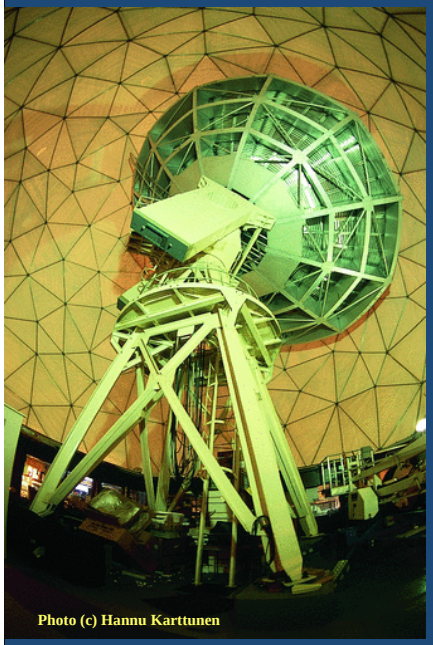

Long Term Radio Monitoring -- Why Do We Need It?

M. Tornikoski, A. Lähteenmäki [1]
E. Valtaoja [2]
T. Hovatta, E. Nieppola,
I. Torniainen, M. Kotiranta [1]

[1] Metsähovi Radio Observatory, Finland
[2] Tuorla Observatory, Finland

Observations of various source samples

- Many on-going projects, also very large samples.
  - Typically, spectral indices & variability.
  - The Metsähovi group:
    Can we / the Planck satellite / other (sub)mm telescopes detect sources that have been *assumed* to be faint at higher frequencies?
    - GPS sources and candidates (talk by Torniainen et al.)
    - the complete BLO sample (talk by Nieppola et al.)
  - Often only few observing epochs
    (especially for the larger samples
    or when telescope time is very limited).

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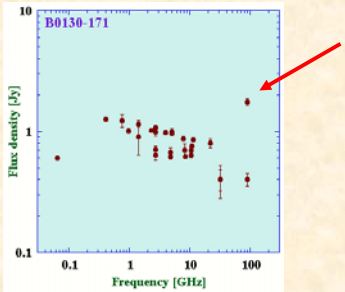

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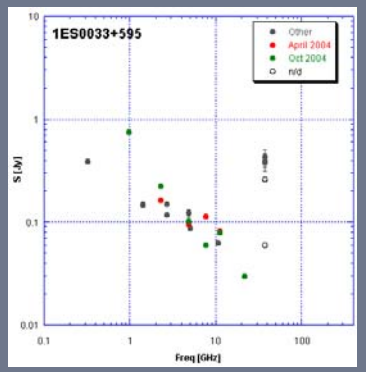
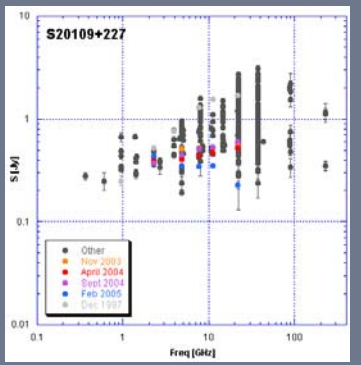
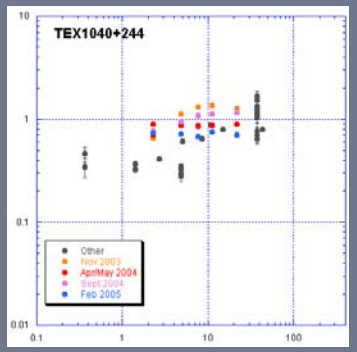
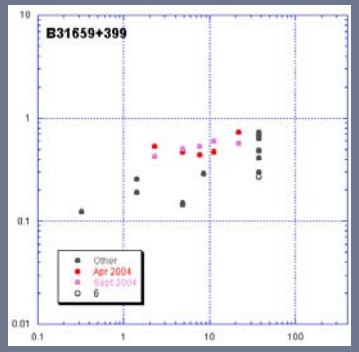
Some multifrequency data





... multifrequency data





3 – 4 years of data.

How much do we know now?

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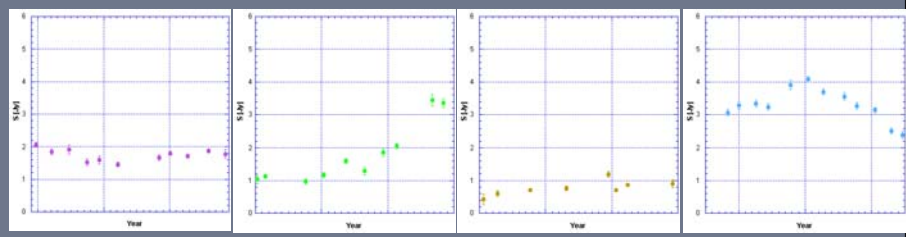

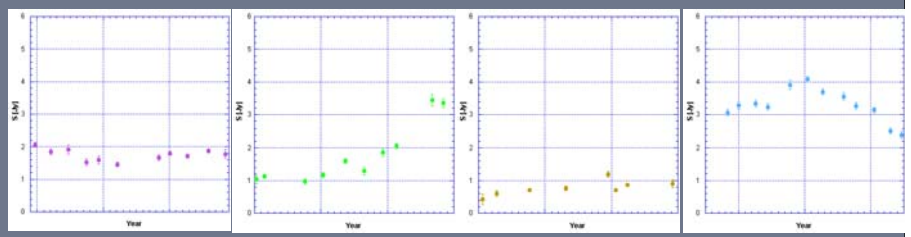

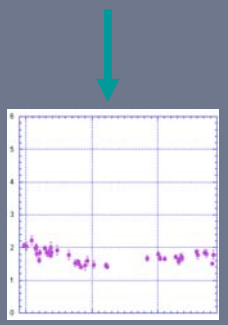

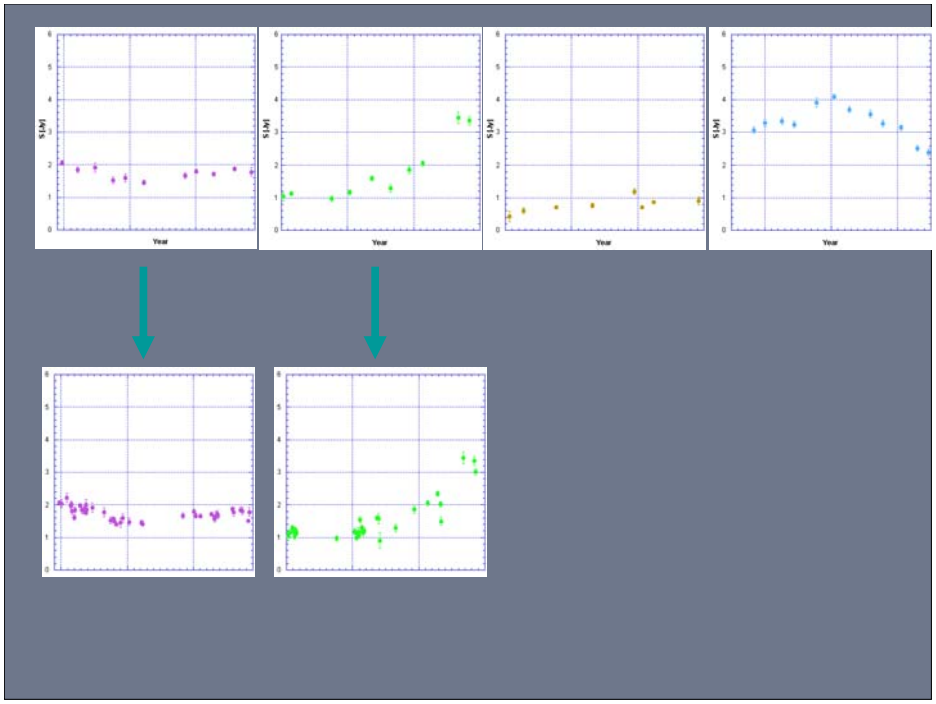

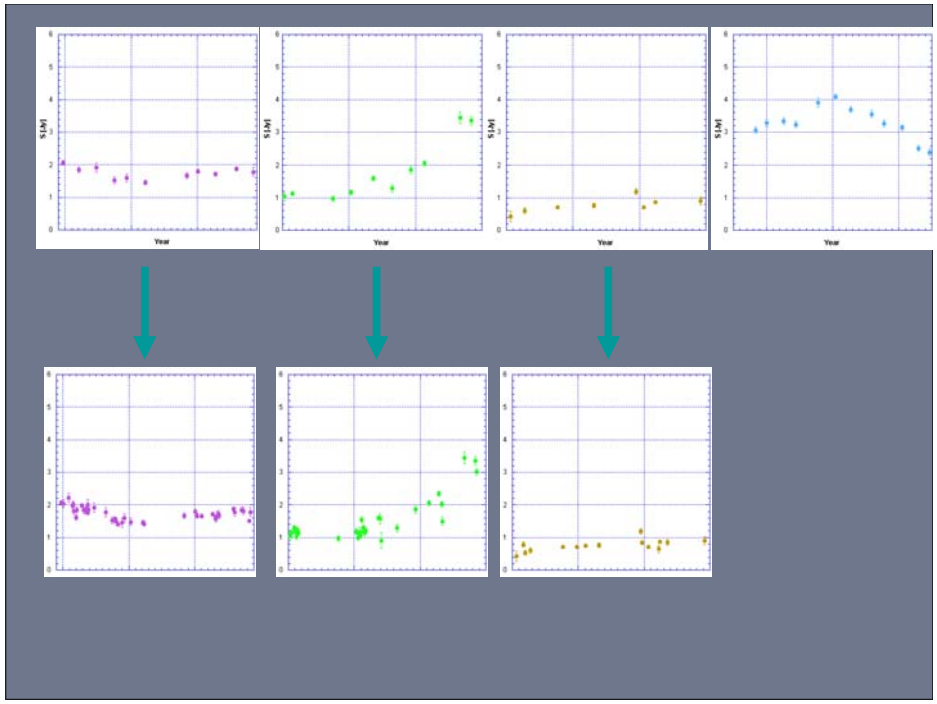

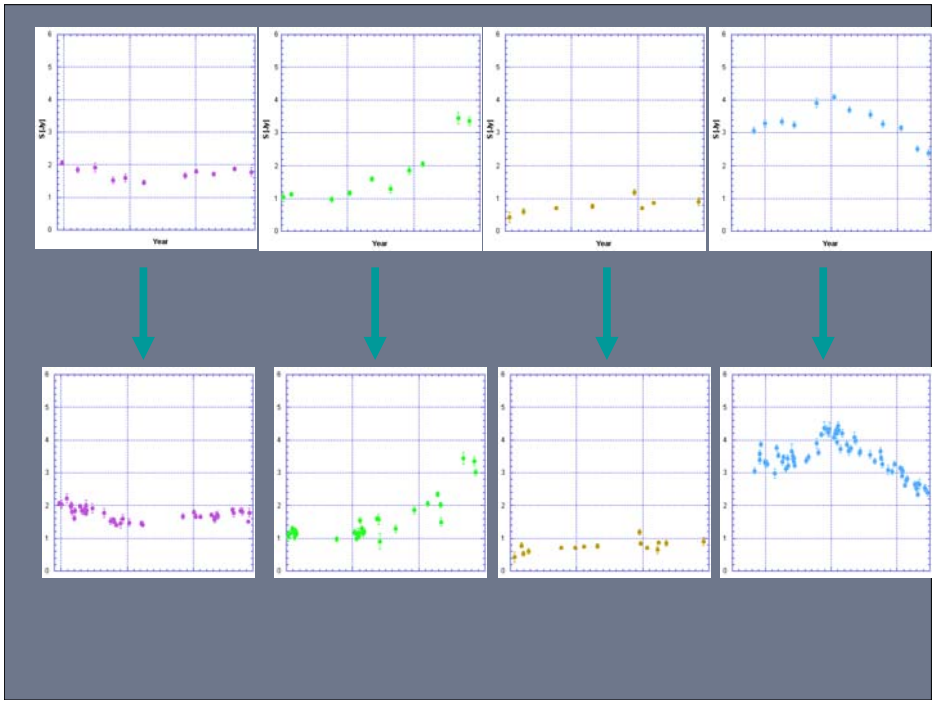

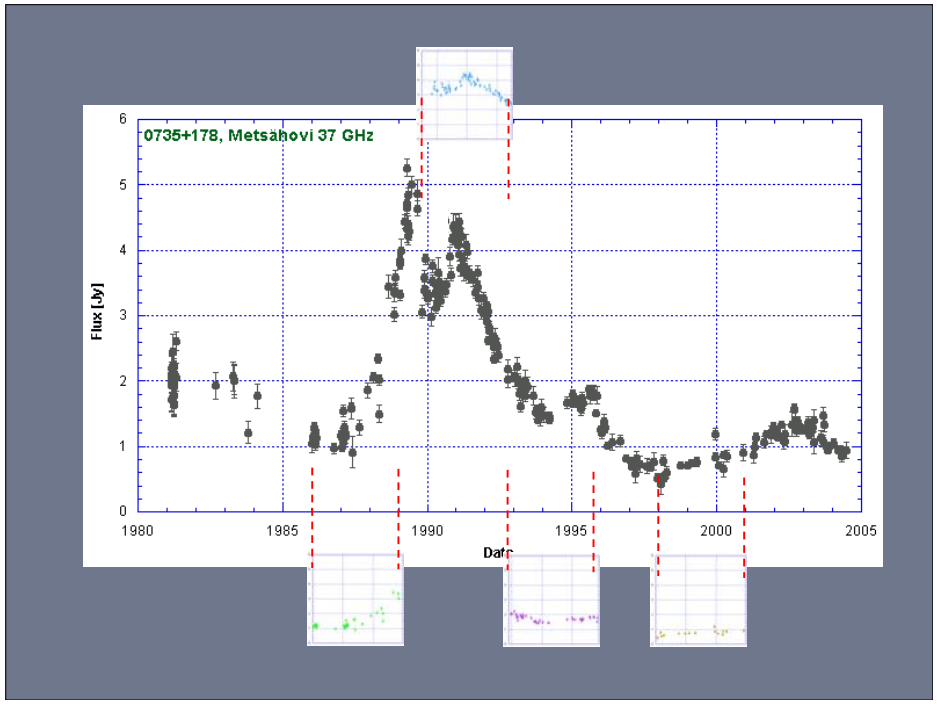
0735+178, Metsähovi 37 GHz
Flux [Jy]
0
1
2
3
4
5
6
1980
1985
1990
1995
2000
2005

Three (five, ten, ...?) years of observations are <u>not enough</u> for determing a "typical behaviour" of an AGN!

<u>Long timescales</u> are more important than dense sampling!

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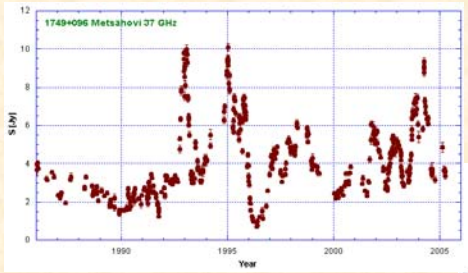
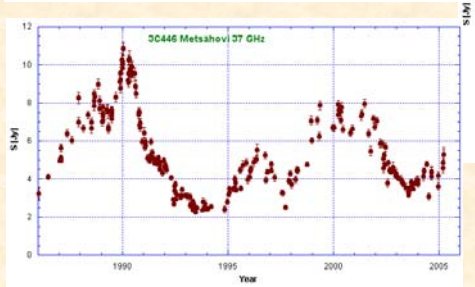
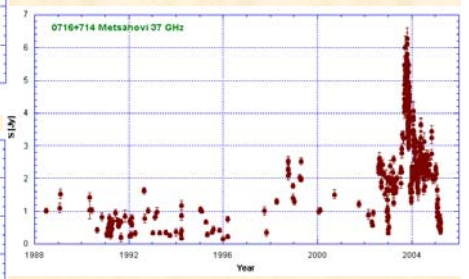
More examples:







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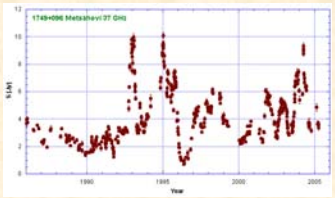
Some statistics

How much time (nr. of data points or a random observing epoch) does a source spend in an **1)** active **2)** intermediate **3)** quiescent state?



1)

2)

3)

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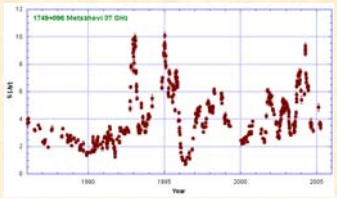

1)

2)

3)

For all the 80 best-monitored sources at 37 GHz:
1) 11%
2) 38%
3) 51%

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9 times out of 10 we are likely to see the source in a quiescent or an intermediate state!

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What does this mean?

- No idea about the ”real” activity behaviour
  - Incorrect conclusions about variability, continuum spectra, detectability, effects on the CMB foregrounds, ...
  - Misinterpretations about source types, subtypes, ...
  - Exclusion of interesting objects!
- Multifrequency (radio) observing campaigns are bound to fail (or, at least ”fail”).
- Incorrect theoretical interpretations?

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Extensive analysis of 25 years of multifrequency data

or

How to predict activity behaviour in AGNs?

- Typical flare timescales
  - From visual inspection, flare statistics, general activity statistics (quiescent/active/im.states), mathematical analysis (SF, DCF, periodograms...), flare decomposition & analysis.
  - For various source types, subtypes, individual sources...
  - Timescales vs. luminosities etc.
  - Note: 25 yrs of data very different from 10 yrs of data!

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... 25 years of multifrequency data

- Typical flare structures
  - Very different shapes, durations, rise & decay times, duty cycles.
  - “Flare taxonomy”: simple vs. multipart, rapid vs. slow, various rise&fall times and shapes – decomposing the flares.
  - $t_{var} \rightarrow T_{b,obs} \rightarrow D$
  - Connections with other frequency bands & VLBI.
- Typical flare amplitudes
  - Absolute, relative, vs. the frequency band.
  - Compare with predictions from the shock models.

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... 25 years of multifrequency data

- How do we recognise a starting flare?
  - Not all flux increase results in a flare!
  - Timescale analysis & flare taxonomy & support observations: educated guesses.
  - Also: self-organised maps etc. advanced analysis methods.

    → "Flare Prediction Testbed"
- Have been focusing on observational aspects (esp. CMB foregrounds):
  "what are we likely to see in a given source at a given time?",
  moving towards the theory:
  the radio shock models, blazar sequence scenario, ...
- Several papers in preparation by the Metsähovi-Tuorla radio team.

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