Problem

- How to plan for the future?
- How are we to assess the benefits vs cost trade-offs of different software methods?
- How are we to make future plans for the agency, given some much change in current practices?
Approach

Using traditional methods, there are no answers to these questions.

The local tuning problem.
- Software process models most accurate after local tuning
- But, data required for local tuning is hard to obtain
  • Due to business sensitivity associated with the data
  • And differences in how the metrics are defined, collected and archived.

New method
- Stability analysis
  • Check for stable conclusions existing in that space of possible tuning.
- If that works,
  • infer a set of software development policy recommendations to NASA
Approach (details)

- Implement USC software process models
  - COCOMO time / effort estimation,
  - COQUALMO defect prediction
  - MADACHY threats model

- Using
  - historical data, define space of past tunings
  - NASA experts, define standard project types

- Using simulated annealing, Monte Carlo simulation/optionation across intersection of
  - A particular project type
  - Space of possible tunings

- Rank options by frequency in good, not bad

- Test top ranked options for their median and variance effect. Smile if
  - Reduced median and variance in defects/efforts/time/threats

Sample run (after 10,000 runs, little improvement)
Relevance to NASA

NASA’s software methods are rapidly evolving
- NASA IV&V is the use of early lifecycle model-based validation.
- Agile process,
- Assertion-based analysis,
- Eclipse-based programming,
- Matlab-based automatic code generation,
- Simulation-oriented development cycles,
- etc.

Any stability in all that chaos?
- Can we make any plans for the future?
Accomplishments

- After extensive interviews with...
  - SE research gurus
  - Experienced NASA developers/managers
- Clear evidence of variance in NASA software processes

- In numerous case studies...
  - Massic reduction in
    - Defects/effort/time/threats
    - Both median and variance
  - Options required to reach minimum defects/effort/time/threats
    - Are a small subset of all options
Next Steps

- Required: more NASA software gurus
  - Wanted: volunteers from SAS
- More simulation studies
  - To confirm / refute stability hypothesis
- Generation of recommendations
  - For different NASA project types