

# SaTScan Version History

## SUMMARY

- 1997 **Version 1.0:** Spatial and space-time scan statistics. Poisson model.
- 1998 **Versions 2.0-2.1:** Bernoulli model. Purely temporal scan statistic.
- 2002 **Versions 3.0-3.1:** Space-time permutation model. Prospective analyses.
- 2003 **Version 4.0:** Risk adjustments. Missing data.
- 2004 **Versions 5.0-5.1:** Multivariate scan statistics. Bernoulli model covariate adjustment.
- 2005 **Versions 6.0-6.1:** Ordinal model. Exponential model. Elliptic window shape.
- 2006 **Version 7.0:** Normal model. User defined neighbors file. Iterative analysis adjusting for more likely clusters.
- 2009 **Version 8.0-8.1:** Multinomial model, Weighted normal model, Continuous scan statistics, Isotonic scan statistic, Multiple coordinates per location, Meta locations. Support for 64-bit platforms.
- 2010 **Version 8.2:** Support for Mac OS X platform.
- 2010 **Version 9.0:** Spatial variation in temporal trends, Weighted normal model with covariates, Sequential Monte Carlo p-values, Gumbel based p-values, Generic input dates.

## DETAILS

### **Version 9.0, July 19, 2010**

#### *New Analytical Features*

Spatial variation in temporal trends analysis

Ability to adjust for covariates with the purely spatial weighted normal model.

Sequential Monte Carlo based p-values, Gumbel based p-values and a default combination of different types of p-values

#### *Other Improvements*

Ability to specify input file dates in generic numerical format.

Option to print Monte Carlo rank of reported clusters.

Option to print column headers in ASCII output files.

#### *Minor Fixes*

Corrected bug when the adjustments for known relative risk file when using flexible scanning window.

Corrected bug that could occur with iterative scan when not using grid file.

Corrected import wizard to properly report error when CSV file record is missing columns.

### **Version 8.2.1, April 8, 2010**

#### *Minor Fixes*

Corrected bug which caused program to crash when insufficient memory is available to create all requested simulation threads.

### **Version 8.2.0, March 16, 2010**

*Improvement*

Added support for Mac OS X platform.

*Minor Fixes*

Corrected missing parameter setting in results summary file.  
Corrected failing behavior of Poisson alternate randomizer.  
Added missing parameter check with continuous Poisson model.

**Version 8.1.1, December 14, 2009**

*Minor Fixes*

Corrected bug which occurred when reading parameter file.

**Version 8.1.0, December 3, 2009**

*Improvement*

Added support for 64-bit platforms.

**Version 8.0.2, November 9, 2009**

*Minor Fixes*

Corrected bug in reported recurrence interval for prospective surveillance adjusting for earlier analyses.  
Corrected format error with date fields of file importer.  
Corrected several typos in graphical application and messaging.  
Refactored the compactness penalty input field for Java change in behavior.

**Version 8.0.1, June 8, 2009**

*Minor Fixes*

Corrected bug when the adjustments for known relative risk file was used for prospective analyses.  
Corrected issue with the windows graphical user interface using excessive amounts of memory when executing Monte Carlo replications.  
Corrected issue with reading the maximum temporal cluster size into the windows graphical user interface when value is greater than 50.

**Version 8.0, March 9, 2009**

*New Analytical Features*

Multinomial probability model  
Weighted normal probability model  
Continuous scan statistic with a Poisson probability model  
Isotonic spatial scan statistic  
Multiple coordinates per location  
Meta Locations; an enhancement to the user defined neighbors.

*Other Improvements*

Re-implementation of the graphical interface in Java.  
Graphical user interface available for Linux.

*Minor Fixes*

Minor improvements in the output files.

Correction of an erroneous error message that was sometimes reported from the graphical user interface when running the space-time permutation model.  
Correction to the zero population check.

**Version 7.0.3, May 10, 2007**

*Minor Fixes*

Correction in temporal adjustment for log linear with automatically calculated time trend.

**Version 7.0.2, March 8, 2007**

*Minor Fixes*

With multiple data sets defined, constructed circles/ellipses could exceed defined maximum when defined as percentage of population at risk. Updated to consider population in all data sets.

**Version 7.0.1, October 12, 2006**

*Minor Fixes*

Added requirement that detected clusters have at least two cases when using Normal probability model.

**Version 7.0, August 14, 2006**

*New Analytical Features*

Normal model for continuous data.

Specification of user defined neighbors file to define windows with non-Euclidean distance metrics.

Iterative analysis option whereby the p-values for secondary clusters are adjusted for the existence of more likely clusters that are found and reported.

*Other Improvements*

Option to disable temporal data checking feature. Rather than generating an error, cases and controls outside the study period are simply ignored.

Option to disable spatial data checking feature. Rather than generating an error, cases, controls and population that do not correspond to a location specified in the coordinates file are simply ignored.

More flexibility in defining different combinations of the maximum scanning window size and the maximum reported cluster size.

*Minor Fixes*

Removed the need to specify a coordinates file when doing a purely temporal analysis.

**Version 6.1.3, May 4, 2006**

*Minor Fixes*

Correction in geographical overlap of secondary clusters (platform variation).

Corrected possibly incorrect ranking of reported clusters when executing with more than one processor and applying early termination option.

**Version 6.1.2, April 7, 2006**

*Minor Fixes*

Corrected reported relative risk in cluster case information file when using multiple data sets.

### **Version 6.1.1, March 28, 2006**

#### *Minor Fixes*

Corrected calculation of semi-minor and semi-major axes.

Correction in geographical overlap of secondary clusters.

### **Version 6.1, March 13, 2006**

#### *New Analytical Features*

Spatial and space-time scan statistics using an elliptic rather than circular spatial cluster shape, with or without a non-compactness penalty. This feature is only available with Cartesian coordinates but not with latitude/longitude coordinates.

#### *Other Improvements*

Faster computations for purely temporal analyses.

Option to specify the maximum size of reported clusters in a different unit than the one used for the maximum size of all clusters evaluated.

The Cluster Information file has been split into two separate output files, to make the size more manageable.

Option to suppress warning messages.

### **Version 6.0, October 24, 2005**

#### *New Analytical Features*

Ordinal probability model for categorical data that is ordinal in nature.

Exponential probability model for continuous survival time data with and without censoring.

#### *Other Improvements*

Utilization of parallel processors when available on the computer for faster computing times.

Less memory requirements for certain very large data sets with many geographical locations.

The number of different data sets that can be analyzed as part of the multiple data set feature has been increased to twelve.

#### *Minor Fixes*

Windows interface option to suppress calculation of critical values.

Updated user guide and help system.

Corrected minor error in the radius reported in the cluster information file, which did not take the curvature of the earth into account.

Updated the import wizard to provide correct error messages when the specified dBase file cannot open.

Additional data validation tests implemented for the Poisson model.

Revised reporting of cluster information multivariate analyses with multiple data sets.

### **Version 5.1.3, April 18, 2005**

#### *Minor Fixes*

Corrected the reported population value for purely spatial clusters when running a space-time analysis using the Bernoulli model.

### **Version 5.1.2, March 24, 2005**

#### *Minor Fixes*

Ability in batch mode to suppress the calculation of the loglikelihood value required for statistical significance at the 0.01 and 0.05 levels.

### **Version 5.1.1, March 18, 2005**

#### *Minor Fixes*

Parameter file read correction when there are multiple data sets.

Suppress zero population warnings when there is input data from multiple data sets.

Prospective surveillance start date no longer validated when not adjusting for earlier analyses.

### **Version 5.1, December 30, 2004**

#### *Improvements*

Faster computing time for prospective space-time analyses.

Ability to run a Poisson based purely temporal analysis without a population file, assuming a constant risk over time.

Option to save the imported files in any location specified by the user.

#### *Minor Fixes*

Updated User Guide.

User Guide available on the help pull down menu.

New print button for the main results file to the toolbar and file menu.

Some dBase output fields changed to numerical.

Reorganized parameter file.

### **Version 5.0, September 21, 2004**

#### *New Analytical Features*

Multivariate scan statistics, with simultaneous analysis of up to four different data sets.

Adjustment for covariates in the Bernoulli model.

Adjustments for a temporal trend that is automatically calculated by SaTScan.

Adjustment for purely spatial clusters with the Poisson model.

#### *Other Improvements*

Redesigned windows interface, separating standard and advanced features.

Improved interface for the SaTScan import wizard.

Faster speed for data sets with a very large number of cases.

A wider variety of date options allowed in the SaTScan file format input files.

#### *Minor Fixes*

The study time period can now have the same start date and end date.

When requesting a report of only non-overlapping clusters, overlapping is now defined in terms of having one or more location IDs in common rather than the previous definition of the two circles overlapping each other. Results will in most cases be identical.

Fixed problem when calculating the expected number of cases when the population in the population file is specified in days.

Updated error and warning messages.

Ability to define time intervals in years when the time aggregation is defined in terms of month, and in years or months when the aggregation is defined in terms of days.

The definition of the circle radius redefined from the length of a straight line through the crust of the earth 'as the worm crawls' to the length of a curved line along the surface of the earth 'as the crow flies'.

### **Version 4.0.3, February 3, 2004**

#### *Minor Fixes*

Incorporated SaTScan license agreement as part of the installation procedure.

Fixed bug, where SaTScan was unable to read more than five decimals for latitude/longitude coordinates.

### **Version 4.0.2, November 10, 2003**

#### *Minor Fixes*

Problem when using the relative risk adjustment file fixed.

Improved error messages.

### **Version 4.0.1, October 23, 2003**

#### *New Analytical Features*

Adjustment for covariates when the space-time permutation model is used.

Adjustments for purely spatial, purely temporal or space-time clusters, using a special adjustments file with user specified relative risk adjustments for each spatial, temporal and/or space-time location.

Ability to adjust for missing data.

Nonparametric adjustment for temporal trends using stratified randomization, replacing the previous nonparametric adjustment method used in versions 2 and 3 (only for Poisson model). The old version is still available in batch mode.

Prospective purely temporal analysis.

An optional special circle size file for defining the maximum geographical circle size that is distinct from the regular population file.

Completely flexible specification of ranges for the start and end time of temporal clusters to be evaluated.

Option to terminate the Monte Carlo simulations early when the p-value is large.

Ability to use a percentage of the study period as the maximum temporal cluster size when running a prospective analysis (previously only available for retrospective analyses).

Option not to adjust for previous analyses when doing prospective analyses. This replaces the alive cluster option, which did the same thing but with more limited output information.

#### *Other Improvements*

Faster space-time analyses.

Option to report only small cluster up to a maximum size, even when larger clusters are adjusted for in the analysis.

When launching SaTScan, a dialog box asks whether to open a new, a saved or the last worked on session.

Button within SaTScan allows user to quickly check whether there is a newer version. If there is, an automatic update feature is available.

A pull-down menu lets the user quickly select one of the ten last opened sessions.

Automatic reading of case and control time precisions, whether day, month or year.

#### *Minor Fixes*

Improved and more detailed error messages.

A problem when reading more than four Cartesian coordinates when opening the special grid file with the Import Wizard has been fixed

### **Version 4.0, October 20, 2003**

*Limited release.*

### **Version 3.1.3, October 16, 2003**

#### *Bug Fix*

Error in the calculation of the null occurrence rate corrected.

### **Version 3.1.2, July 16, 2003**

#### *Minor Fixes*

Updated SaTScan user guide.

Minor changes in the output files.

Fixed error when purely spatial clusters are included in a prospective space-time analysis.

### **Version 3.1.1, June 13, 2003**

#### *Minor Fixes*

Fixed error when purely temporal clusters are included in a prospective space-time analysis.

### **Version 3.1, June 9, 2003**

#### *New Analytical Features*

Population counts can now be specified for specific months or day, in addition to years.

Null occurrence rates, such as 'once every 15 months', are shown for clusters detected in prospective analyses.

#### *Other Improvements*

Analysis history file created with brief information about each analysis run performed. It is automatically generated in dBase format.

Parameters file structure switched to the more flexible windows style 'ini file', maintaining support for the previous line based parameter files.

Input population file can read decimal population numbers in addition to integers.

Locations that specify the same geographical coordinates are automatically combined and are treated as one location in the analysis.

Top ten most likely clusters are reported when zero simulations are requested.

Improved and more detailed error messages for invalid parameters and input data.

Optional output files with relative risks and simulated log likelihood ratios available in dBase format.

Import wizard expanded to handle character delimited and fixed column input file formats.

Data importer interface improved for ease of use.

Areas with a single case ignored when evaluating clusters.

About box with hyperlinks to website and email.

Updated SaTScan User Guide

#### *Minor Fixes*

Corrected problem when printing results from the run analysis window.

Simultaneous SaTScan runs within the same session can no longer access the same result file concurrently.

Format of results files corrected to prevent excess space between data fields.

Input file names can now be directly typed into parameter window controls (as in v2.1).

Installed sample parameter files no longer have hard coded paths for respective data files.

Main window buttons enabled based upon active child window.

Fixed problem with the import wizard, which was unable to read more than three covariates in the population file.

Fixed problem where the import wizard could not read read-only dBase files.

### **Version 3.0.5, April 15, 2003**

#### *Minor Fix*

Corrected problem with maximum temporal window size for prospective analyses.

### **Version 3.0.4, February 6, 2003**

#### *Minor Fixes*

Fixed error by which the special grid file was ignored unless the parameters were saved before a run.

Program terminated with an error when there were locations with zero population and zero cases. The error is now shown only when there are locations with cases but zero population.

### **Version 3.0.3, January 2, 2003**

#### *Improvement*

Improved and easier to use import file wizard.

### **Version 3.0.2, December 10, 2002**

#### *Minor Fixes*

Fixed error when reading latitude and longitude from dBase import files.

The dBase version of the 'Cluster Information' output file reported the log likelihood rather than log likelihood ratio.

### **Version 3.0.1, December 4, 2002**

#### *Minor Fixes*

Fixed problem with the import wizard, that was unable to import dBase population files.

### **Version 3.0, October 17, 2002**

#### *New Analytical Features*

Space-time permutation model using only case data, for the detection and evaluation of space-time interaction clusters, adjusting for purely spatial and purely temporal clusters.

Prospective space-time analyses for the early detection of disease outbreaks, adjusting for a sequence of daily or other time-periodic analyses.

Option of showing more secondary clusters in the output files, using various criteria for the type of geographical overlap.

Ability to specify maximum temporal window size in days, months or years, instead of as a percent of the study period.

#### *Other Improvements*

Import wizard reading dBase input files.

Ability to save parameter settings for future use.

Ability to simultaneously run multiple SaTScan runs within the same session.

'Location information' output file in dBase format, in addition to ASCII (optional)

Optional 'cluster information' output file in ASCII and/or dBase format, with same information as the standard results file in a format easier to export to other programs.

Decreased memory use, leading to increased speed for some large data sets.

SaTScan user guide in pdf format.

New Sample Data Set: Hospital Emergency Room Admissions Due to Fever at New York City Hospitals, Nov 1–24, 2001.

### **Version 2.1.3, September 17, 1998**

#### *Minor Improvements and Fixes*

### **Version 2.1.2, August 25, 1998**

#### *Minor Improvements and Fixes*

### **Version 2.1.1, August, 1998**

#### *Minor Improvements and Fixes*

### **Version 2.1, July 29, 1998**

#### *New Analytical Features*

Bernoulli model, for 0/1, case/control type data.

Purely temporal analyses.

Ability to specify geographical coordinates in latitude and longitude.

Ability to include purely temporal clusters in space-time analyses.

Adjustment for temporal trends using either a log-linear or nonparametric model.

*Other Improvements*

Sample data: Childhood leukemia and lymphoma in North Humberside, England, 1974-1986.

Option to print simulated log likelihoods to a file.

Option to print relative risks for each census area as part of the output file.

**Version 1.0.5, March 16, 1998**

*Minor Fixes*

**Version 1.0.4, January 21, 1998**

*Minor Fixes*

**Version 1.0.3, October 31, 1997**

*Minor Fix*

Corrects a problem with SaTScan sometimes terminating abnormally when there are census areas with zero population.

**Version 1.0.2, September 18, 1997**

*Improvements*

Expanded help text, including the sections on statistical method and comparisons with other methods.

SaTScan icon created

**Version 1.0.1, July 17, 1997**

*Analytical Features*

Poisson model.

Purely spatial and space-time analyses.

Adjustment for covariates.

Scanning for high, low or either high or low rates.

Optional special grid file to define circle centroids.

Geographical coordinates in two or three dimensions, in the regular Cartesian coordinate system.

Max geographical circle size defined as percent of population at risk.

Max temporal cluster size defined as percent of study period.

Space-time analyses scanning either 'all' clusters or only 'alive' clusters.

Ability to include purely spatial clusters in space-time analyses.

*Other Features*

Installation program.

Help system.

Sample data: Brain cancer incidence in New Mexico.

Standard text based output file.

Location information output file in ASCII format, with each row containing information about a particular location and its cluster membership (\*.gis).

**Version 1.0.0, June 30, 1997**

*Private Release*