

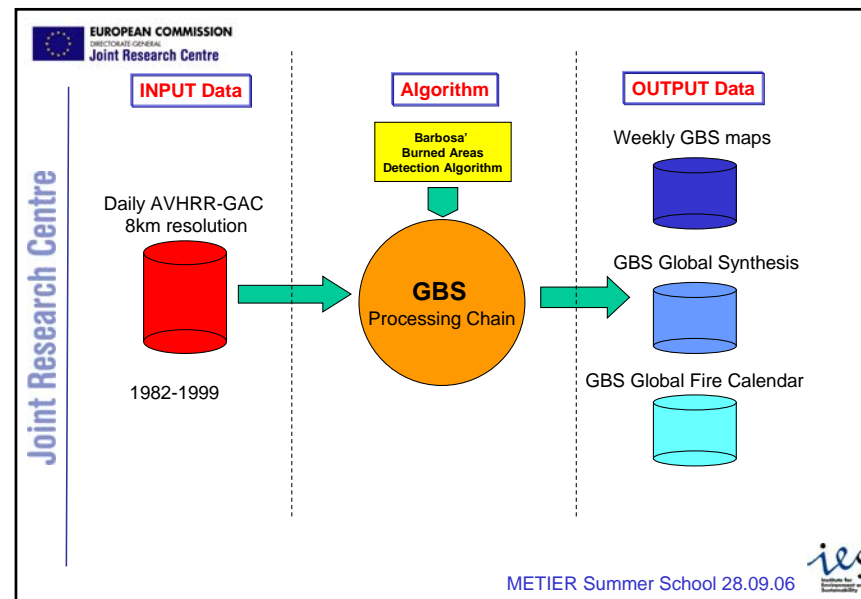
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Global Burned Surface 1982-1999 (GBS). A First Step to studies on Global Fire Activity*

*(Carmona-Moreno et al., 2005) – C. Carmona-Moreno, A. Belward, J.P. Malingreau, A. Hartley, M. Garcia-Alegre, M. Antonovsky, V. Buschtaber, V. Pivovarov. "Characterising Interannual variations in global fire calendar using data from Earth observing satellites". Global Change Biology. September 2005.

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- **INPUT Data = NOAA-AVHRR GAC data**
 - The processor on board the NOAA satellites samples the real-time NOAA-AVHRR-LAC 1km resolution data to produce reduced resolution NOAA-AVHRR GAC data.
 - The INPUT data is a time series of :
 - **DAILY** Global acquisitions from 1982 to 1999 (gap in 1994)
 - **NASA recommends not to use GAC data since septembre 2000 because of strong calibration problems of the AVHRR-14 instrument !!!**

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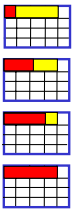
- **Analysing the Input data (1) – Sampling effect**
 - **AVHRR-GAC data is a sampling of the LAC data (full resolution images – 1km at the Equator) :**
 - Four out of every five samples along the scan line are used to compute one average value, and the data from only every third scan line are processed – **4/15 SYSTEMATIC sampling strategy**.
 - As a result, the spatial resolution of a GAC pixel is actually 1.1 km by 4km with a 2km gap between pixels across the scan lines.
 - The NOAA-AVHRR GAC image is then finally projected and resampled to 8km resolution => NOAA-AVHRR GAC 8km resolution images.


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- Analysing the Input data (2) – Sampling effect
 - QUESTION: Are these samplings representative of a full resolution product?
 - We simulated a GAC systematic sampling from a full resolution data set and we compared both data sets.
 - We considered the GBA-2000 data set as our full resolution data. GBA-2000 is a Global Burned surface product computed from VEGETATION data (1.1 km resolution at the Equator as the AVHRR-LAC data).
 - We applied a GAC systematic sampling to the GBA-2000 data set.
 - Let consider the following sampling cases:
 - GBS-Sampling group 1** – A GAC-simulated pixel is considered as “burned” if **at least ONE** of the FOUR pixels is burned.
 - GBS-Sampling group 2** – A GAC-simulated pixel is considered as “burned” if **at least TWO** of the FOUR pixels are burned.
 - GBS-Sampling group 3** – A GAC-simulated pixel is considered as “burned” if **at least THREE** of the FOUR pixels are burned.
 - GBS-Sampling group 4** – A GAC-simulated pixel is considered as “burned” if **ALL the FOUR** pixels are burned.



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- Analysing the Input data (3) – Sampling effect
 - QUESTION: Are these GBS samplings representative of the full resolution image?


Goodness of fit coefficients (GBS-sampling group 1):	
R (coefficient of correlation)	0.987
R ² (coefficient of determination)	0.974
R ² adj. (adjusted coefficient of determination)	0.974
SSR	167976091.888

• The coef. of determination being greater than **97%** => only less than **-3%** of the variability of GBA-2000 is not explained by the GBS-samplings.

Goodness of fit coefficients (GBS-sampling group 2):	
R (coefficient of correlation)	0.997
R ² (coefficient of determination)	0.994
R ² adj. (adjusted coefficient of determination)	0.994
SSR	38173766.103

• Fisher's F probabilities are lower than **0.0001** => there is **0.01%** of risk of assuming that GBS-samplings explain the GBA-2000 data.

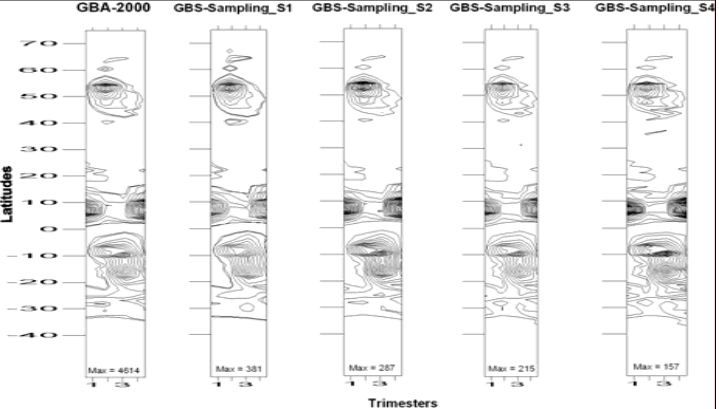
Goodness of fit coefficients (GBS-sampling group 3):	
R (coefficient of correlation)	0.995
R ² (coefficient of determination)	0.990
R ² adj. (adjusted coefficient of determination)	0.990
SSR	65579426.996


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- Analysing the Input data (4) – Sampling effect
 - QUESTION: Are these GBS samplings representative of the full resolution product?

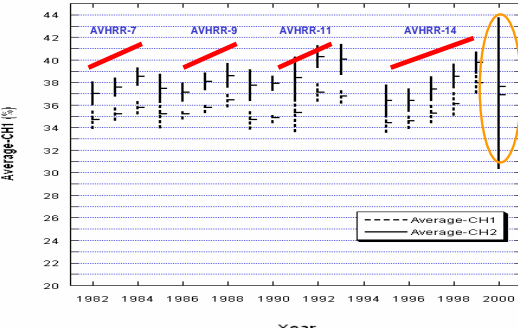



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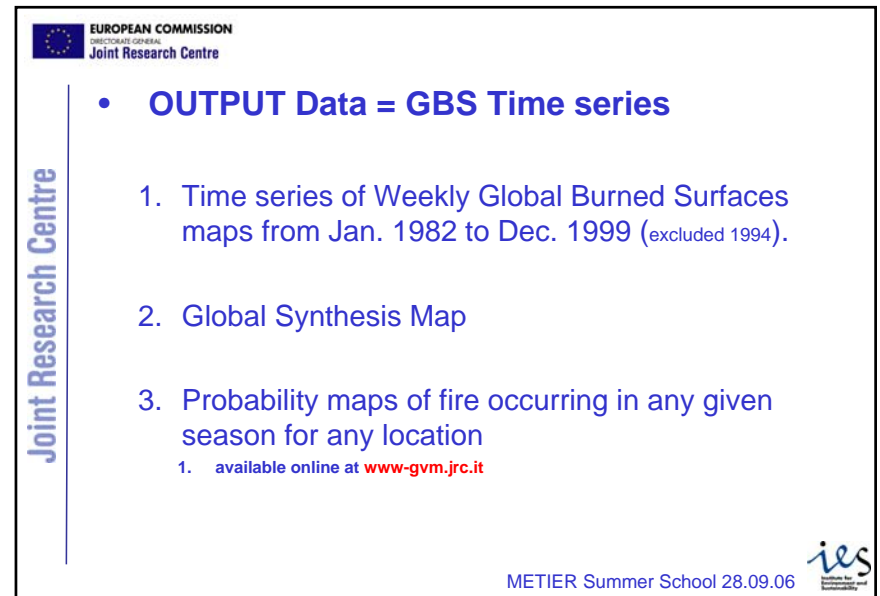
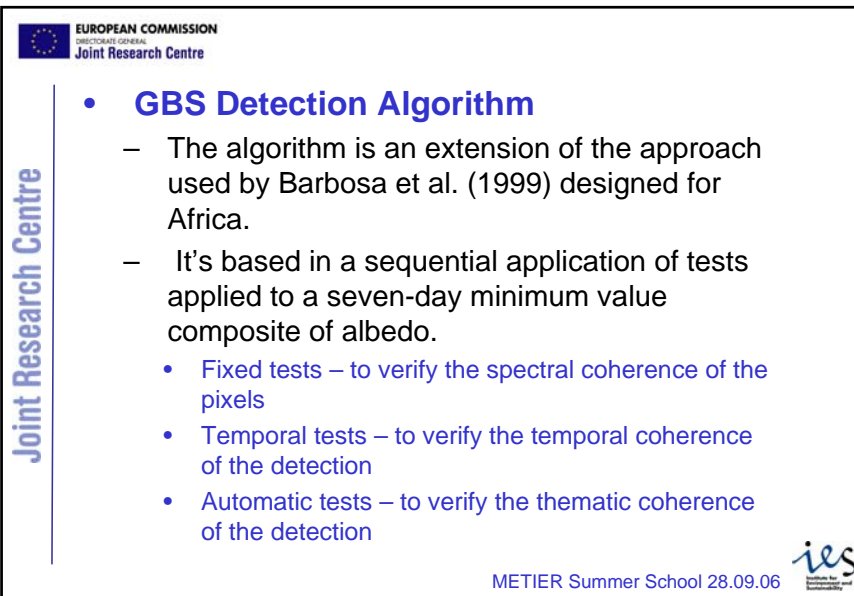
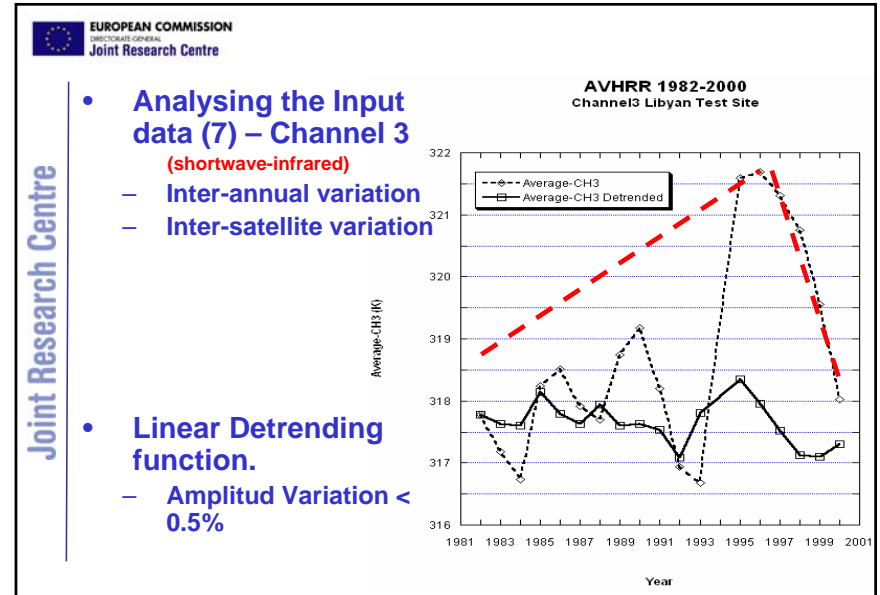
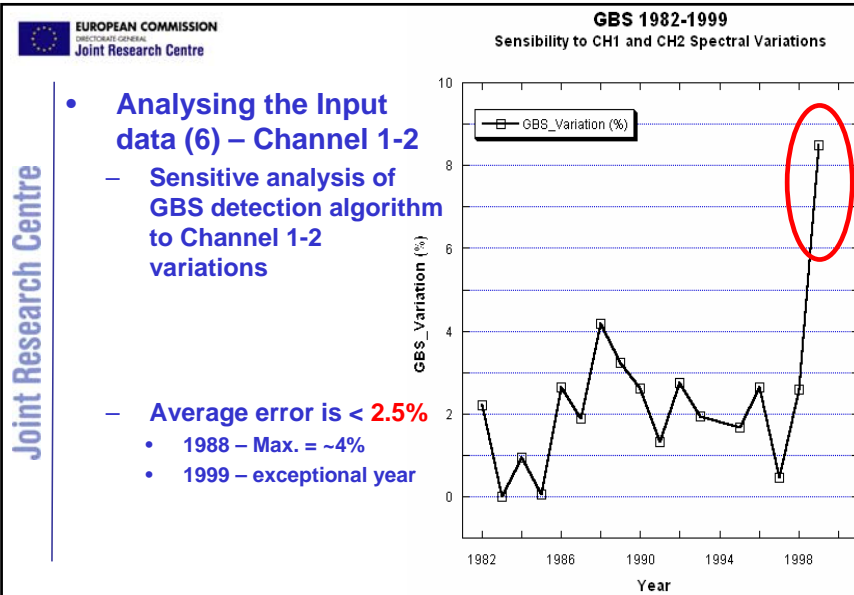
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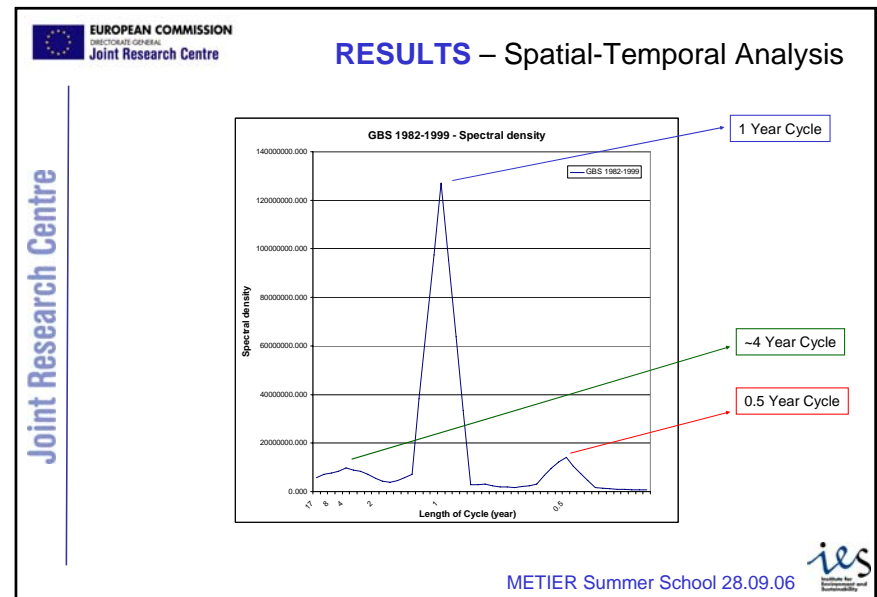
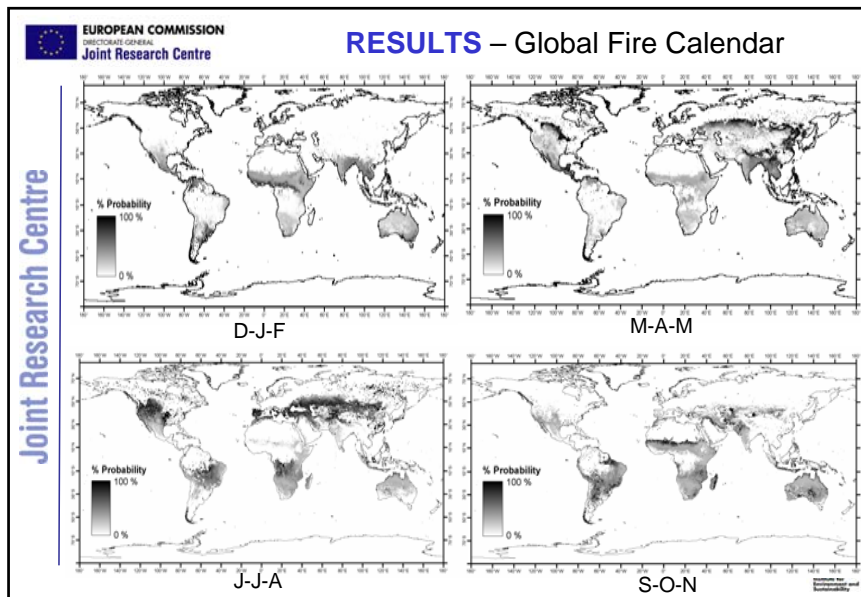
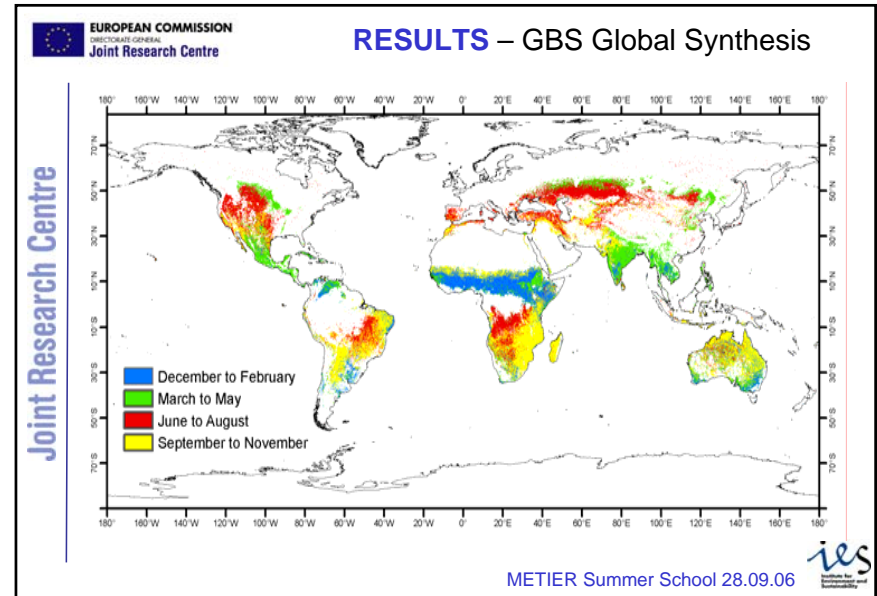
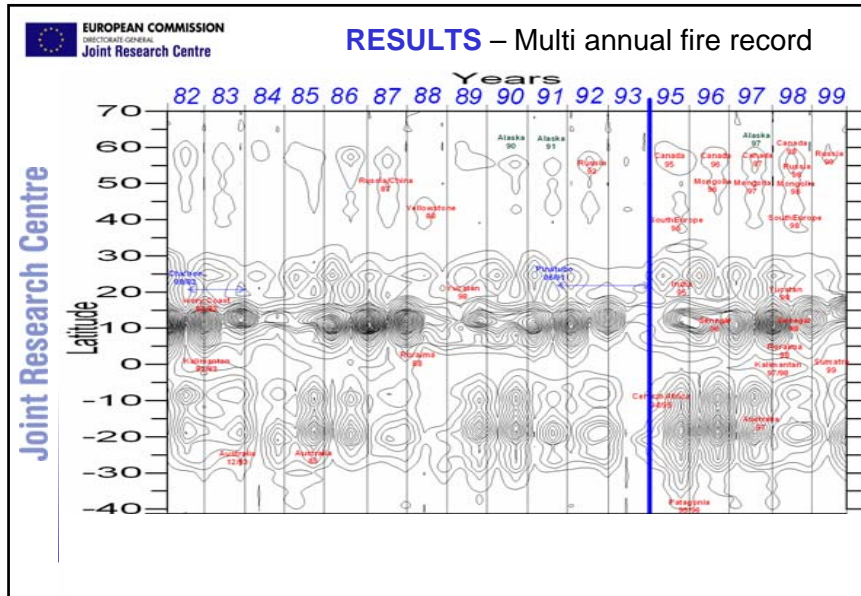
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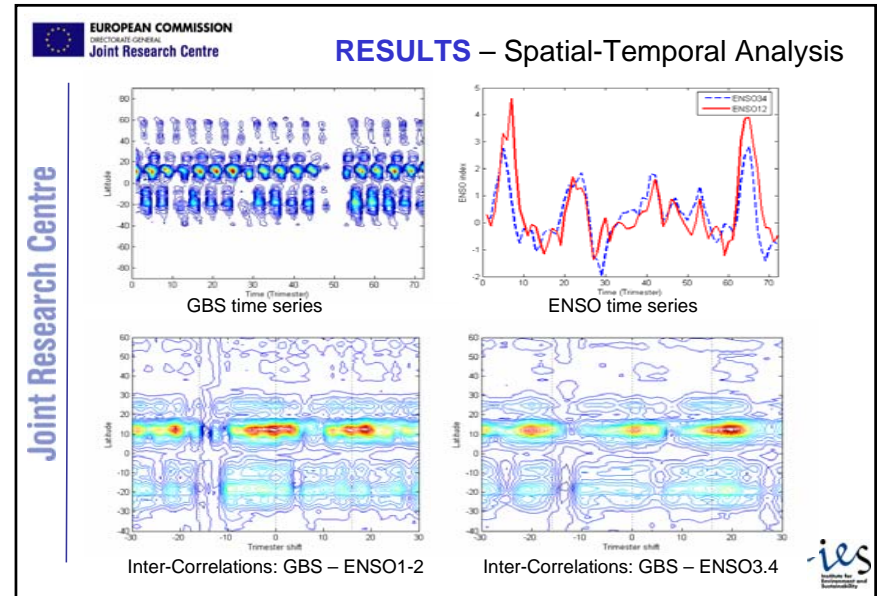
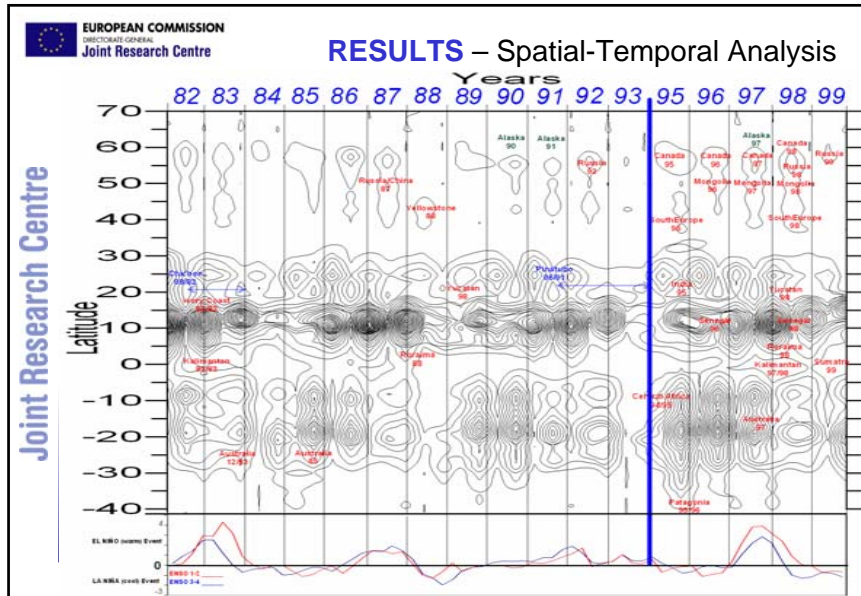
- Analysing the Input data (5) – Channel 1 – 2
(RED and NEAR-INFRARED)
 - Inter-annual variation problems (orbital shift)
 - RMS Error ~4% - Max. (AVHRR-14) : 9.5%
 - Inter-instrument variation problems (inter-calibration)



* Brest and Rossow, 1982 







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CONCLUSIONS

- AVHRR-GAC data – The **ONLY** consistent long time series (18 years) of EO data.
- Our analysis highlights **shortcomings** in the currently available :
 - processed AVHRR GAC records (**calibration issues**); and,
 - Our Global Burned Surface detection algorithm (Boreal areas, Cloud, ...)
- The GBS time series is **NOT suitable** for **QUANTITATIVE** estimations :
 - The GAC systematic sampling strategy => only sampled pixels can be involved in a quantitative estimation which represent ~38% of the actual burned pixels (estimations from GBA-2000).
 - Very Coarse resolution (8 km re-projected) => **Omission errors** => Under-estimations
- **BUT** for **QUALITATIVE** studies => Spatial-temporal Trend estimations
 - The GAC Systematic samplings are representative (>97%) of the higher resolution products (Estimations from GBA-2000).
 - Detection of **inter** and **intra-annual** trends
 - **Spatial-temporal distribution** of the fire activity => Spatial-temporal distribution of biomass burning emissions (!!!)
- Global Fire Calendar product is available on-line at www-gvm.jrc.it
- **Inter-correlations/tele-connections** with other global phenomena (i.e. ENSO) => Influence on the spatial-temporal distribution of the fire activity (!?) => This have to be **further investigated** with longer time-series.

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