# Observations of extragalactic sources from WMAP 3-year data

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# Observations of extragalactic sources from WMAP 3-year data

- ★ Introduction:
  - WMAP all-sky survey and our observations

- ★ Results:
  - Variability of source population and classification
  - Correlation in variability at 16.1 and 33 GHz
  - Spectral properties
  - Comparison of VSA and WMAP fluxes

- ★ Summary of results and preliminary conclusions

# WMAP all-sky survey

- WMAP mission - first *all-sky* surveys of extragalactic sources at 23, 33, 41, 61 and 94 GHz

- New Extragalactic WMAP Point Source (NEWPS) catalogue - 369 sources detected at $5\sigma$ in at least one of the frequency bands (López-Caniego et al. 2007)

- Statistical properties of extragalactic sources above $\sim 10$ GHz - still largely unknown.

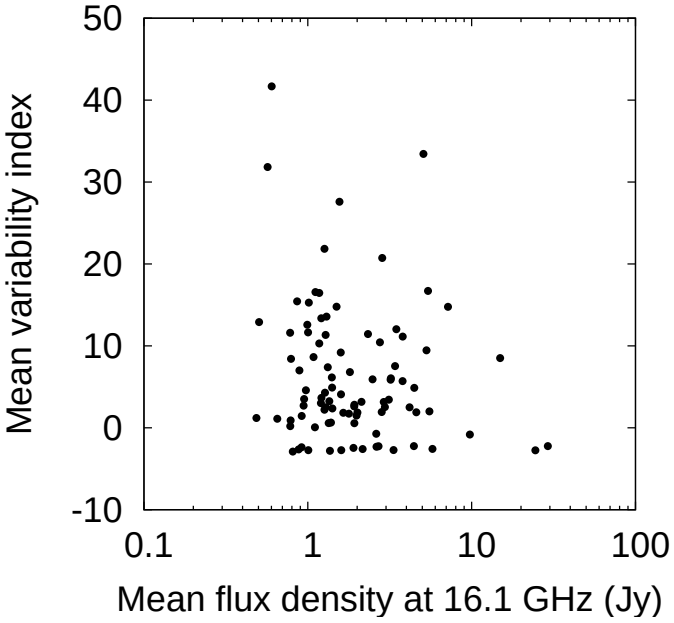
- Studies of variability - only two large-scale surveys complete in flux density at $\geq 15$ GHz

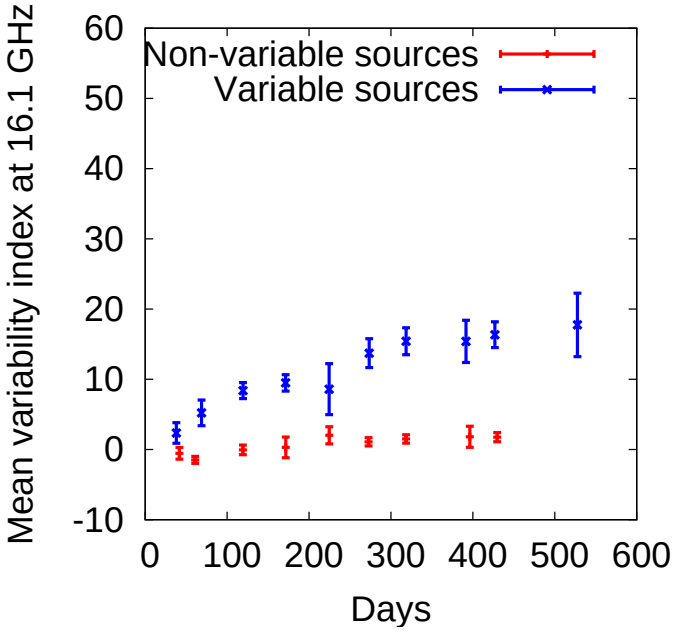
# Observations

- ★ Our sample contains a total of 97 sources and is complete to $\approx 1.1$ Jy at 33 GHz
- ★ Flux densities measured in 2007 and 2008 at 16.1 GHz with Arcminute Microkelvin Imager (AMI) and at 33 GHz with Very Small Array (VSA)
- ★ Flux calibration error $\approx 4\,\%$ but errors on VSA fluxes dominated by thermal noise

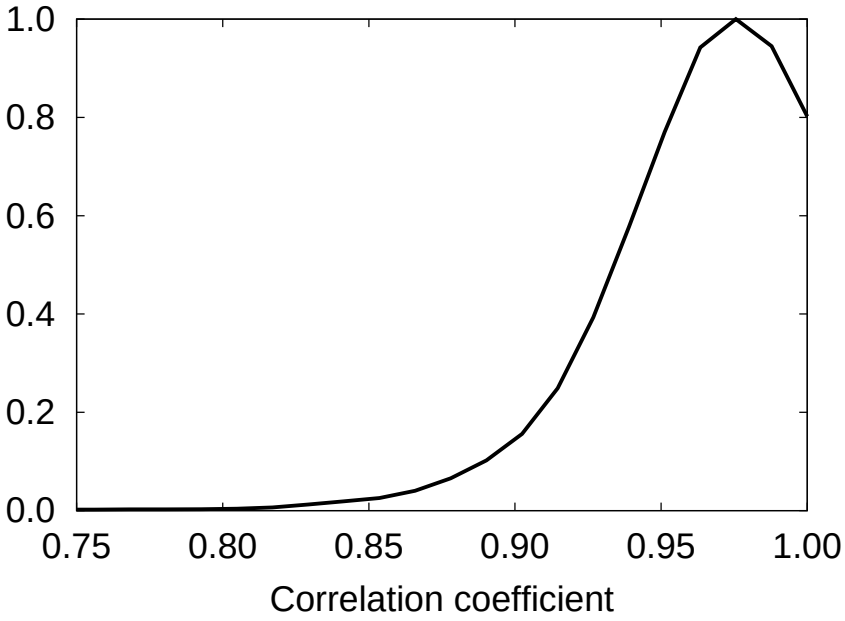
# Variability of source population and classification

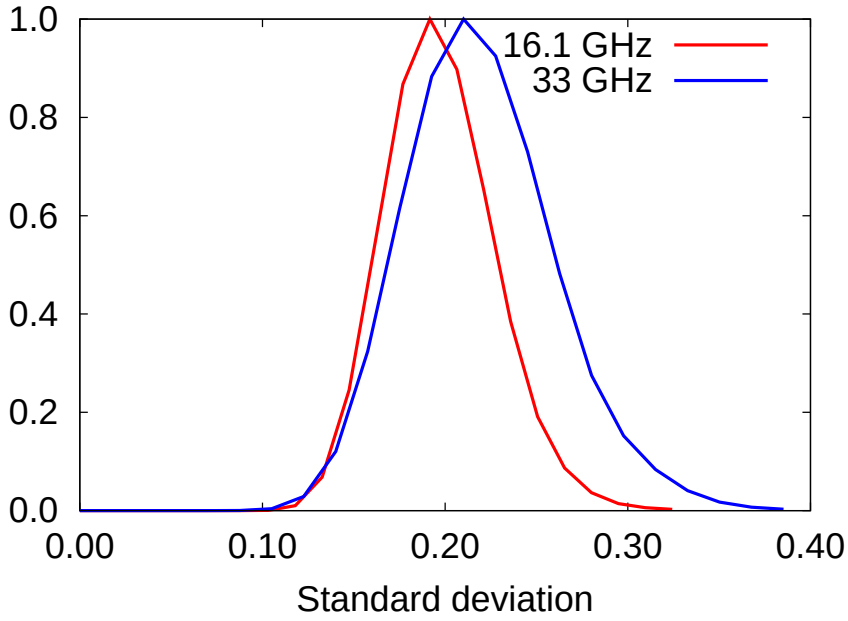
$$V = \frac{100\,\%}{2\bar{s}}\sqrt{(S_1 - S_2)^2 - (\sigma_1^2 + \sigma_2^2)}$$



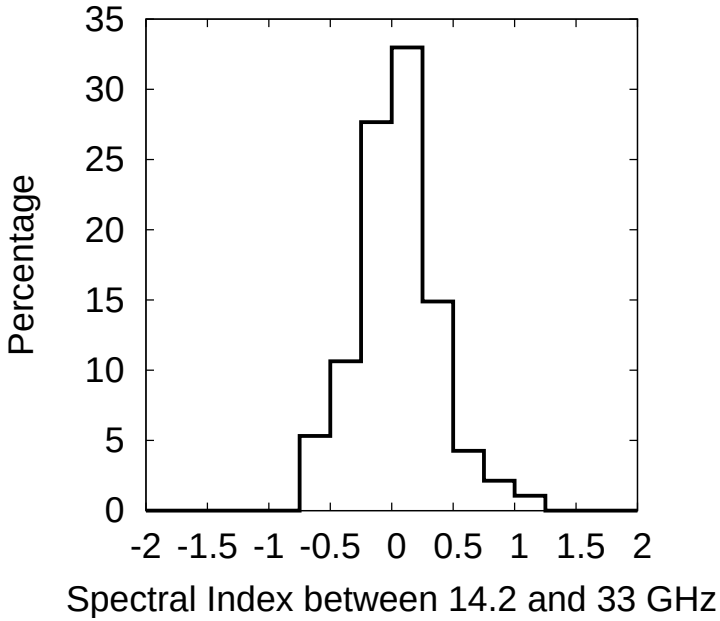



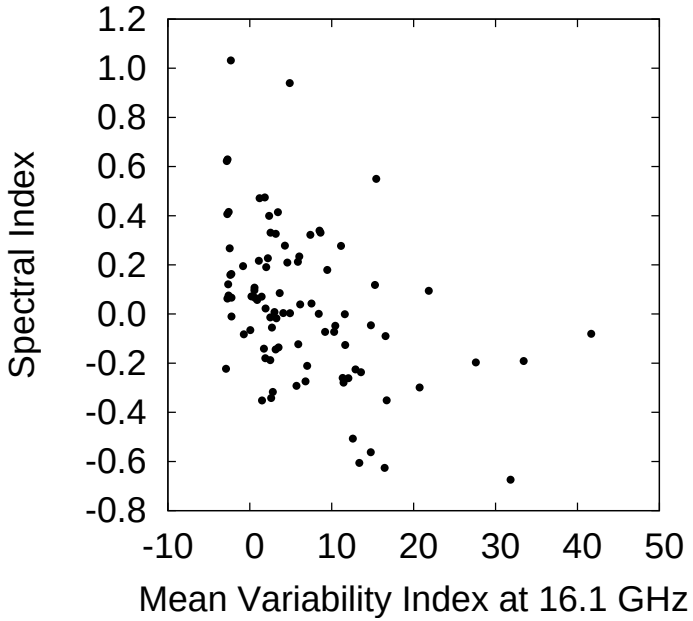
# Correlation in variability at 16.1 and 33 GHz



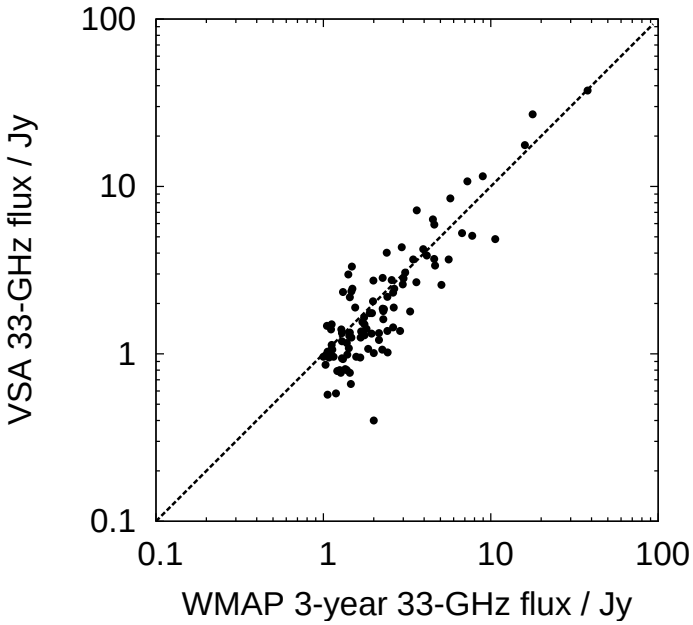



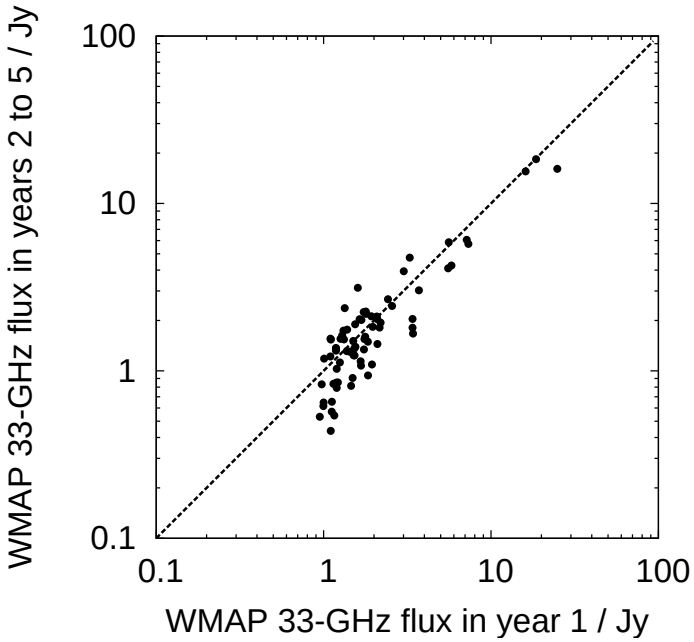
# Spectral properties



# Comparison of VSA and WMAP fluxes



# Summary of results

- ★ No strong correlation between variability and flux density
- ★ 48 % of sources variable above uncertainties of $\approx 4$ per cent at 16.1 GHz
- ★ Variability at 16.1 and 33 GHz very highly correlated ($R = 0.957 \pm 0.032$); little change in levels of variability at the two frequencies
- ★ Median spectral index $\alpha^{33}_{14.2} = 0.04$ ($S \propto \nu^{-\alpha}$); significant shift in spectral index of variable sources ($-0.06 \pm 0.05$) and non-variable sources ($0.13 \pm 0.04$)
- ★ WMAP fluxes affected by Eddington bias

# Preliminary conclusions

- ✯ Lots of variability
- ✯ This will affect the stability in time of high-frequency source catalogues and will affect Planck!

Look out for our paper for details of analysis and further conclusions - Davies & Franzen 2009 in prep.