

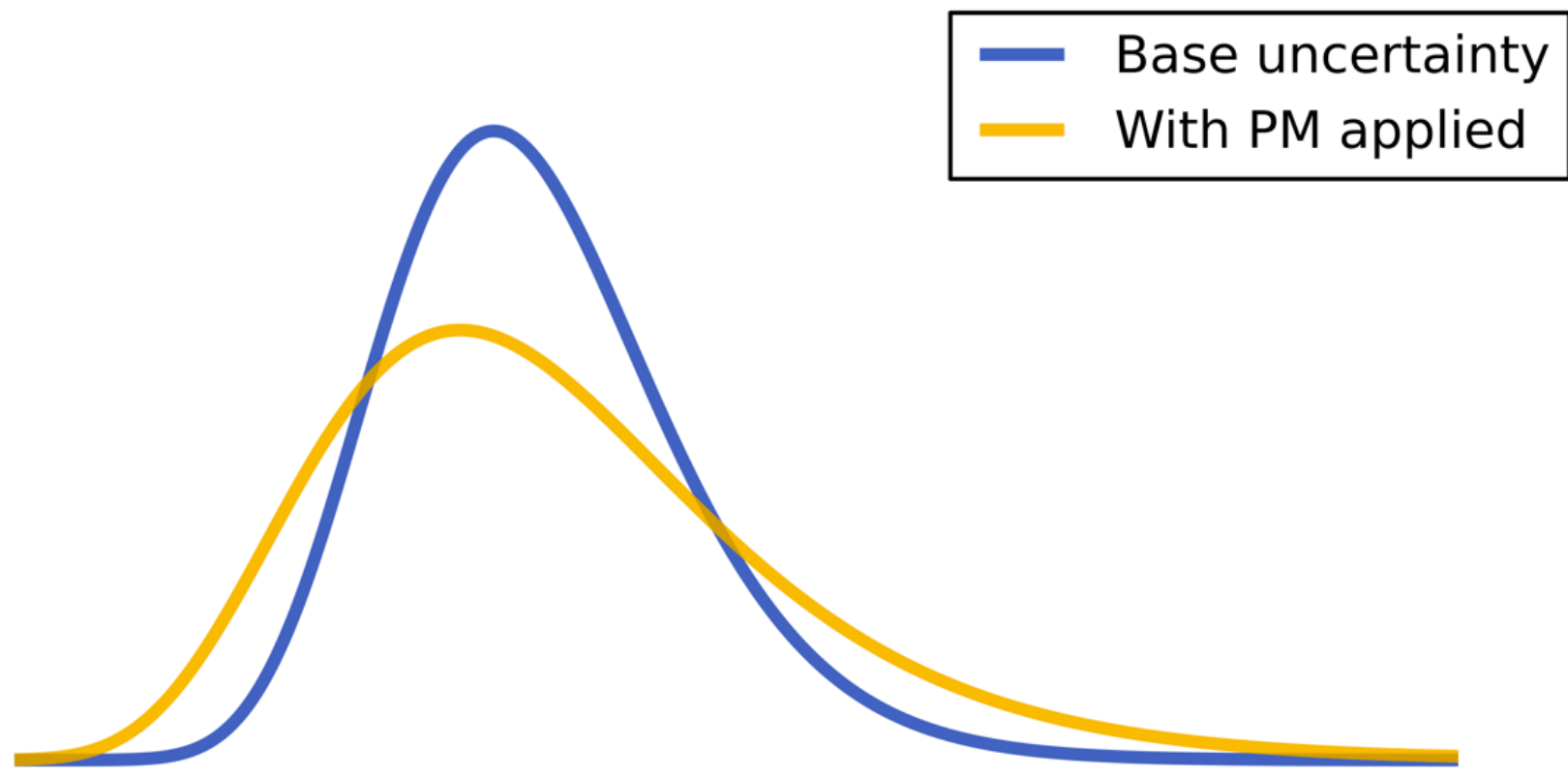


Introduction

- The pedigree matrix (PM) is a *post-normal* approach to assigning uncertainty
- A new version (version 2) of the ecoinvent PM was recently developed

How does the pedigree matrix work?

- Each dataset exchange has a *base uncertainty* which is log-normally distributed
- A new uncertainty distribution is produced by multiplying the *base uncertainty* by a set of additional log-normal PM distributions, each of which has a median of one.
- Applying the PM assumes that each factor is *independent*, i.e. the covariance is zero



The additional PM distributions don't shift the *median*, but *stretch* the distribution at both ends, increasing uncertainty

Versions 1 & 2

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------------|---|------|------|------|-----|
| Reliability | 1 | 1.05 | 1.1 | 1.2 | 1.5 |
| Completeness | 1 | 1.02 | 1.05 | 1.1 | 1.2 |
| Temporal Correlation | 1 | 1.03 | 1.1 | 1.2 | 1.5 |
| Geographical Correlation | 1 | 1.01 | 1.02 | 1.02 | 1.1 |
| Further technological correlation | 1 | 1 | 1.2 | 1.5 | 2 |
| Sample size | 1 | 1.02 | 1.05 | 1.1 | 1.2 |

Pedigree matrix, version 1

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------------------|---|------|------|------|-----|
| Reliability | 1 | 1.05 | 1.1 | 1.2 | 1.5 |
| Completeness | 1 | 1.02 | 1.05 | 1.1 | 1.2 |
| Temporal Correlation | 1 | 1.03 | 1.1 | 1.2 | 1.5 |
| Geographical Correlation | 1 | 1.01 | 1.02 | 1.02 | 1.1 |
| Further technological correlation | 1 | 1 | 1.2 | 1.5 | 2 |

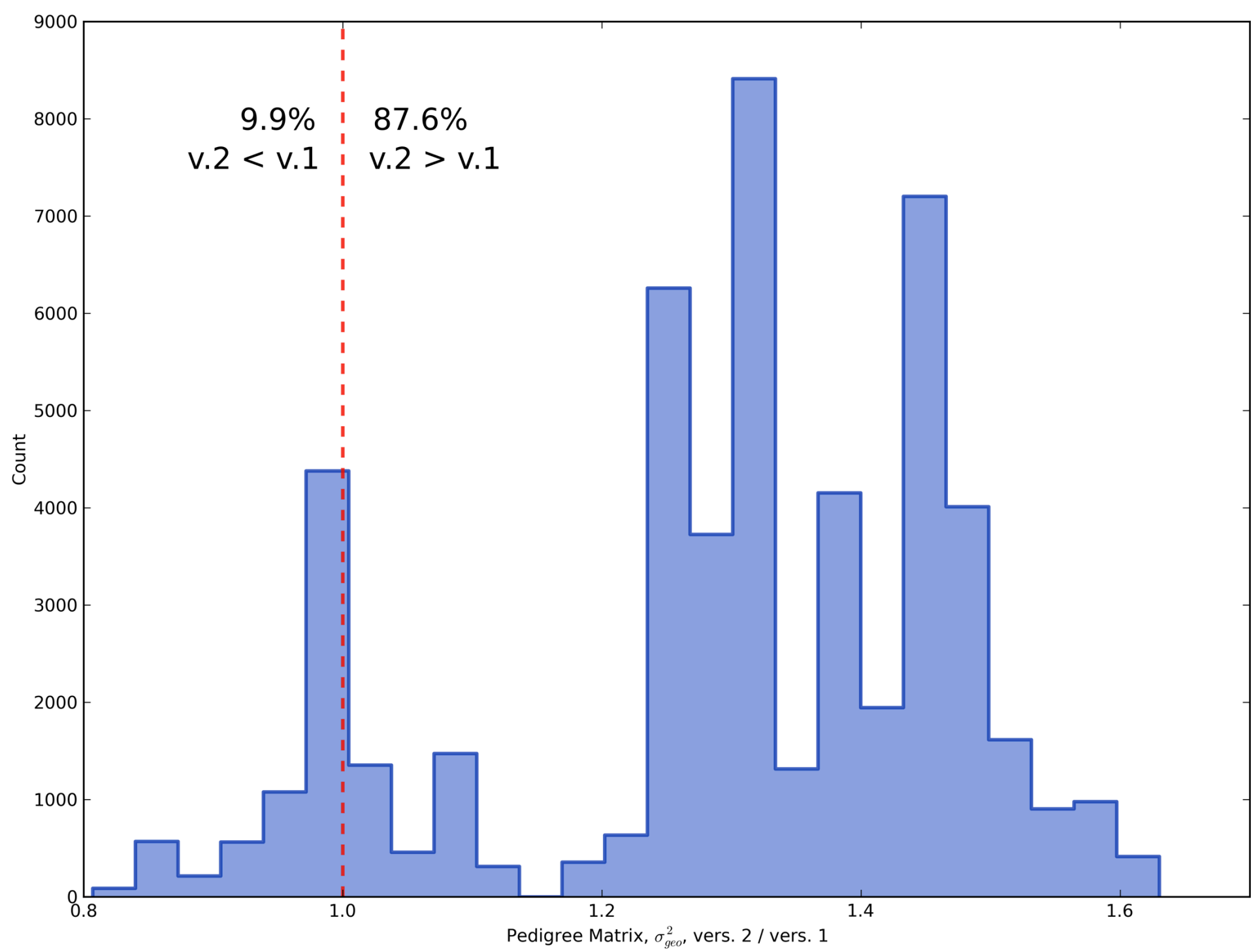
(sample size is removed from version 2)

Pedigree matrix, version 2

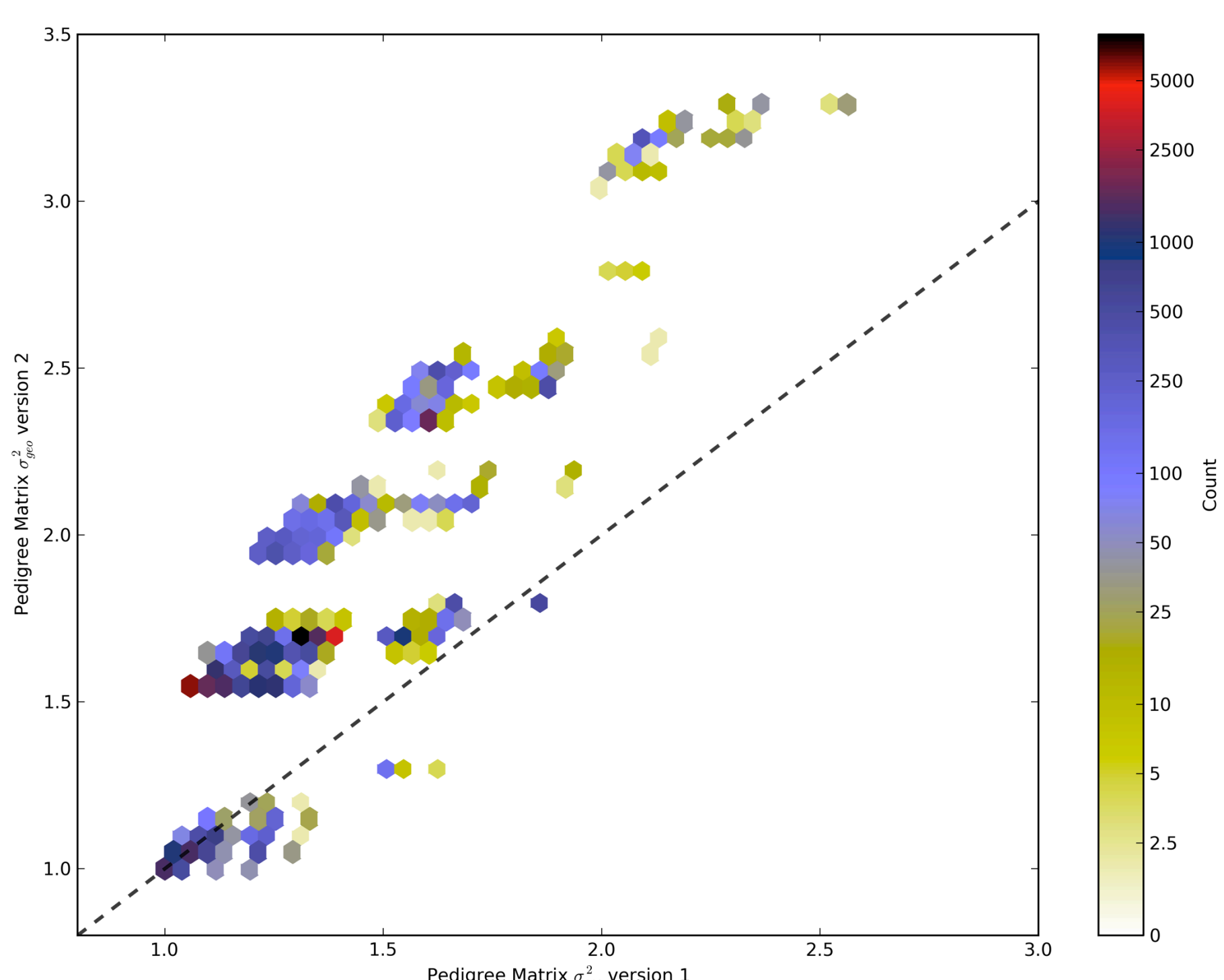
Methodology

- We developed an open source library to make calculations with both versions of the PM easier (see link above)
- Results were calculated for all technosphere and biosphere exchanges in ecoinvent 2.2
- All calculations and graphics were calculated in an online scientific notebook for increased comprehension and reproducibility (see link above)
- See talk on online notebooks Thursday at 10:30 in room *Ligurian 1*

Results



Histogram of the ratio of squared geometric standard deviations, version 2 divided by version 1. Version 2 is larger for 87% of the exchanges in ecoinvent 2.2



Density plot for squared geometric standard deviations, version 2 versus version 1. Differences between versions are small when uncertainty is small, but version 2 PM factors are substantially higher for higher uncertainties

Conclusions

- Pedigree matrix version 2 substantially increases uncertainty in ecoinvent 2.2
- The major source of increased uncertainty is the *reliability* category
- Technological, temporal, and geographical correlation PM factors are rarely used in ecoinvent

Numbers of exchanges in ecoinvent 2.2 with this uncertainty factor (thousands)

Increase (decrease) in PM factor from version 1 to version 2

