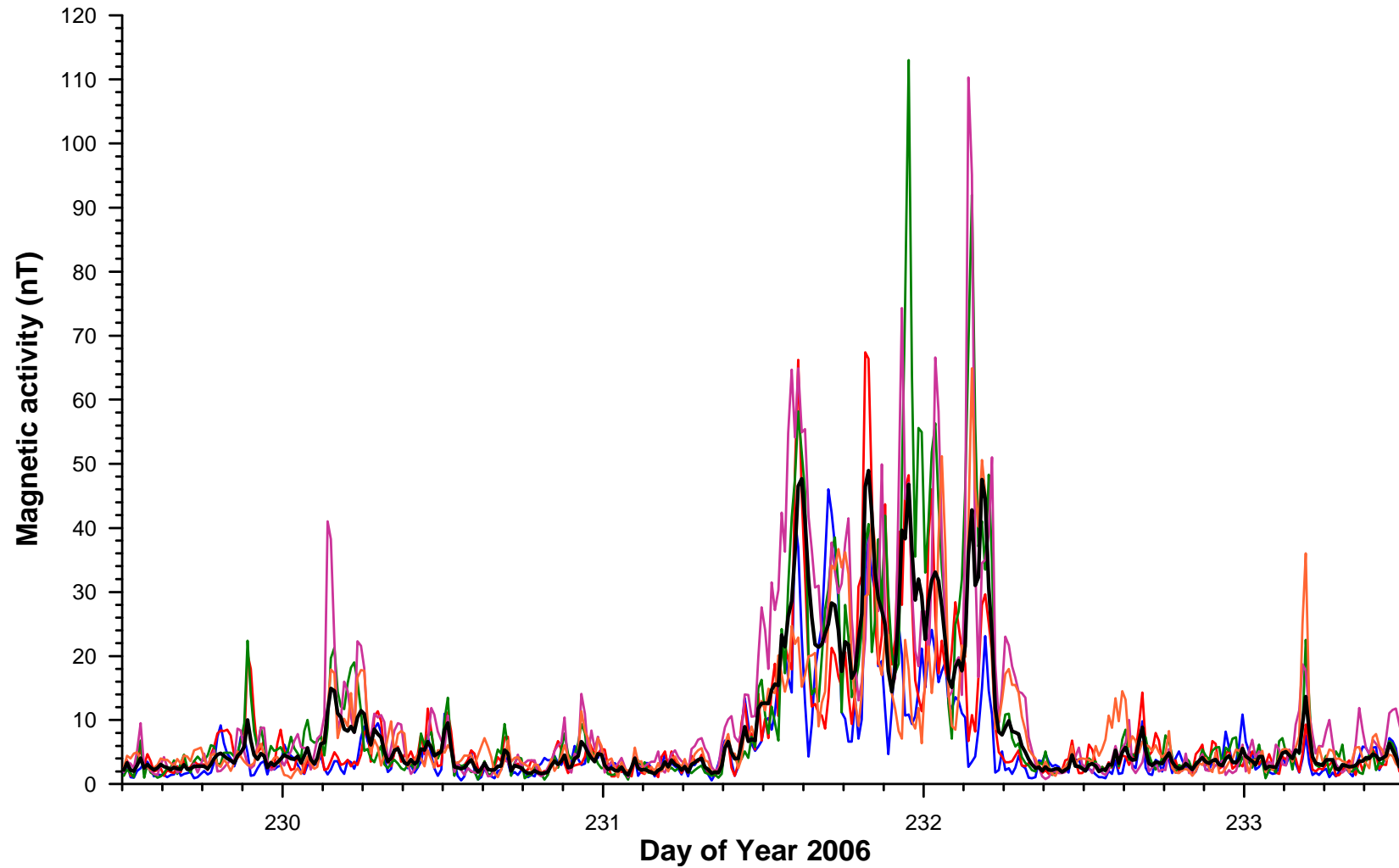
Statement of the issue: the context

- During the last decades, crucial changes occurred in geomagnetic observatory practice and data dissemination:
  - Digital magnetometers,
  - Internet and computer developments,
  - Users strongly required to have preliminary values of geomagnetic indices available on line within delays as short as possible.

- The development of electronic networks made it possible for Institutes which are not part of ISGI to make available on-line preliminary values of geomagnetic indices that are not computed using the 'official' derivation scheme.

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The geomagnetic activity

The geomagnetic activity
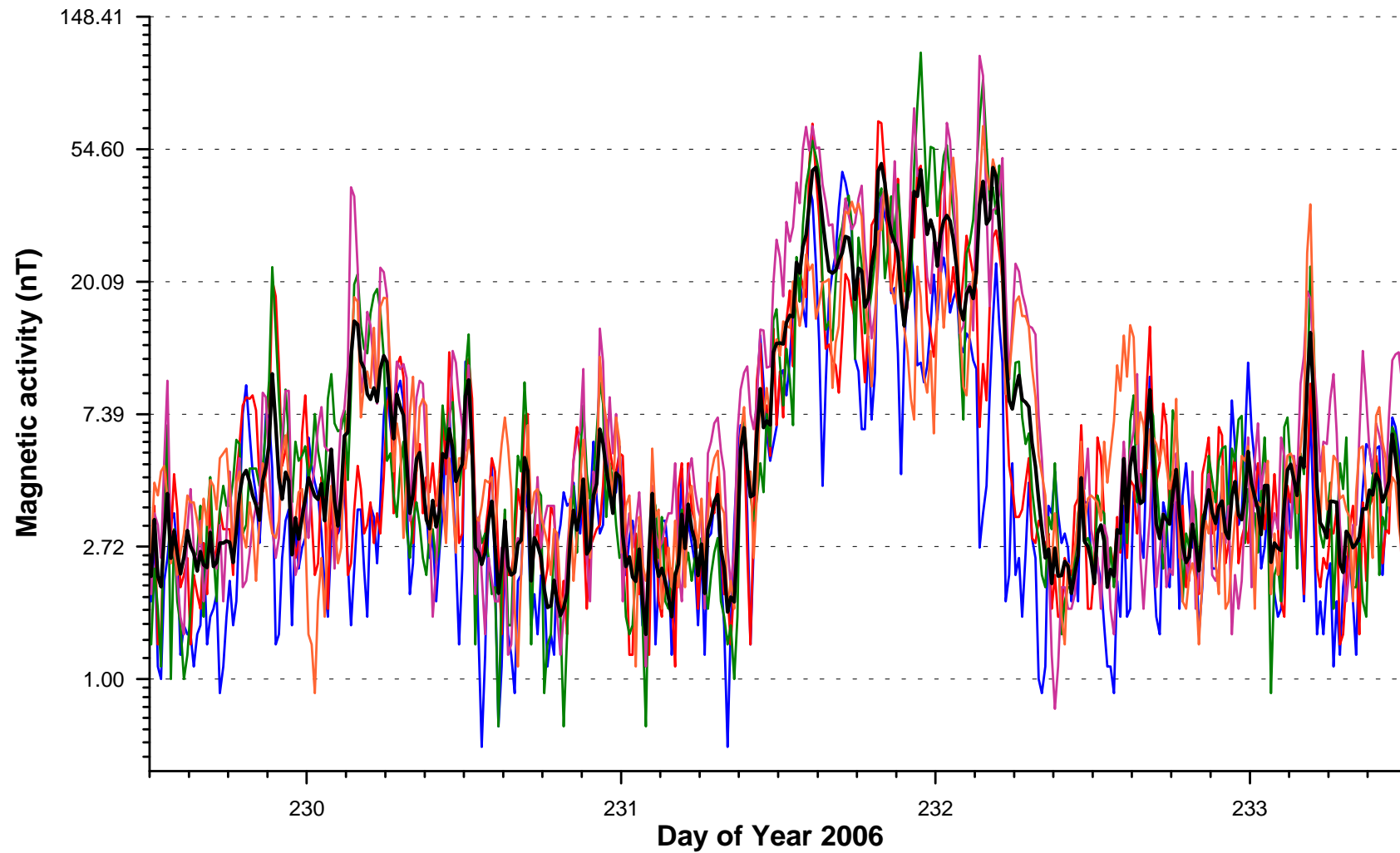
Statement of the issue: the concern

- During the nineties, non-ISGI institutes started to make available on-line estimated values of IAGA geomagnetic indices, without any control on, nor stamping of the quality of their products. In almost all cases, the used derivation schemes were not clearly published, while they may differ from one site to the other, and from the derivation scheme of the 'official' index.

- From the **user's point of view**, the crucial question became:

How to be sure of the quality of geomagnetic indices that are made available on-line through Internet?

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The solution 'stamped' by IAGA

- Each ISGI Collaborating Institute decided to make quick-look values available on-line within the shortest possible delay.

- The reference values of geomagnetic indices are those produced by the ISGI Collaborating Institutes, and they are first made available on-line at the ISGI and ISGI Collaborating Institutes homepages.

- During its 1997 Scientific Assembly, IAGA urged the producers of the estimated indices to clearly label them with "est" at the end of each index name to distinguish them from the official IAGA indices

Resolution 5, IAGA News 38 1998, p. 42

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Data flagging

Keep the present level of quality
⇨ ensure the homogeneity of
    existing long series.

definitive   provisional
      quick-look

Available within a delay of a few weeks;

Based upon data provided by the
observatories at the time of derivation;

Similar statistical properties as the
definitive values.

Available on line within short delays;

Based upon network stations data
(minute values) available on line at the time of derivation;

Similar statistical properties as the definitive values.
Larger confidence interval on each individual estimate.

Estimated

Missing data might be replaced by estimates;

Estimated values of IAGA indices should be named by adding 'est' to the
name of the index (e.g. $Kpest$ for Kp estimates) [IAGA Resolution, 1997].

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Conclusion

- The example discussed here makes clear the need for:

  - Reference(s) scientific organization(s) in charge of the definition of the policy dissemination of the "added value products" – geomagnetic indices in the present case, and of the labelling of the reference places: IAGA in the present case;

  - Reference places where users are sure to find reliable "added value products": ISGI and ISGI Collaborating Institutes in the present case;

  - A deep involvement of the producers in related research activities: Solar Terrestrial physics and Space Weather in the present case $\Rightarrow$ they understand user needs, and propose the best possible solution.

  One of the major WDS challenges is to keep this ability to find out solutions enabling the satisfaction of new requests from users without loosing the present quality of "added value products" and the homogeneity of long term data series.

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Thank you for attention

22nd CODATA International Conference 2010
Capetown, Rep. South Africa
Sept.24 – 27, 2010