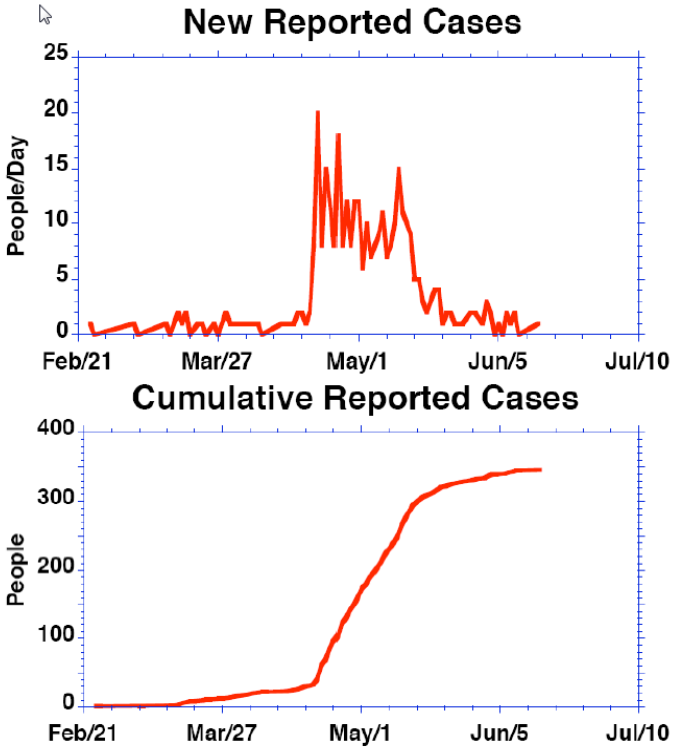
15.871 System Dynamics
Recitation#1

Understanding Epidemics Using

VensimPLE

For use with VensimPLE, version 6.0

A simple model that captures the dynamics of an infectious disease- SARS

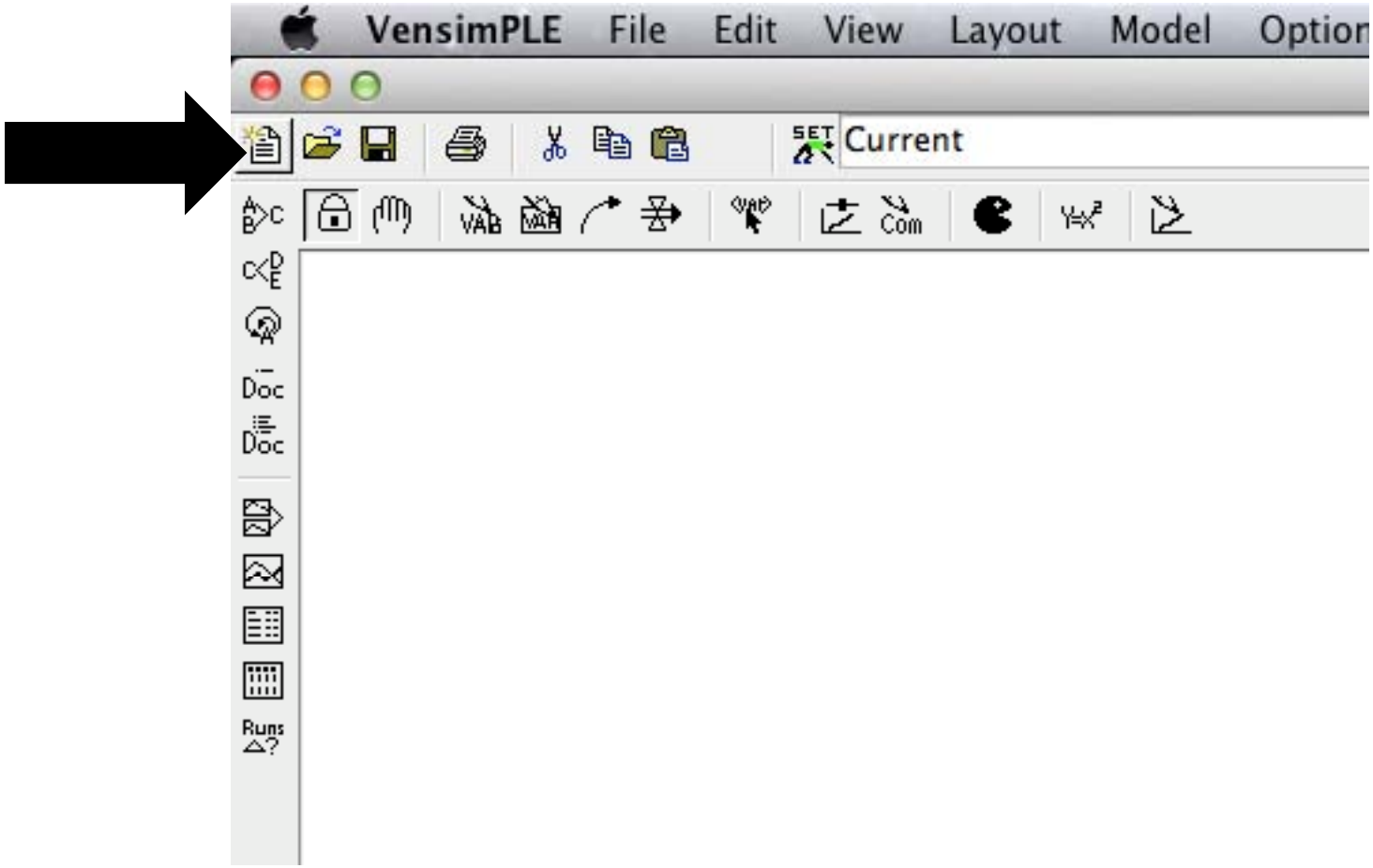


Historical data: SARSDATA.vdf

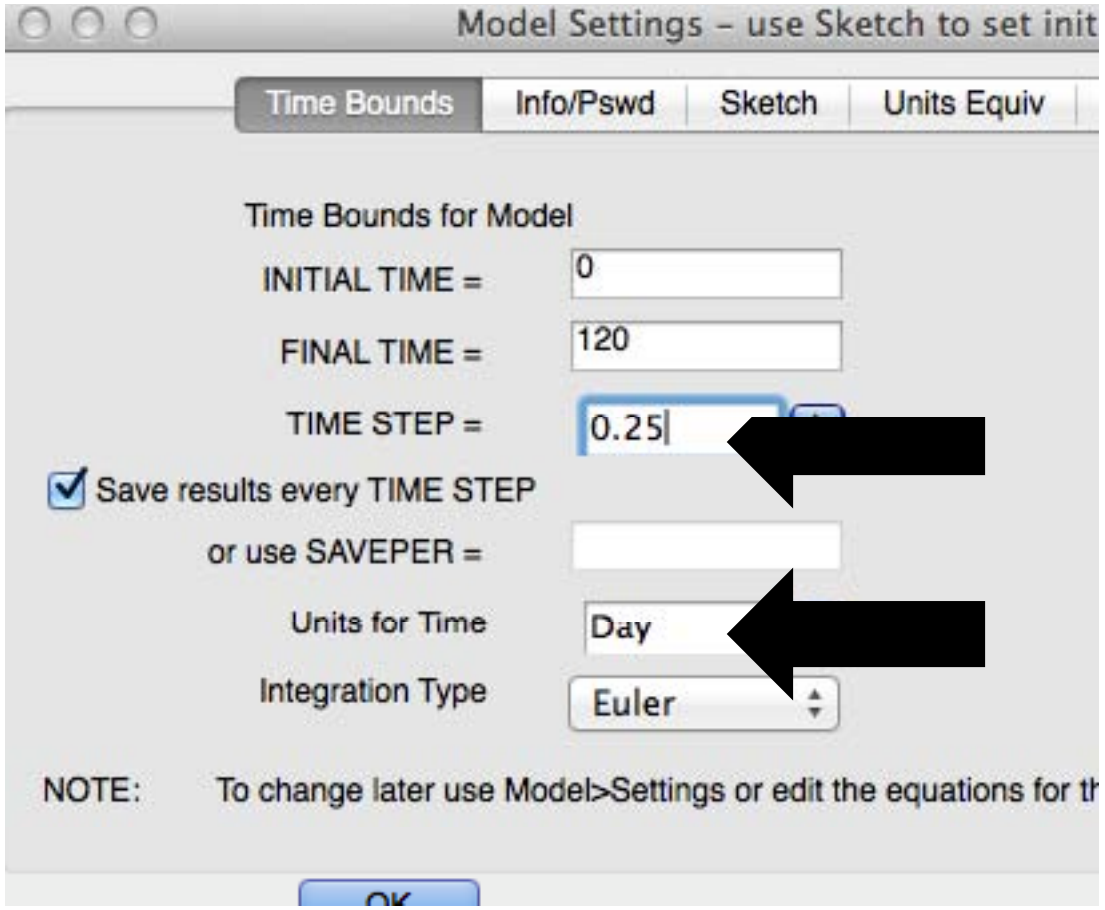
-**the incidence** (rate at which new cases were reported, measured in people/day)

- **cumulative prevalence** (cumulative number of cases reported, measured in people) for SARS in Taiwan

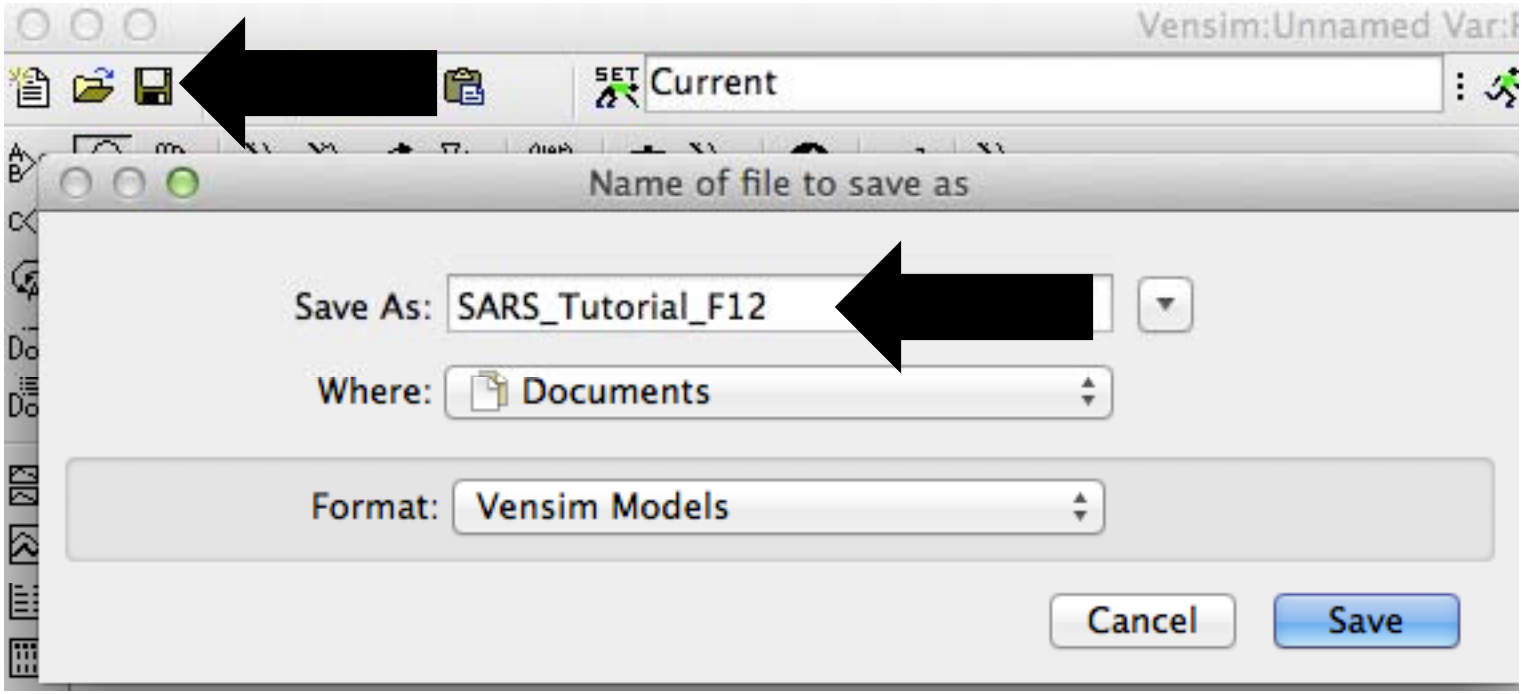
Step 1: Open A New Model



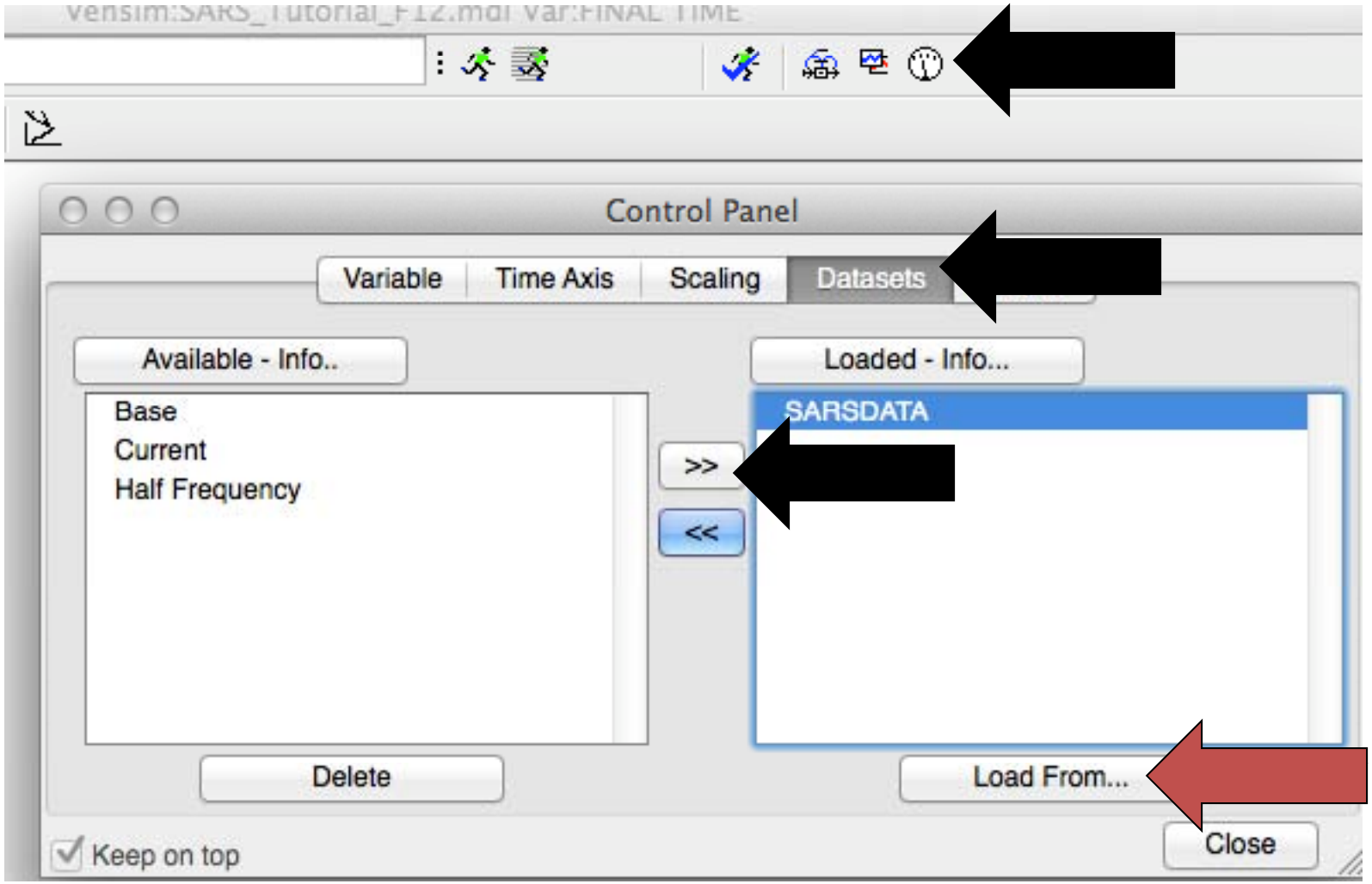
Step 2: Initial Settings



Step 3: Save As “SARS_Tutorial_F12”



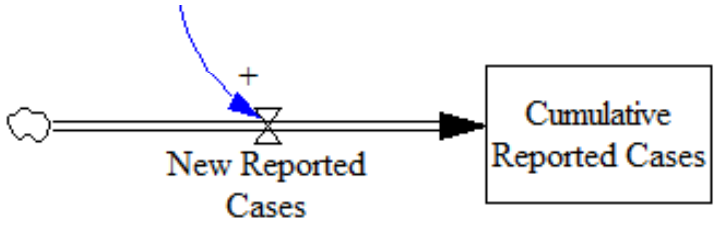
Step 4: Load SARSDATA.vdf



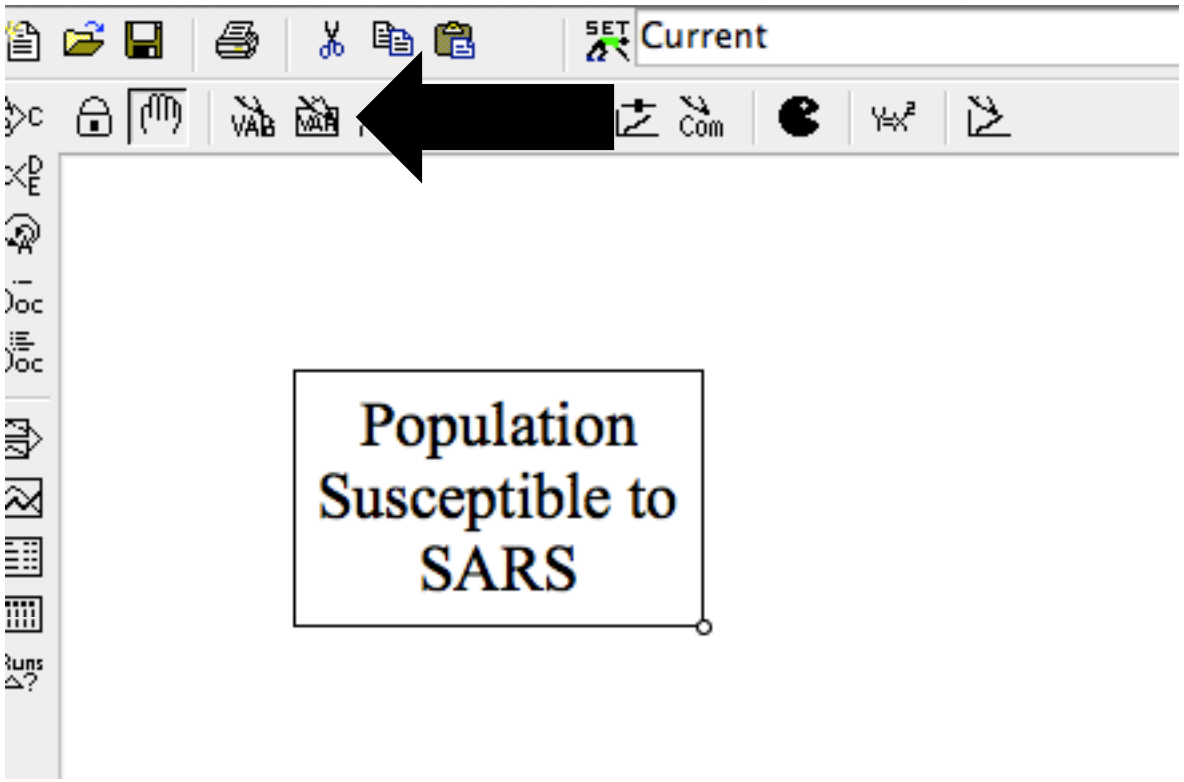
----Warning----

- **We will compare our simulation data to the actual/historical data in this file, so variable names need to match EXACTLY**

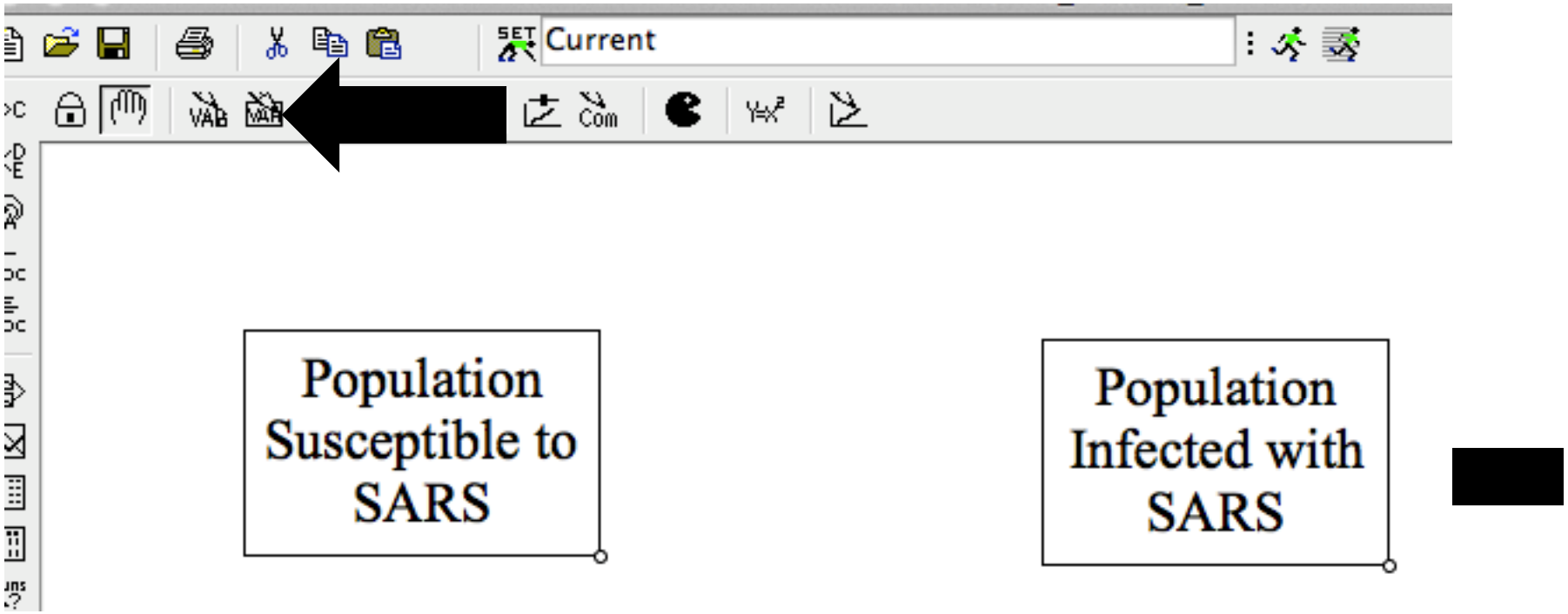
- **SARSDATA has 2 variables, those names have to match:**
  - New Reported Cases
  - Cumulative Reported Cases



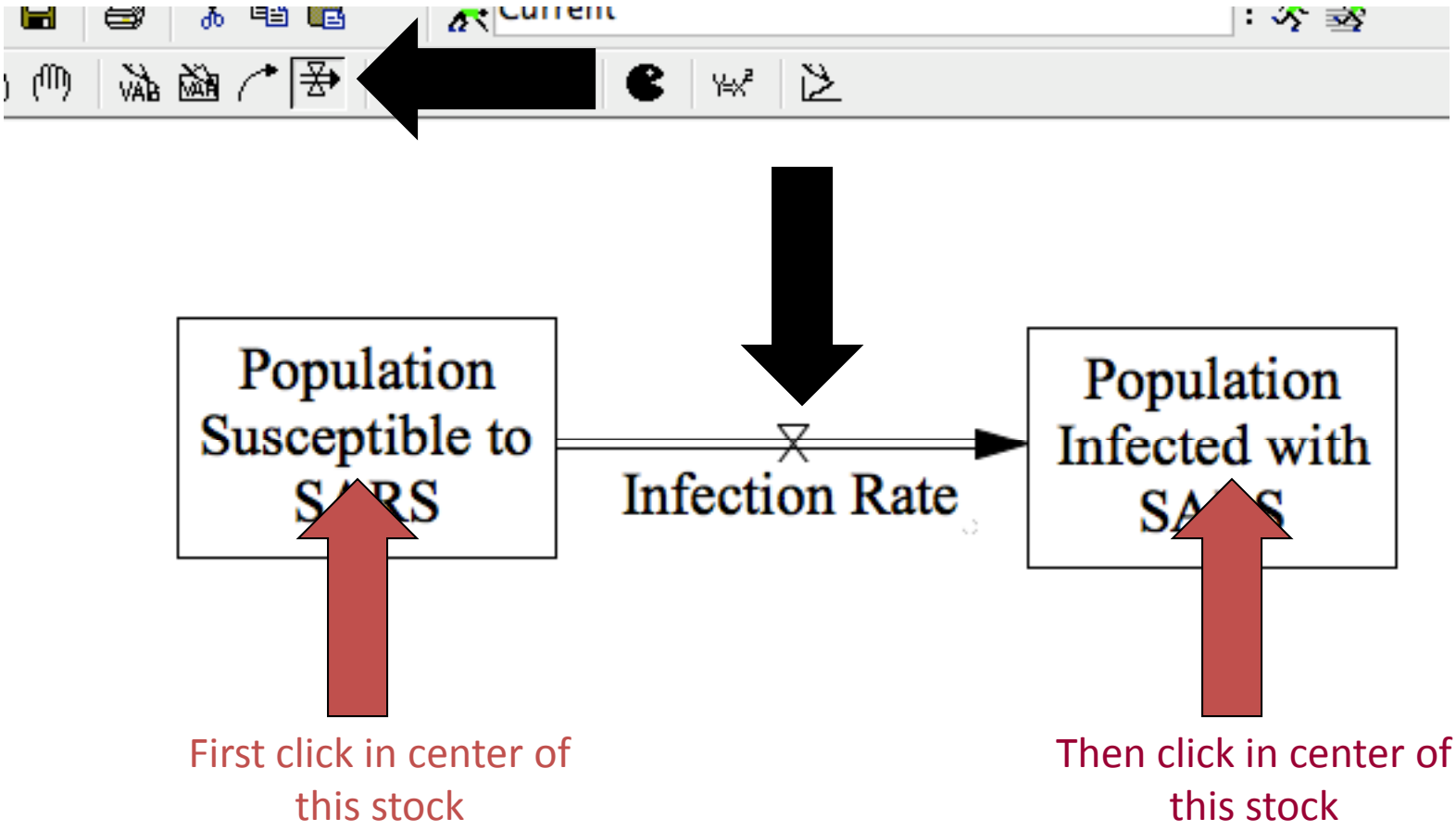
Step 5: Population Susceptible to SARS (stock)



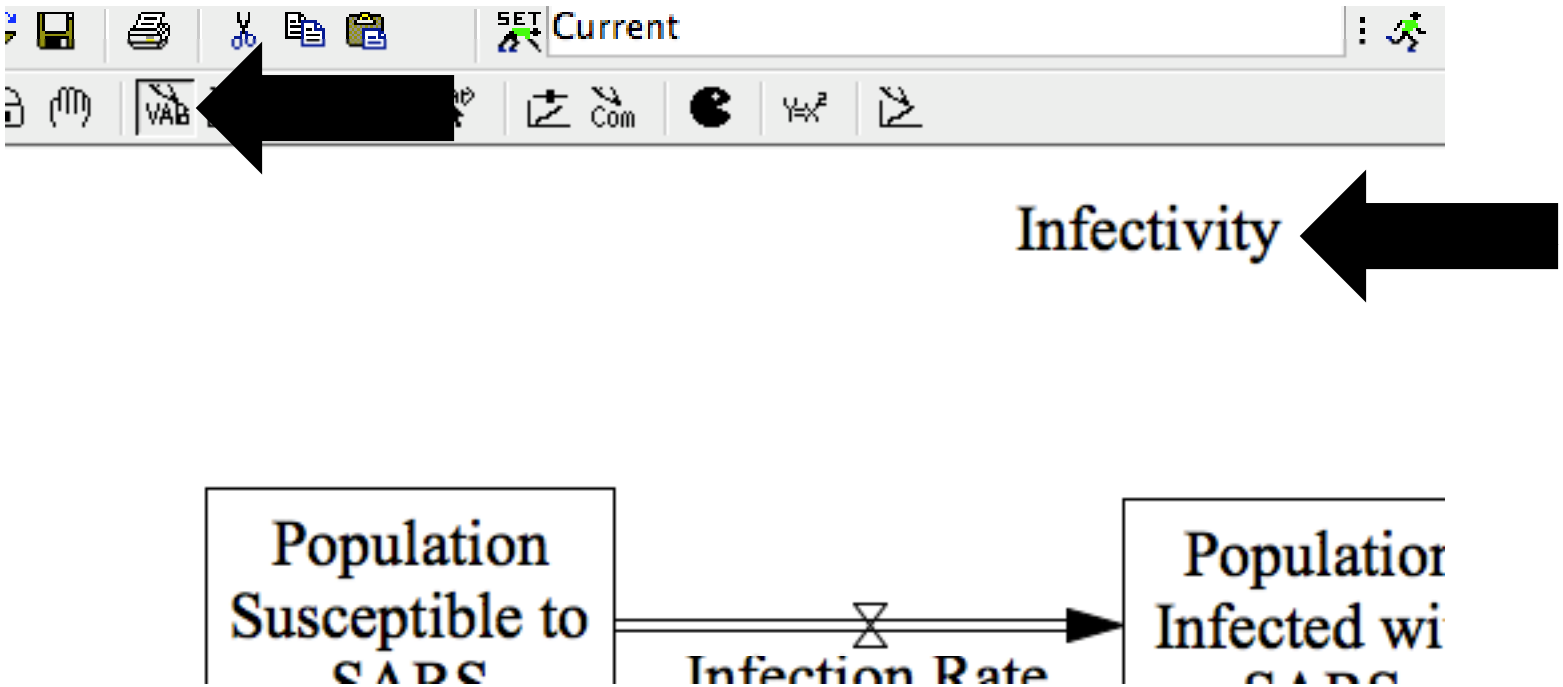
Step 6: Population Infected with SARS (stock/level)



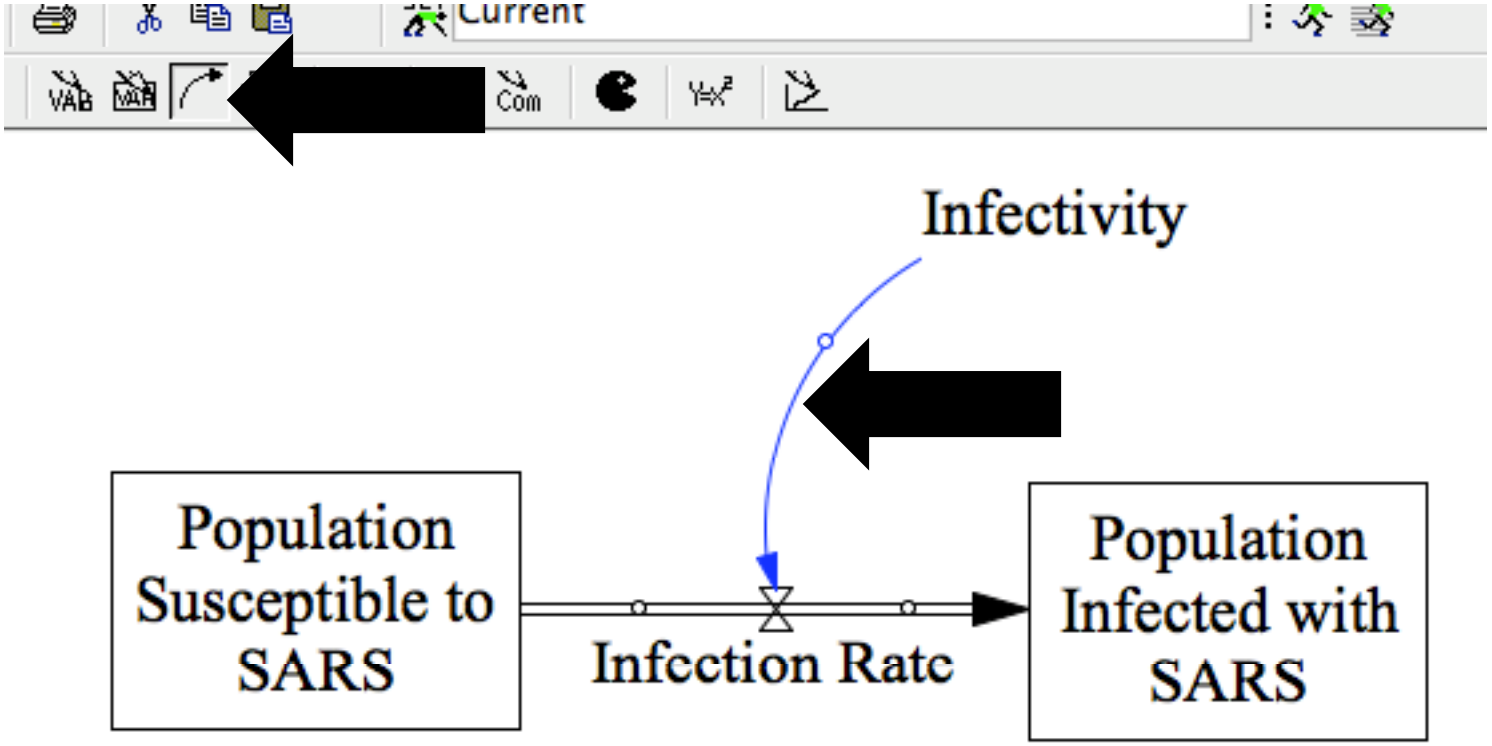
Step 7: Infection Rate (flow/rate)



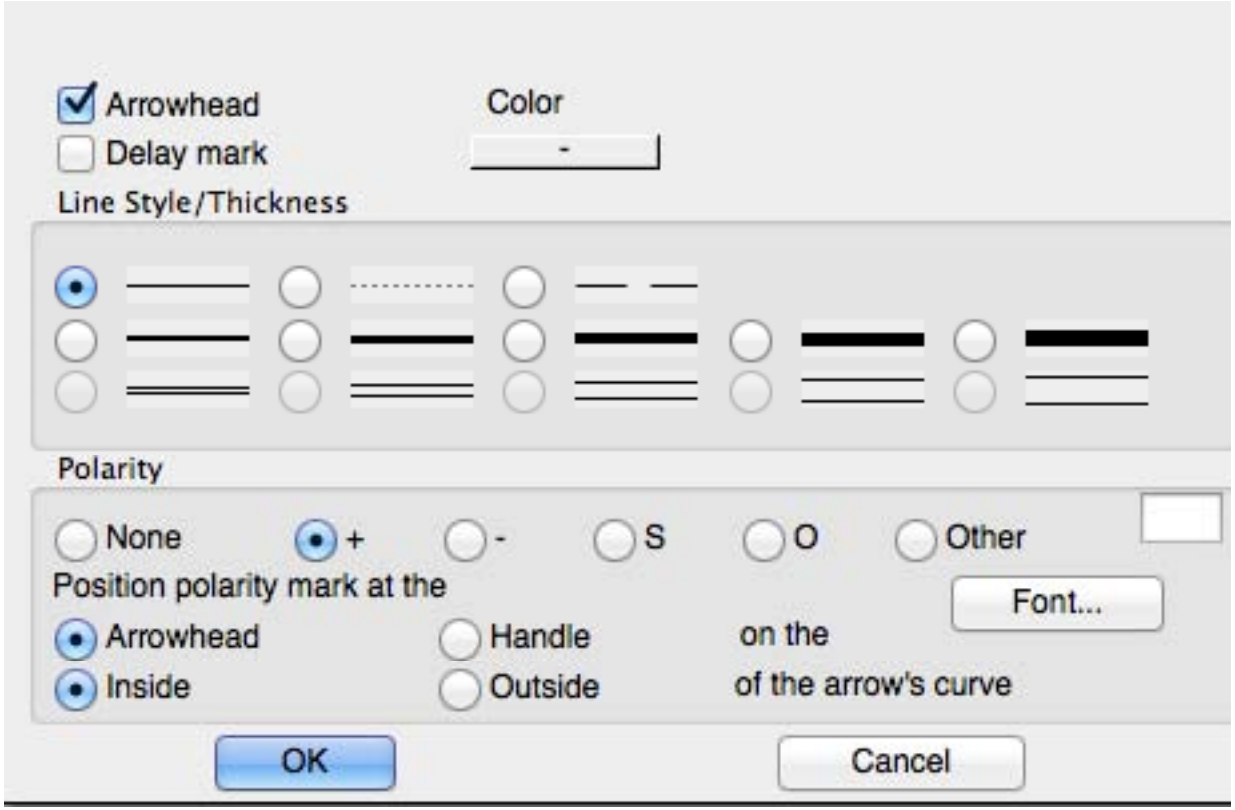
Step 8: Infectivity (auxilary)



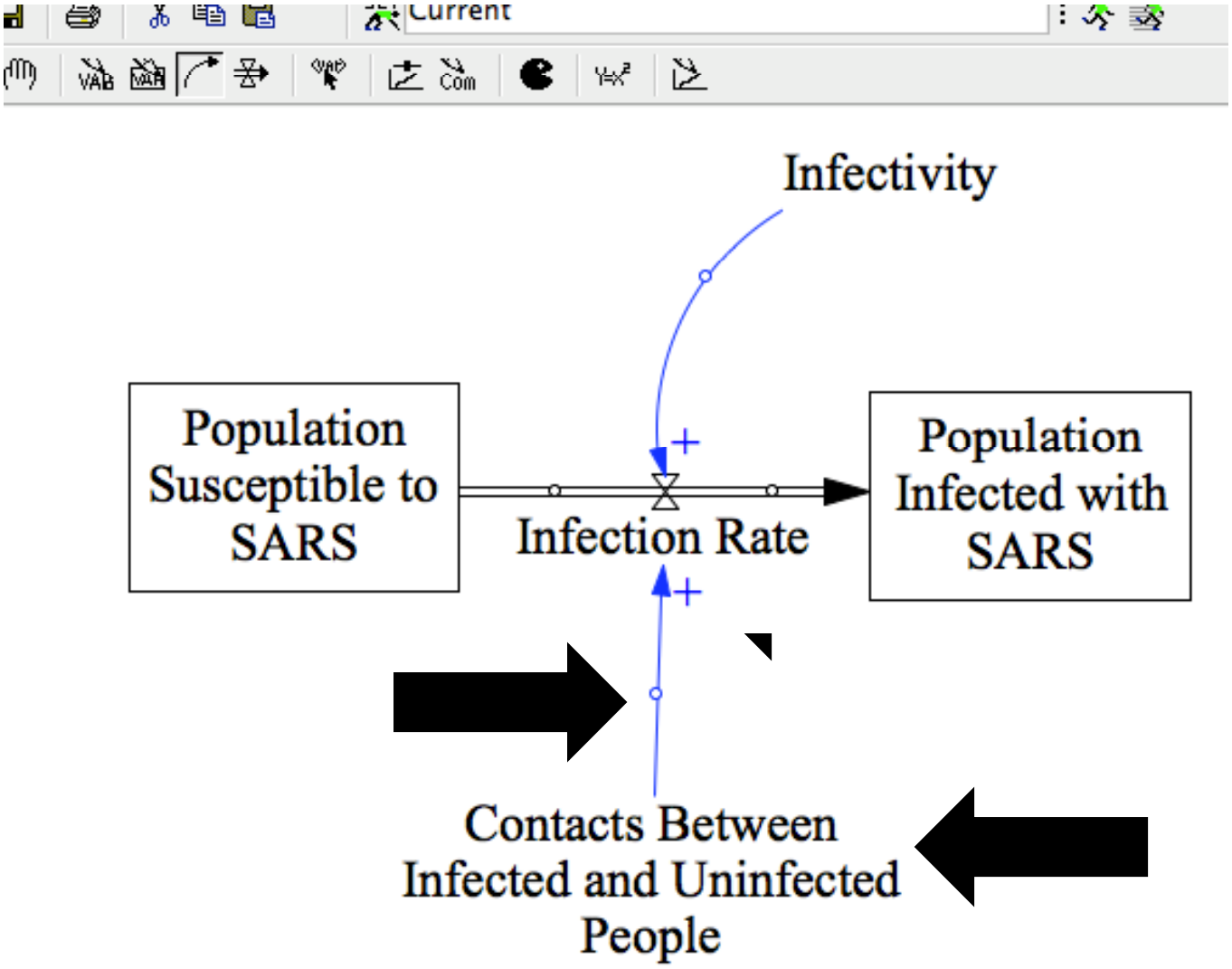
Step 9: Add Causal Arrow



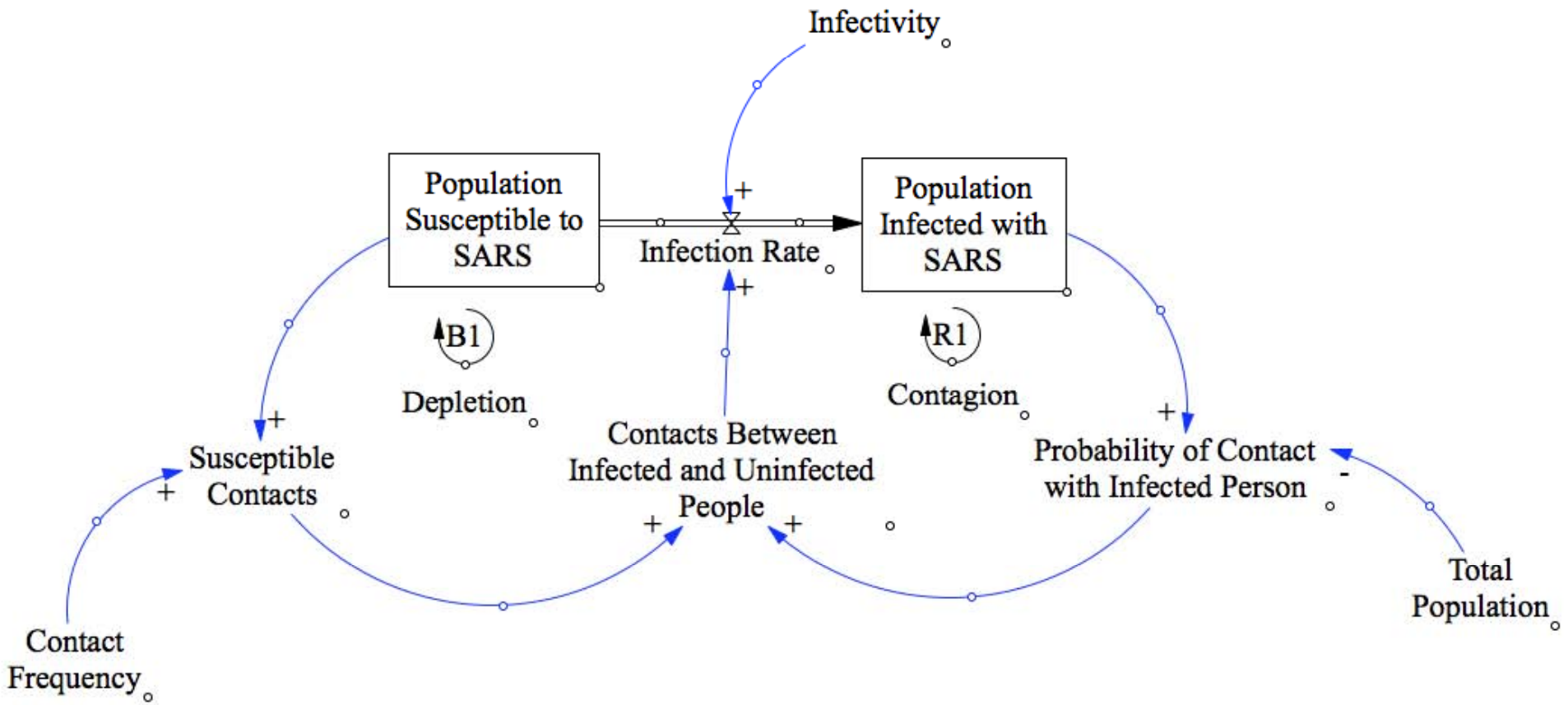
Step 10: Right-click on Arrow “handle” to Add Polarity



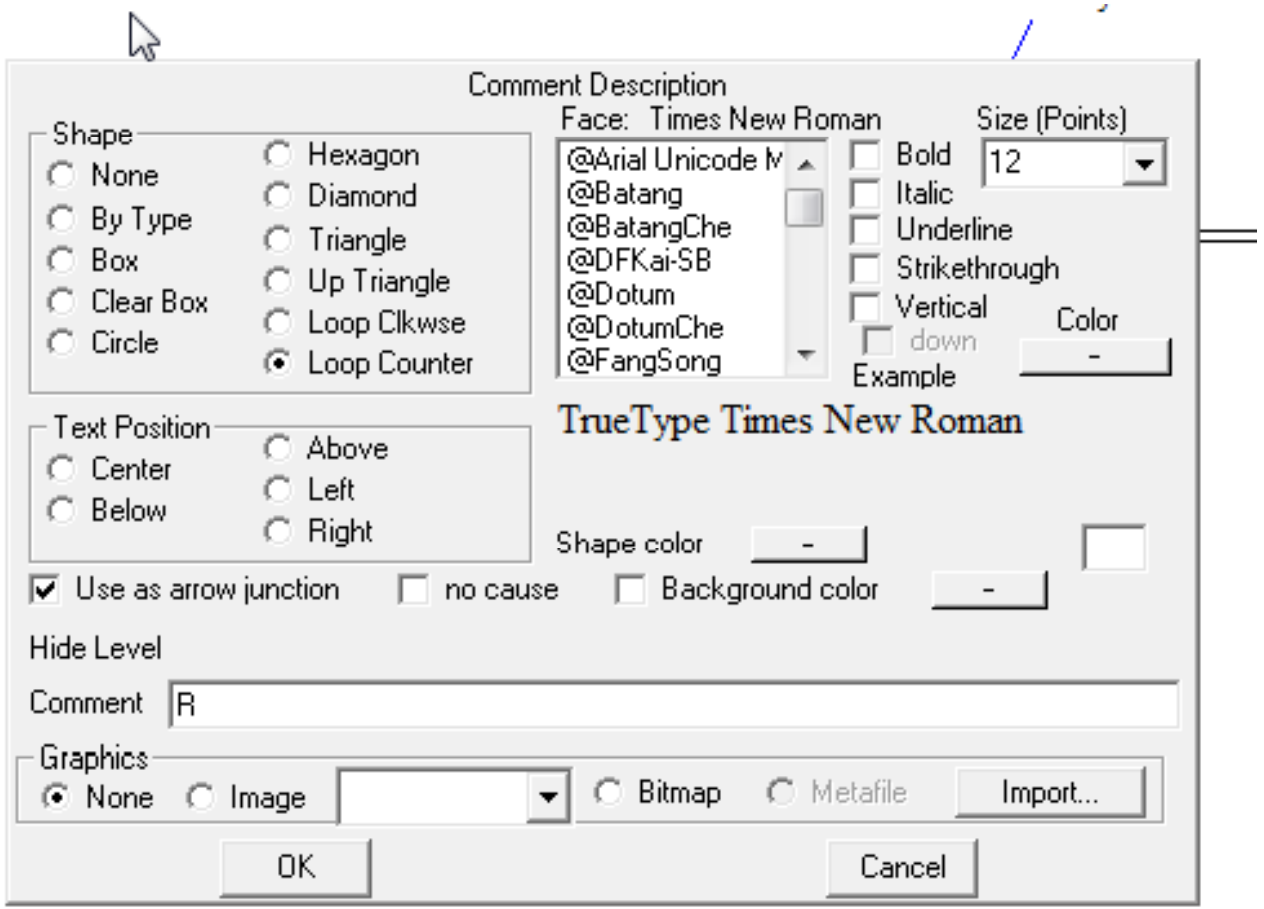
Step 11: Contacts Between Infected and Uninfected People



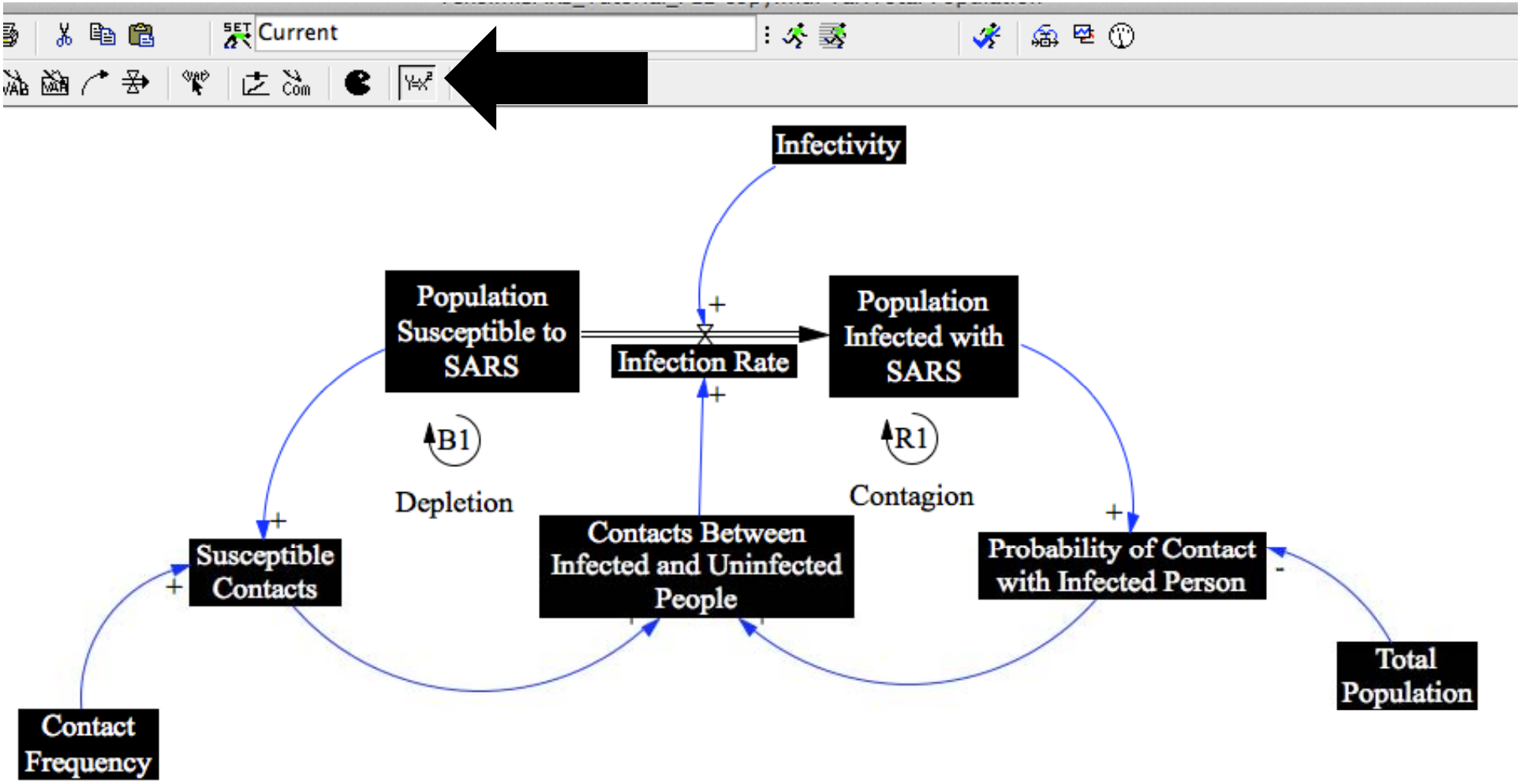
Step 12: Complete the Rest of the Model + Label the Loops



Use comment tool to add labels



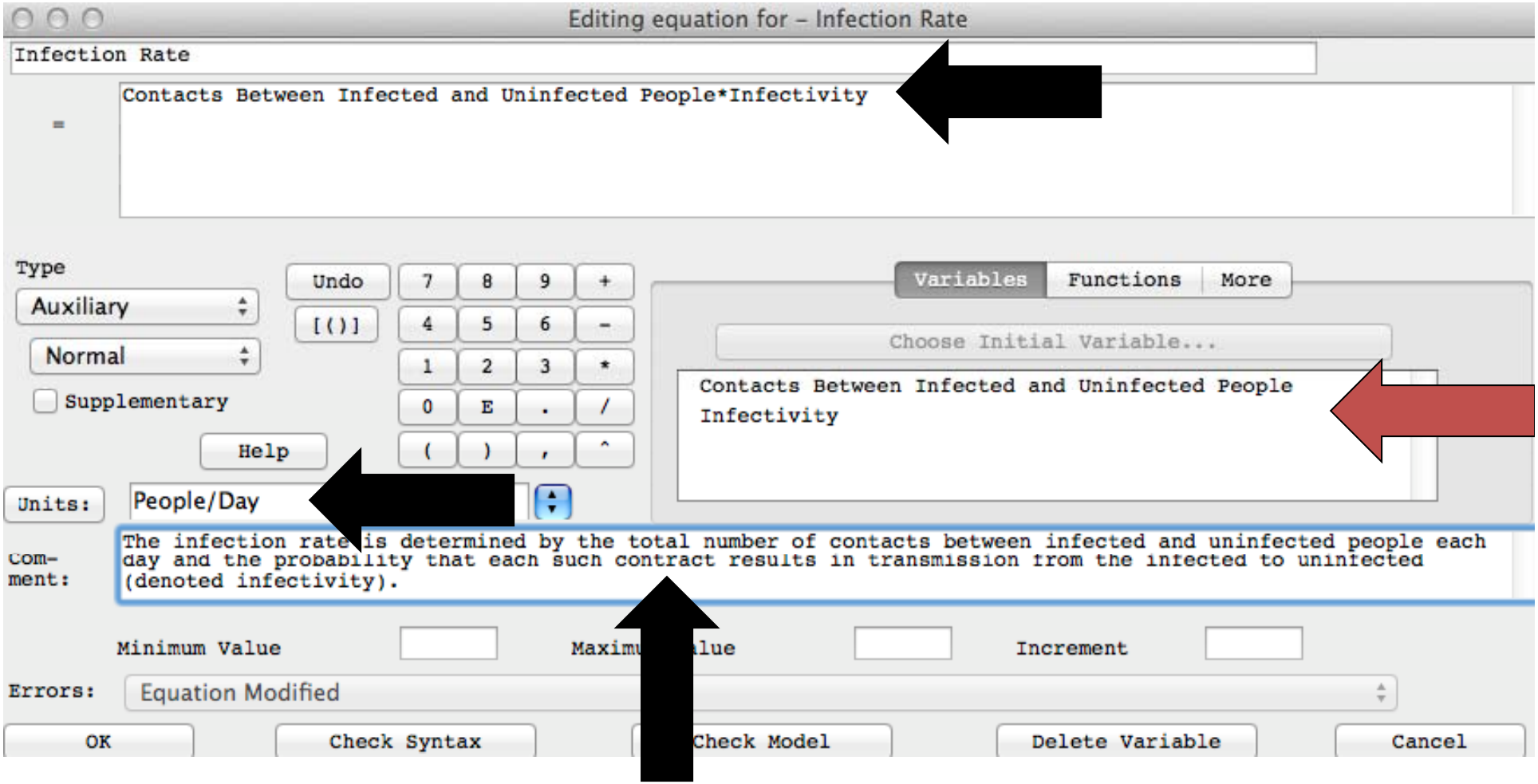
Step 13: Specify Equations



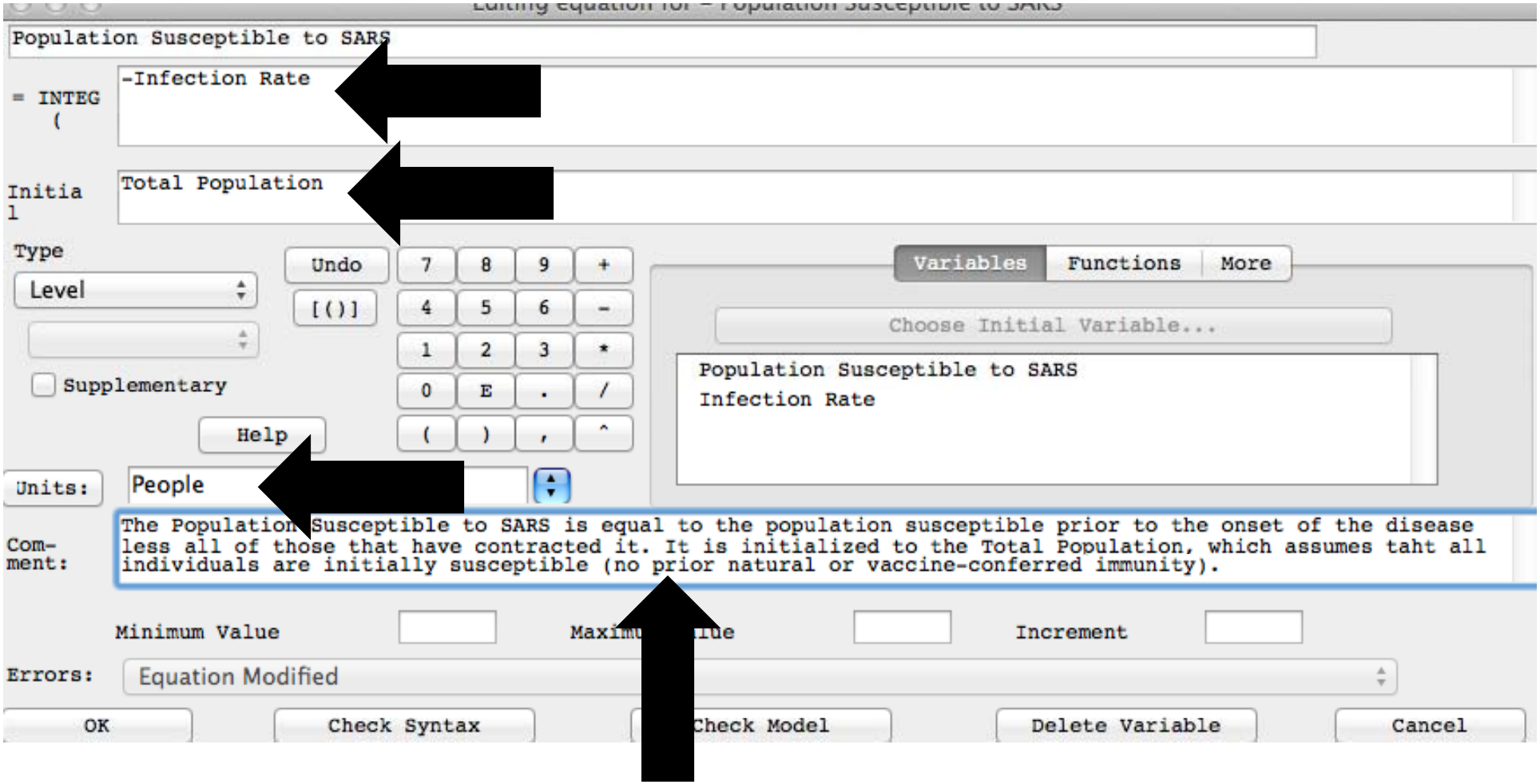
Exogeneous and Endogeneous Variables

- Variables in SD models are classified as either exogenous or endogenous:
  - Exogenous variables are defined independent of other variables of the model.
    - They are functions of time (i.e., Exogenous Variable = *f(t)).*
    - *Of course the exogenous variables may be constants, in which case they are called parameters.*
  - Endogenous variables are influenced by other variables in the system
    - Endogenous Variable = f(x, y, z), where x, y, z are other variables in the model

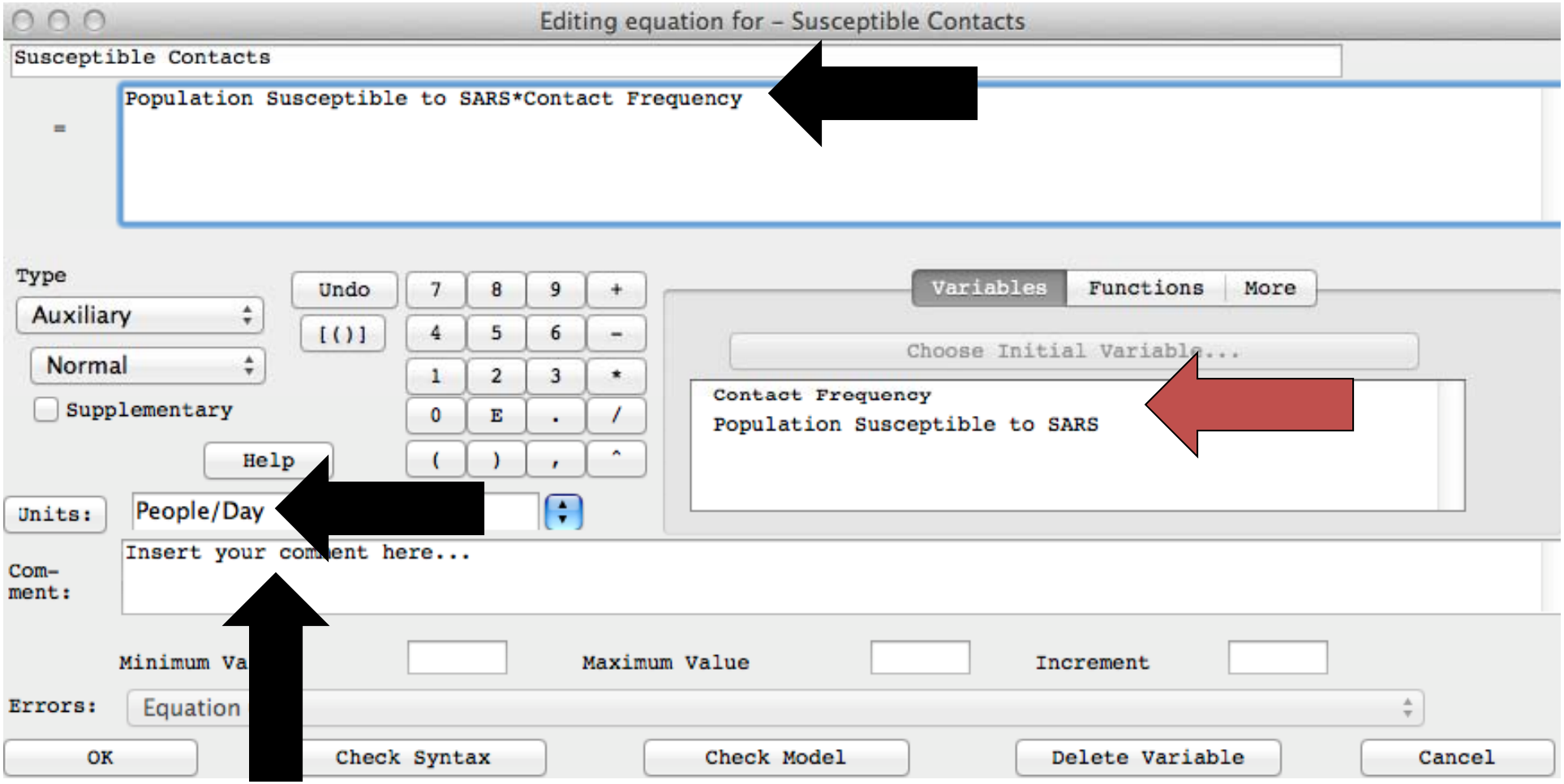
Step 14: Define Infection Rate



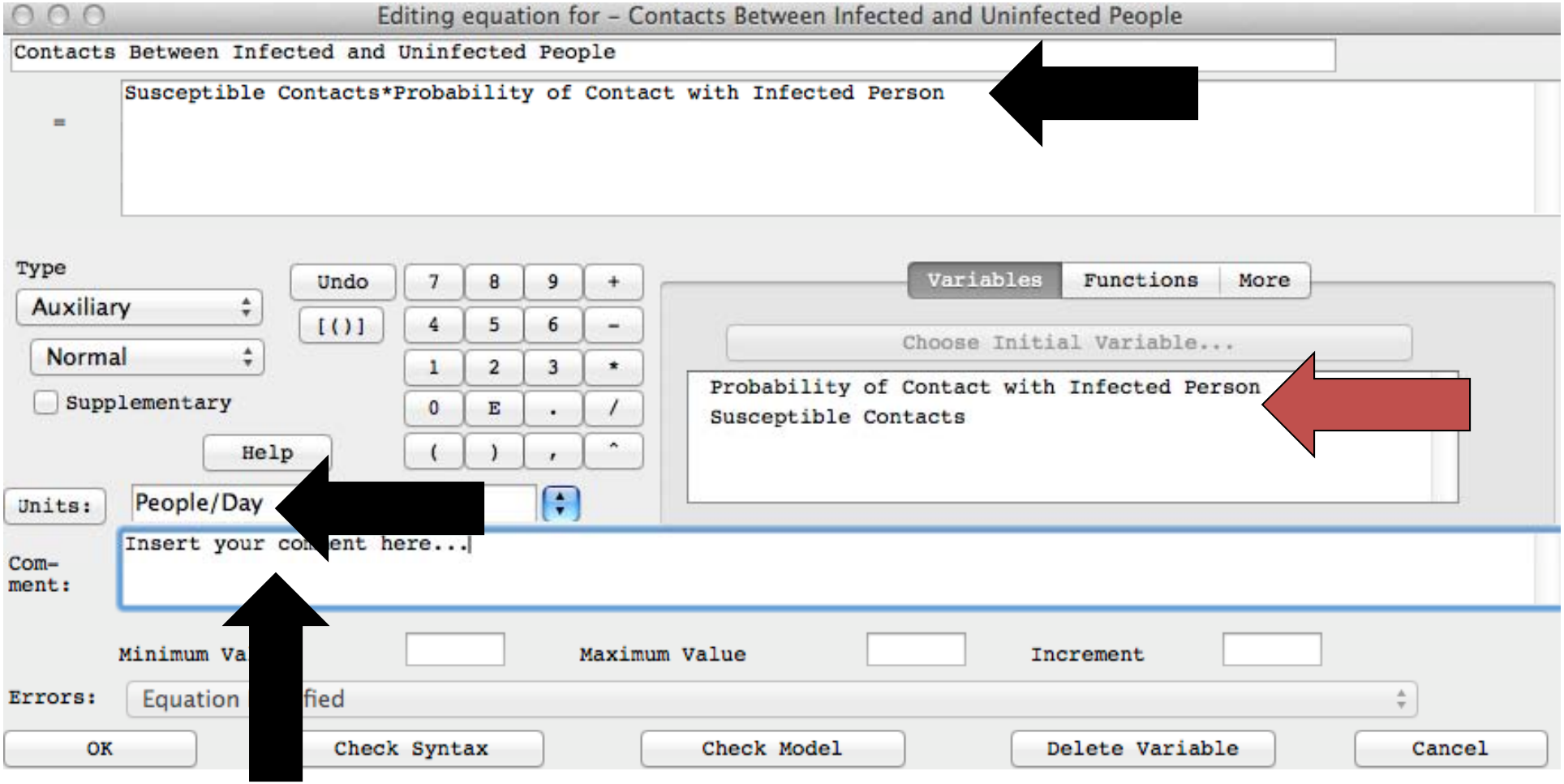
Step 15: Define Population Susceptible to SARS



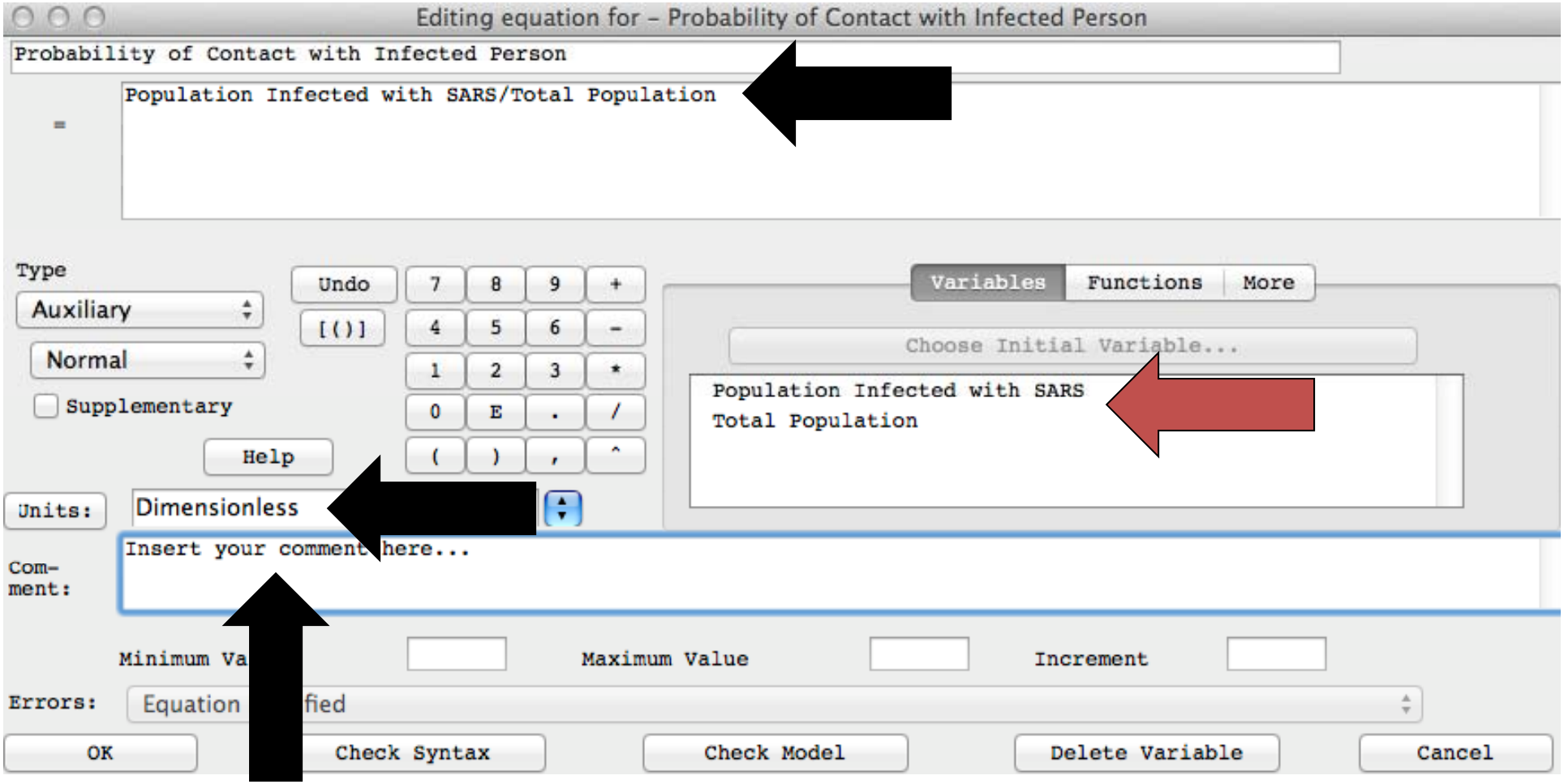
Step 16: Define Susceptible Contacts



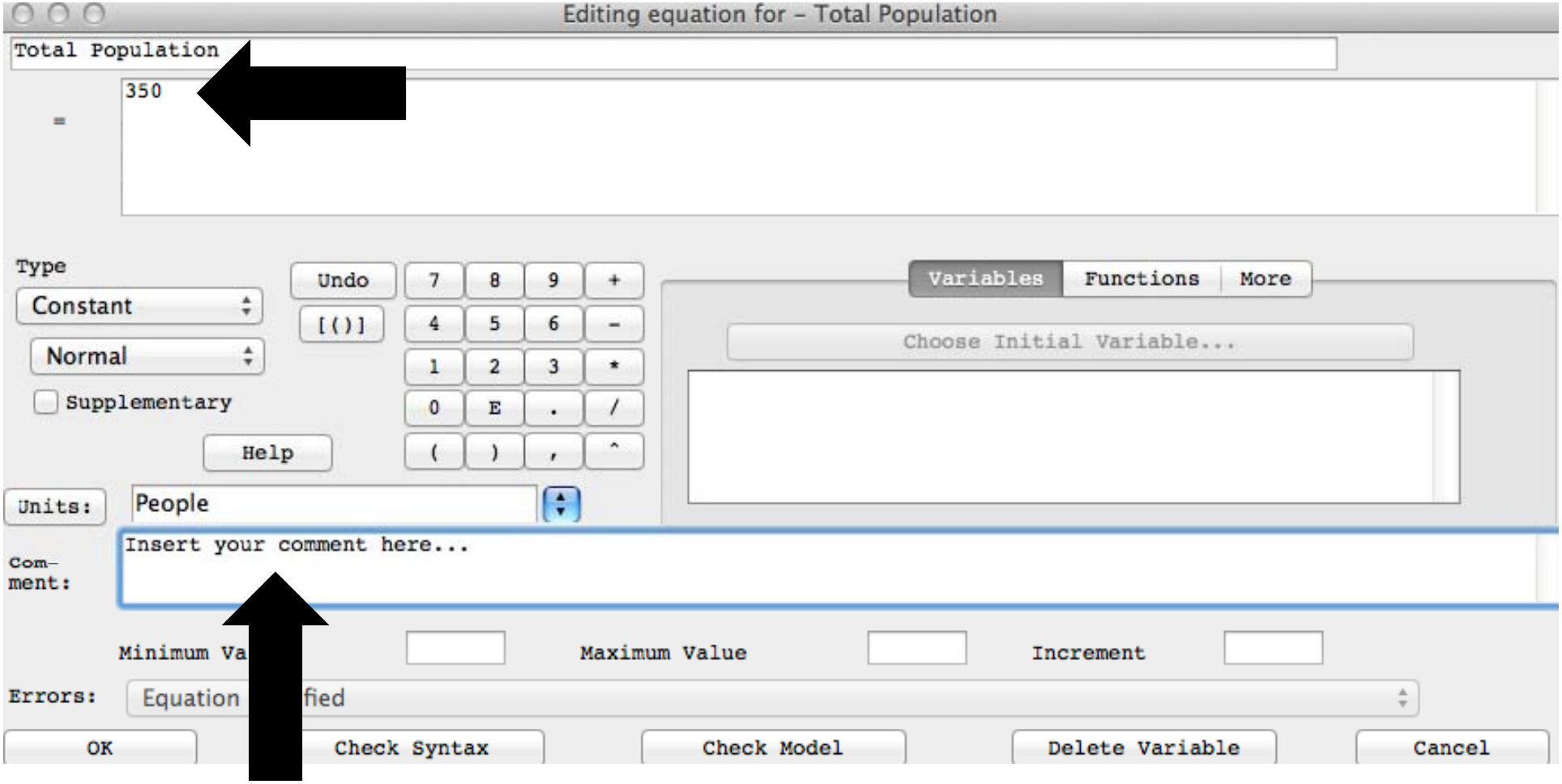
Step 17: Define Contacts Between Infected and Uninfected People



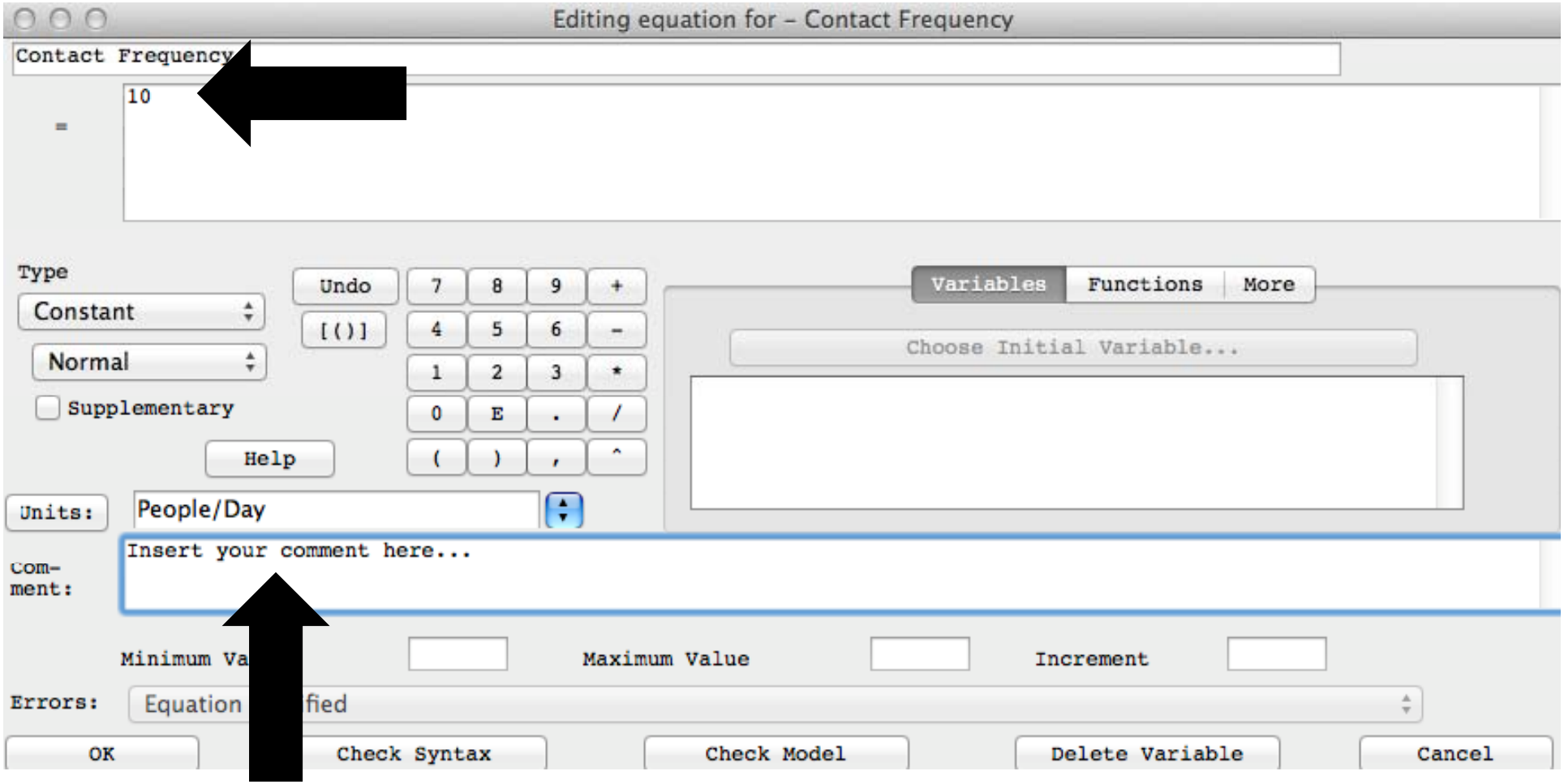
Step 18: Define Probability of Contact with Infected Person



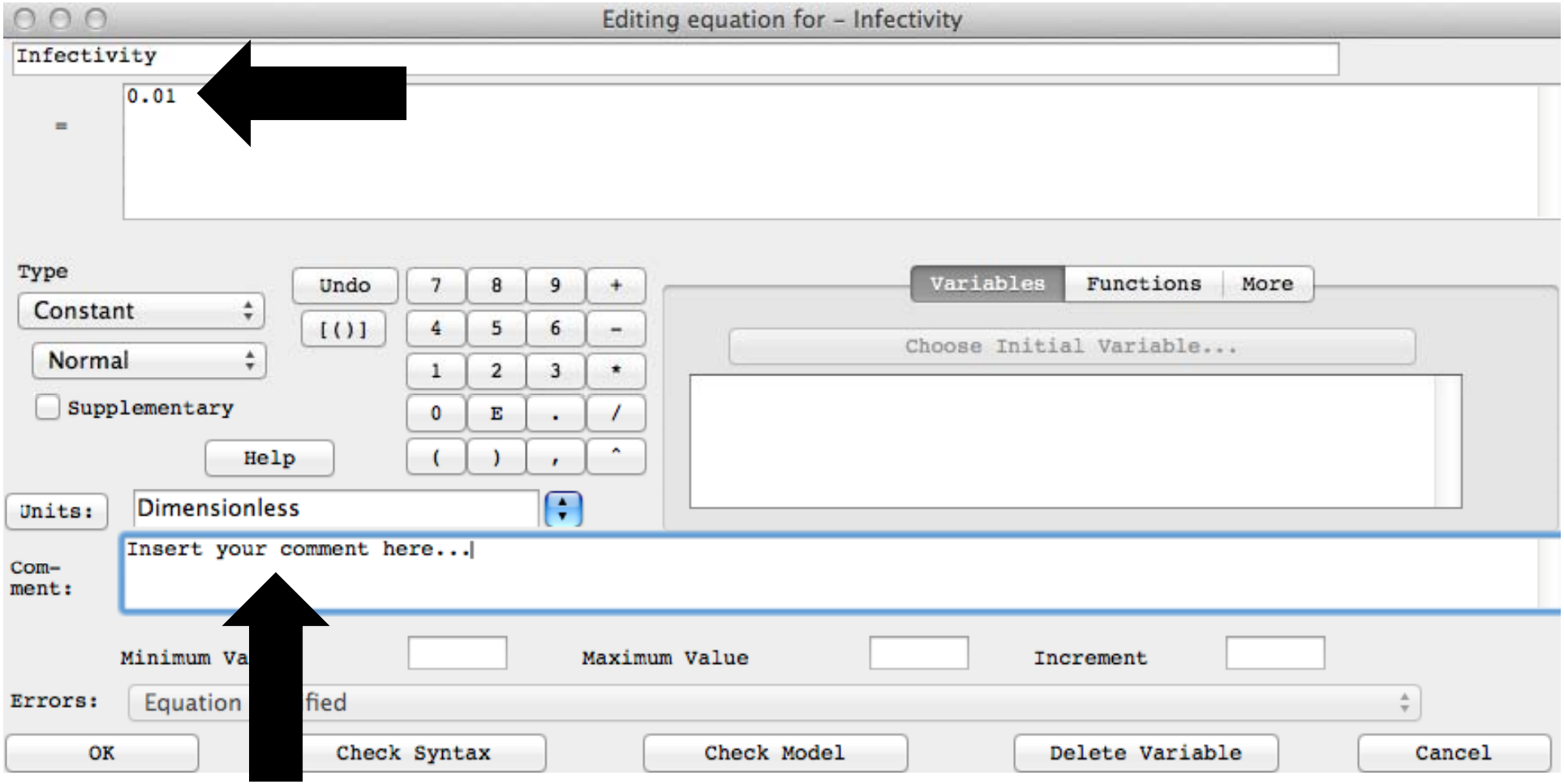
Step 19: Define Total Population



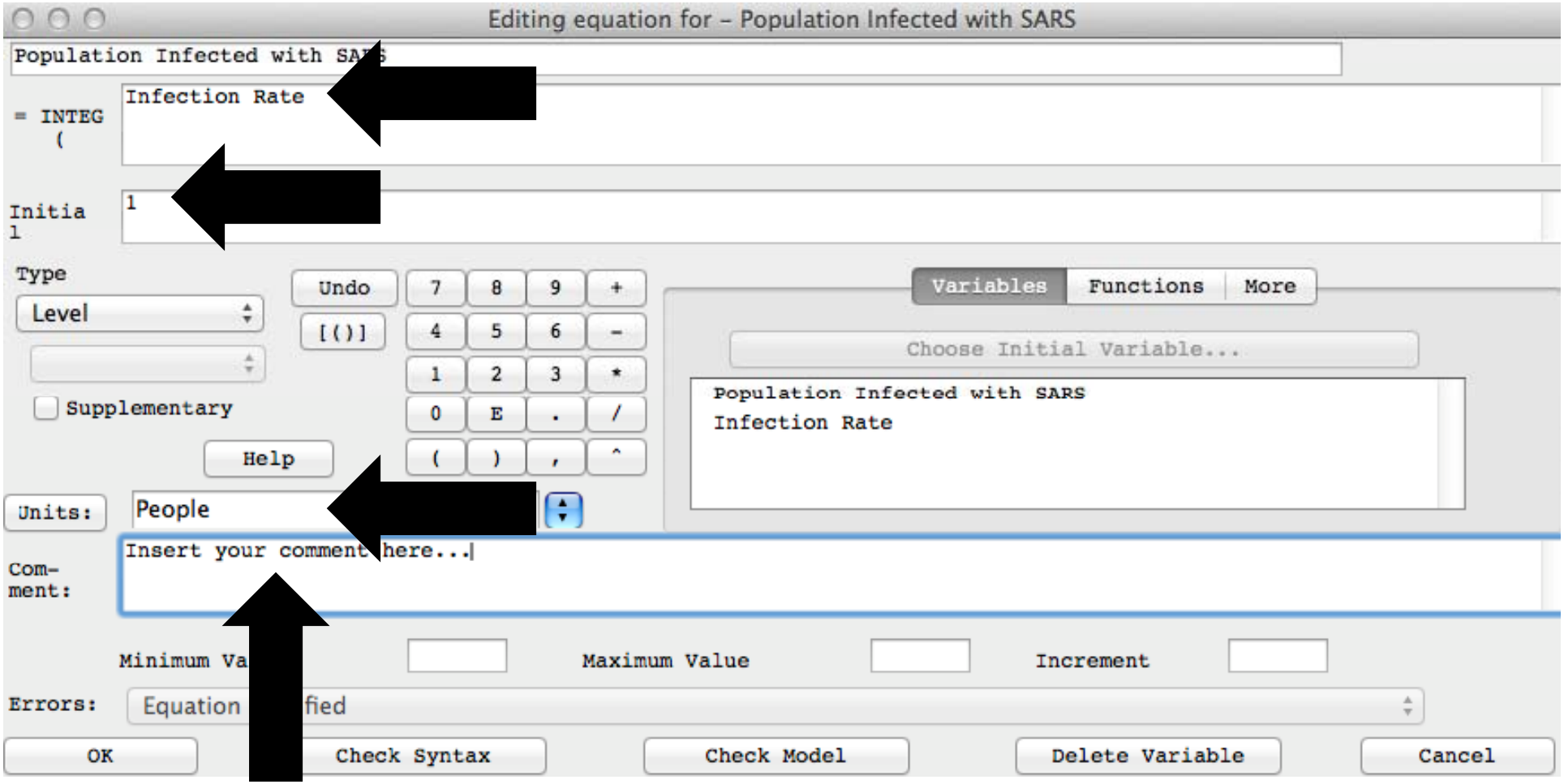
Step 20: Define Contact Frequency



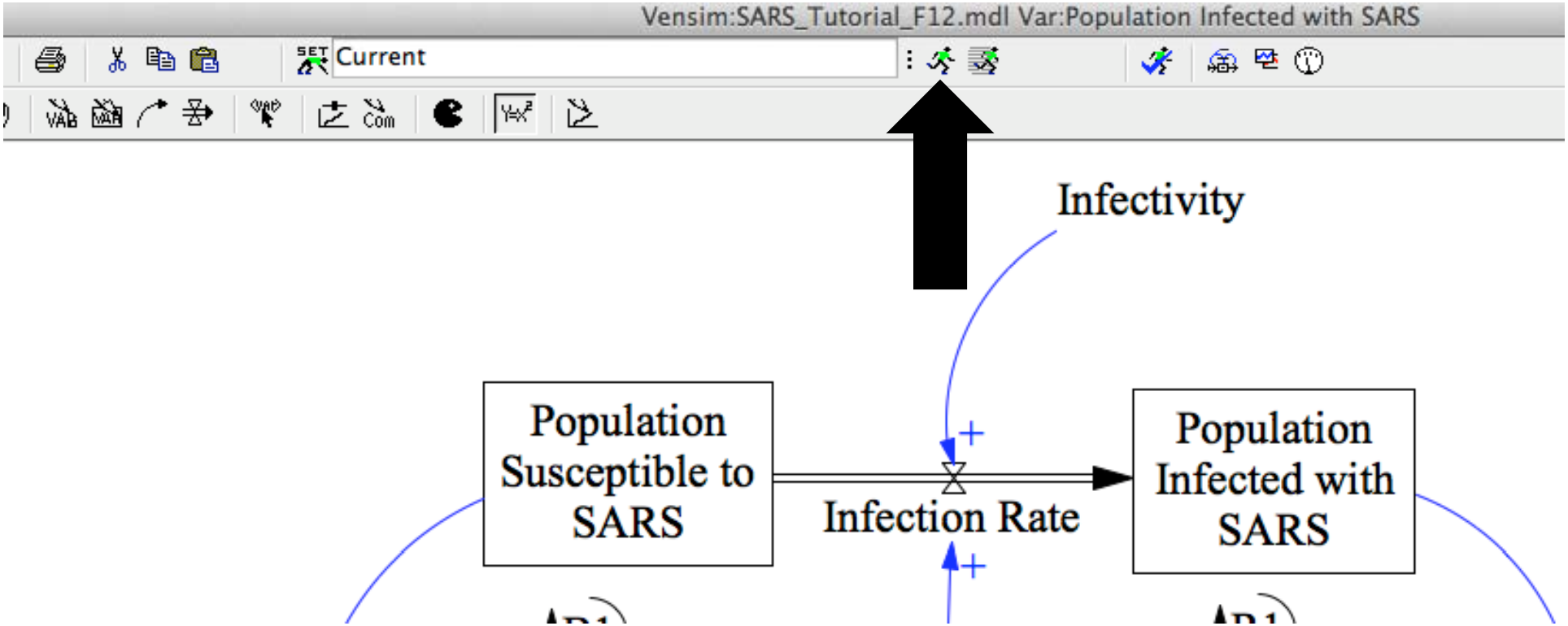
Step 21: Define Infectivity



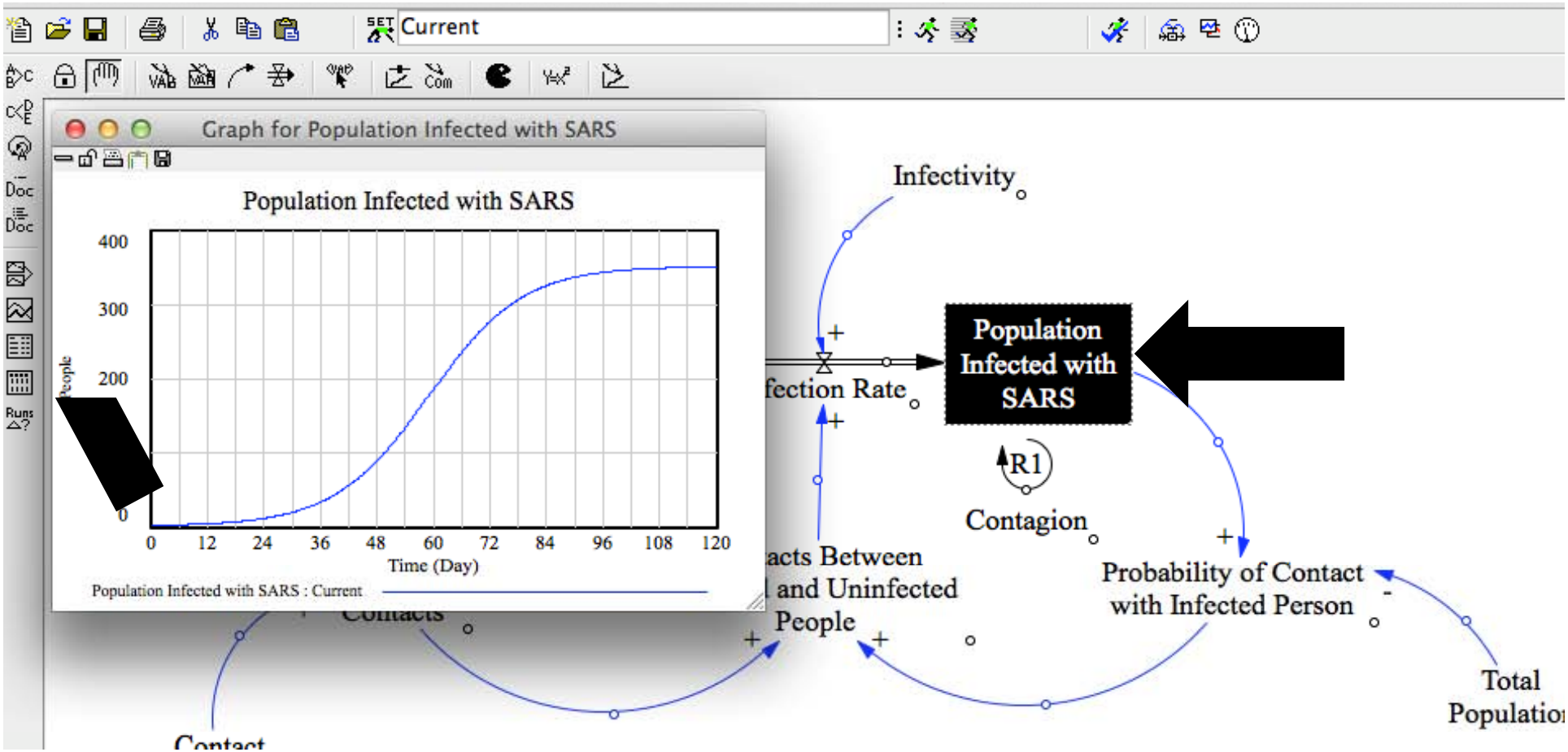
Step 22: Define Population Infected with SARS



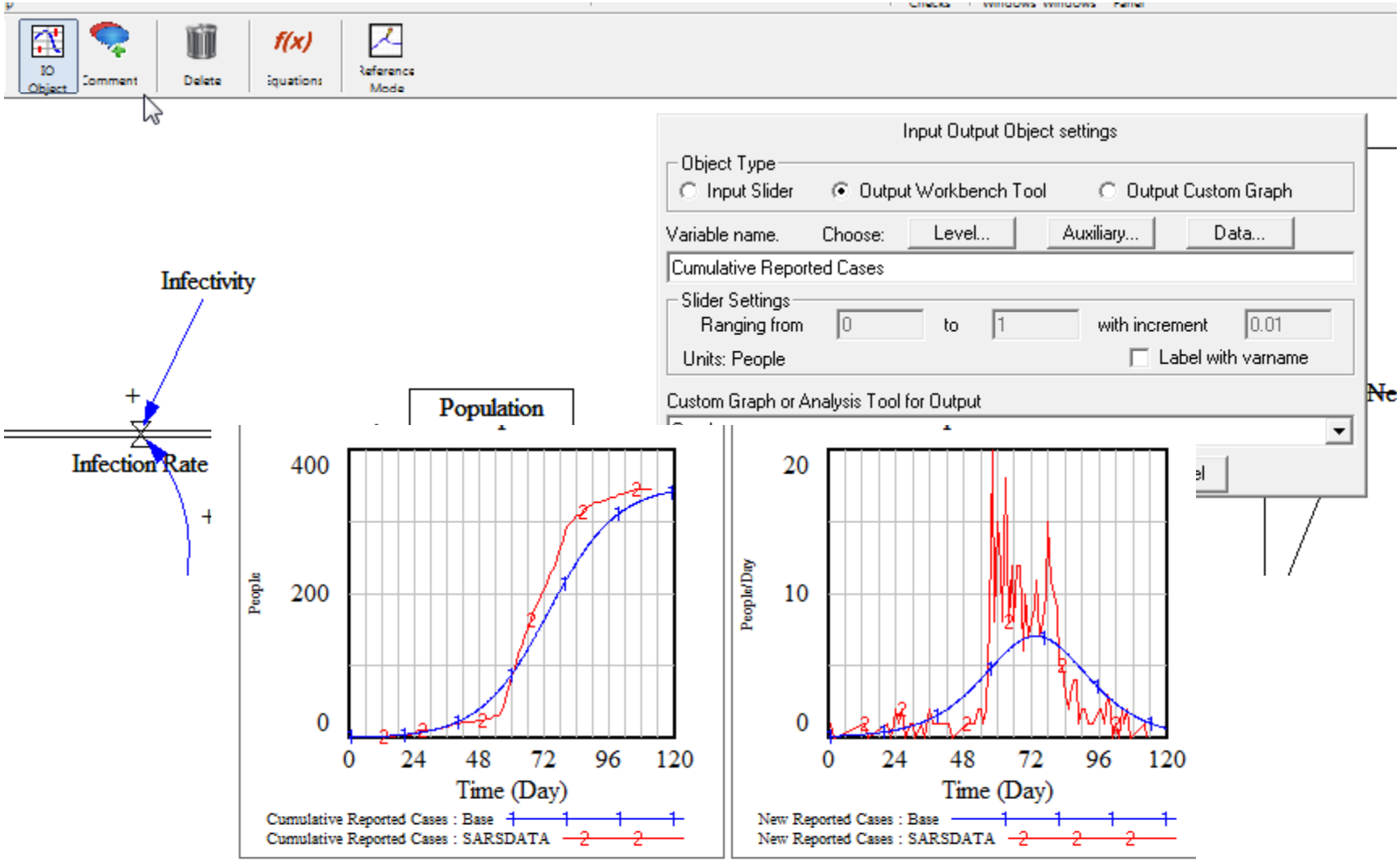
Time Out and Run



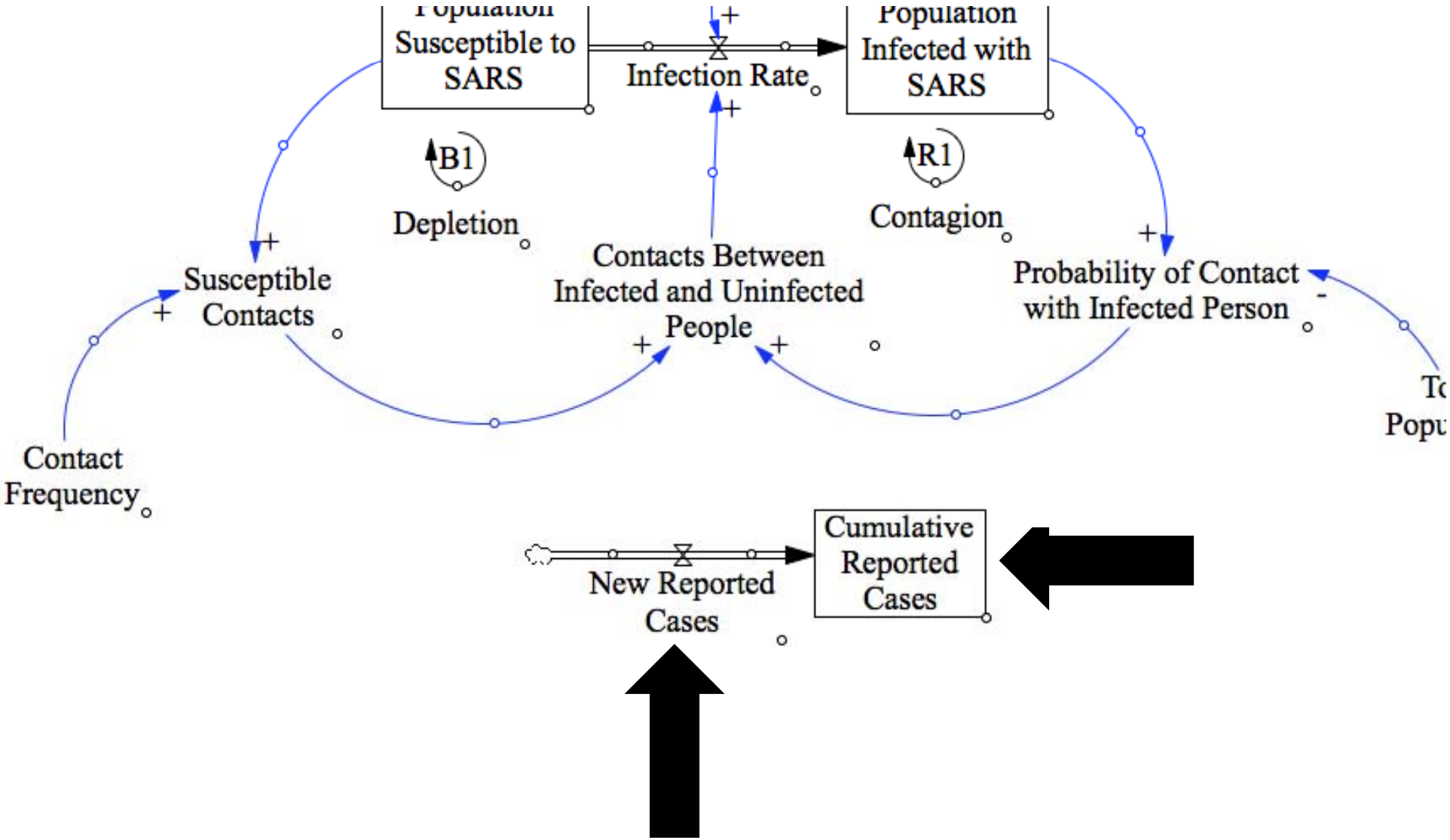
Plotting Results



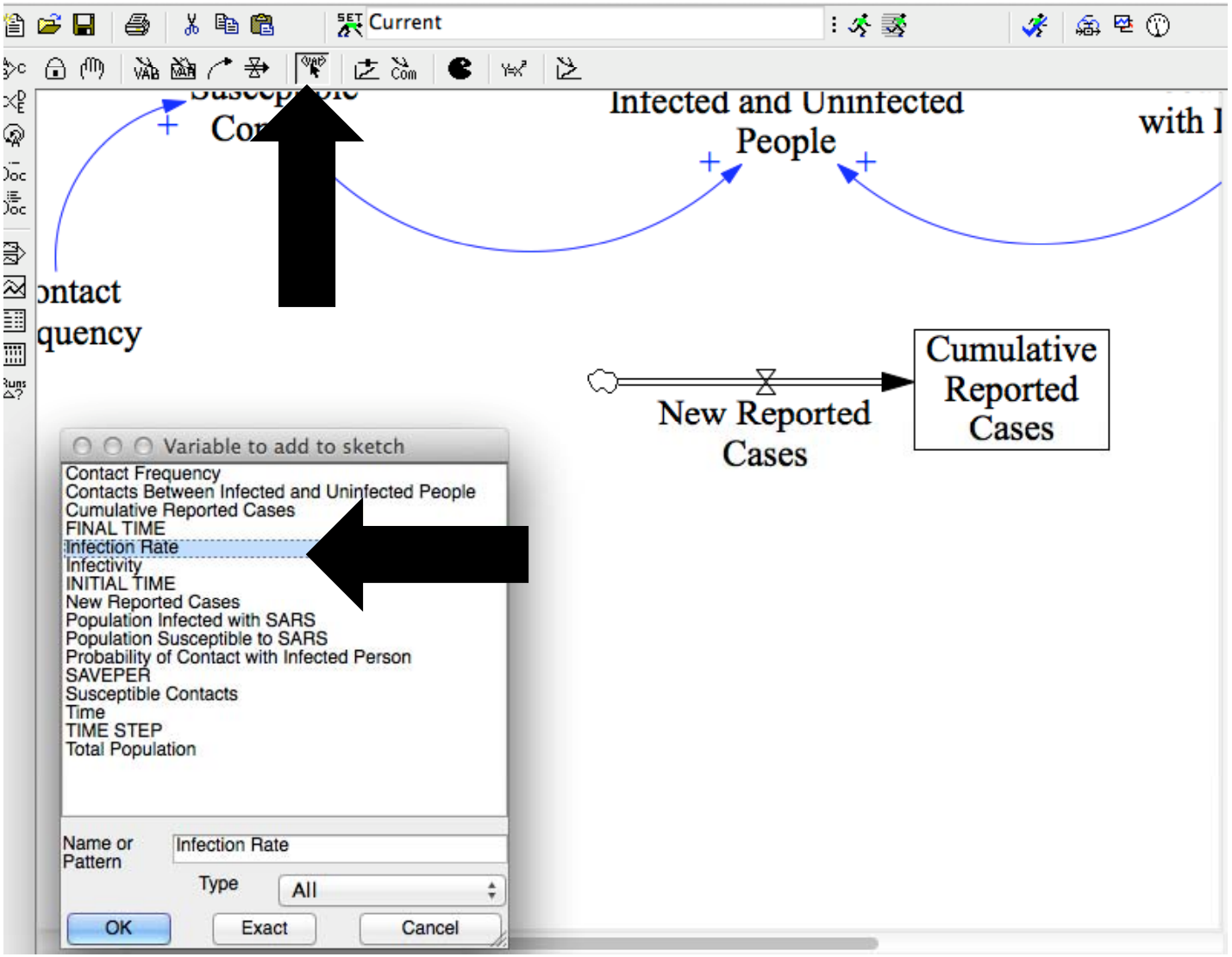
Optional: Permanent Graph
Use: I/O Object or Custom Graph



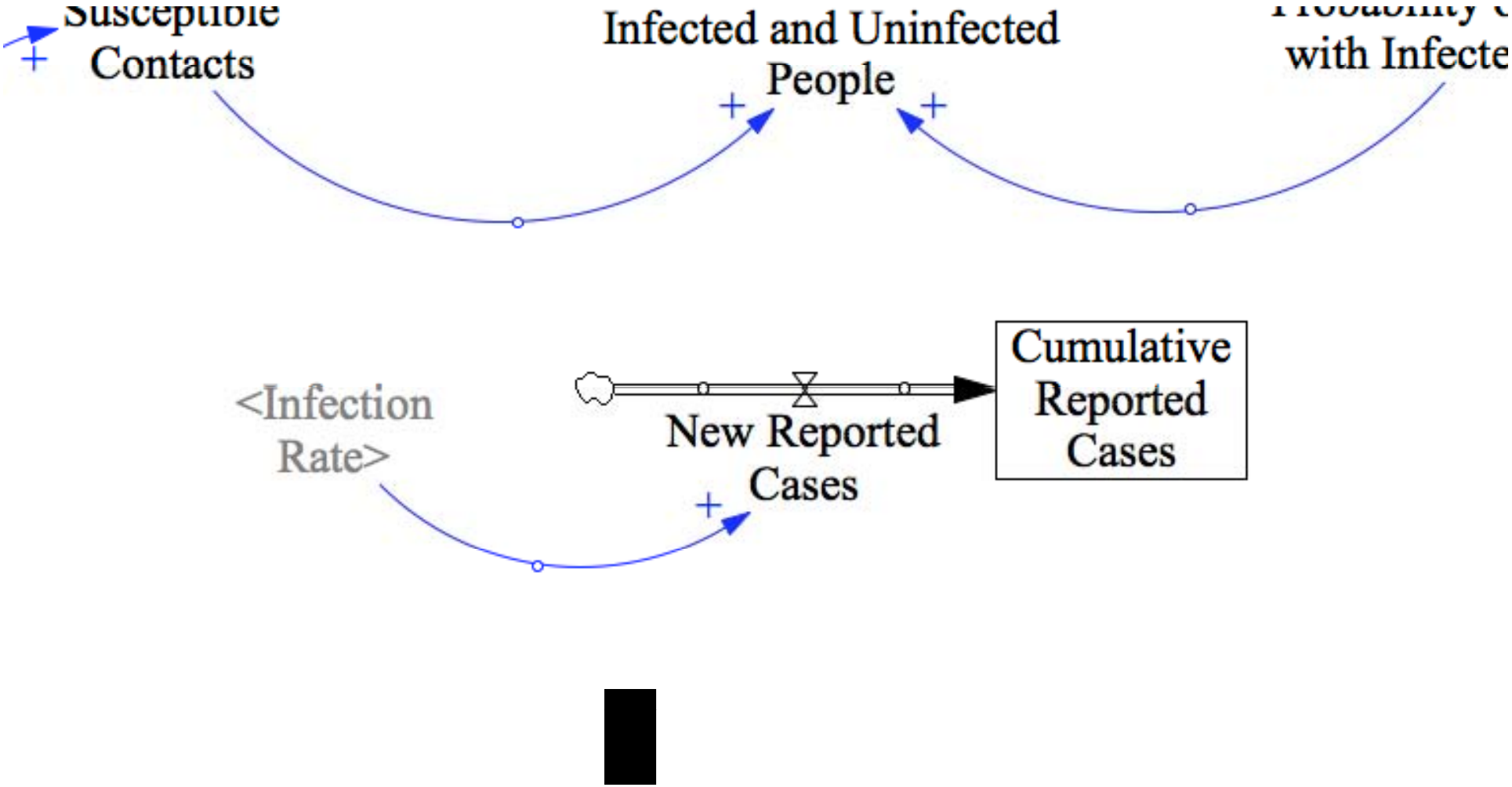
Step 23: Add Variables in the Dataset



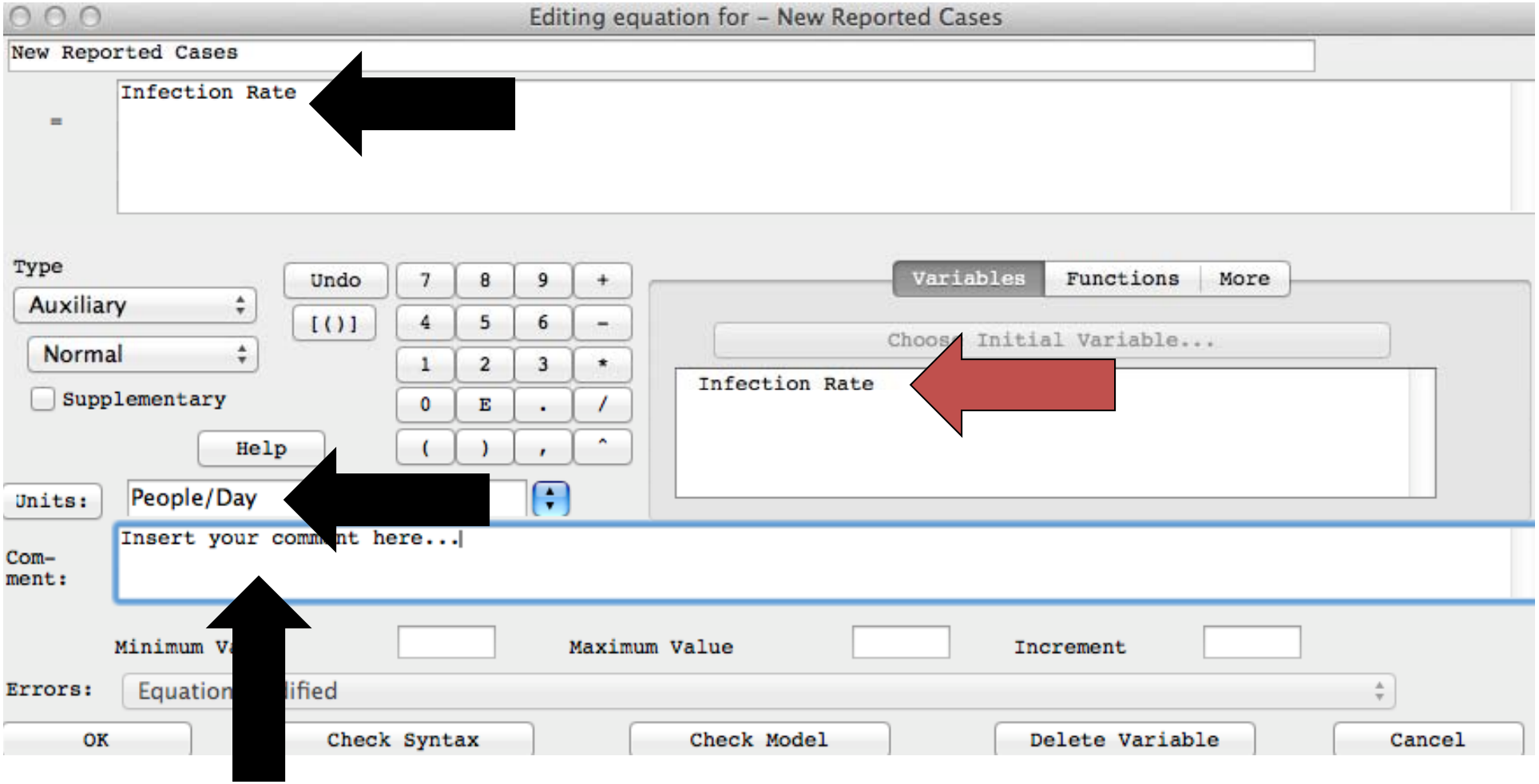
Step 24: Add Infection Rate (as a shadow variable)



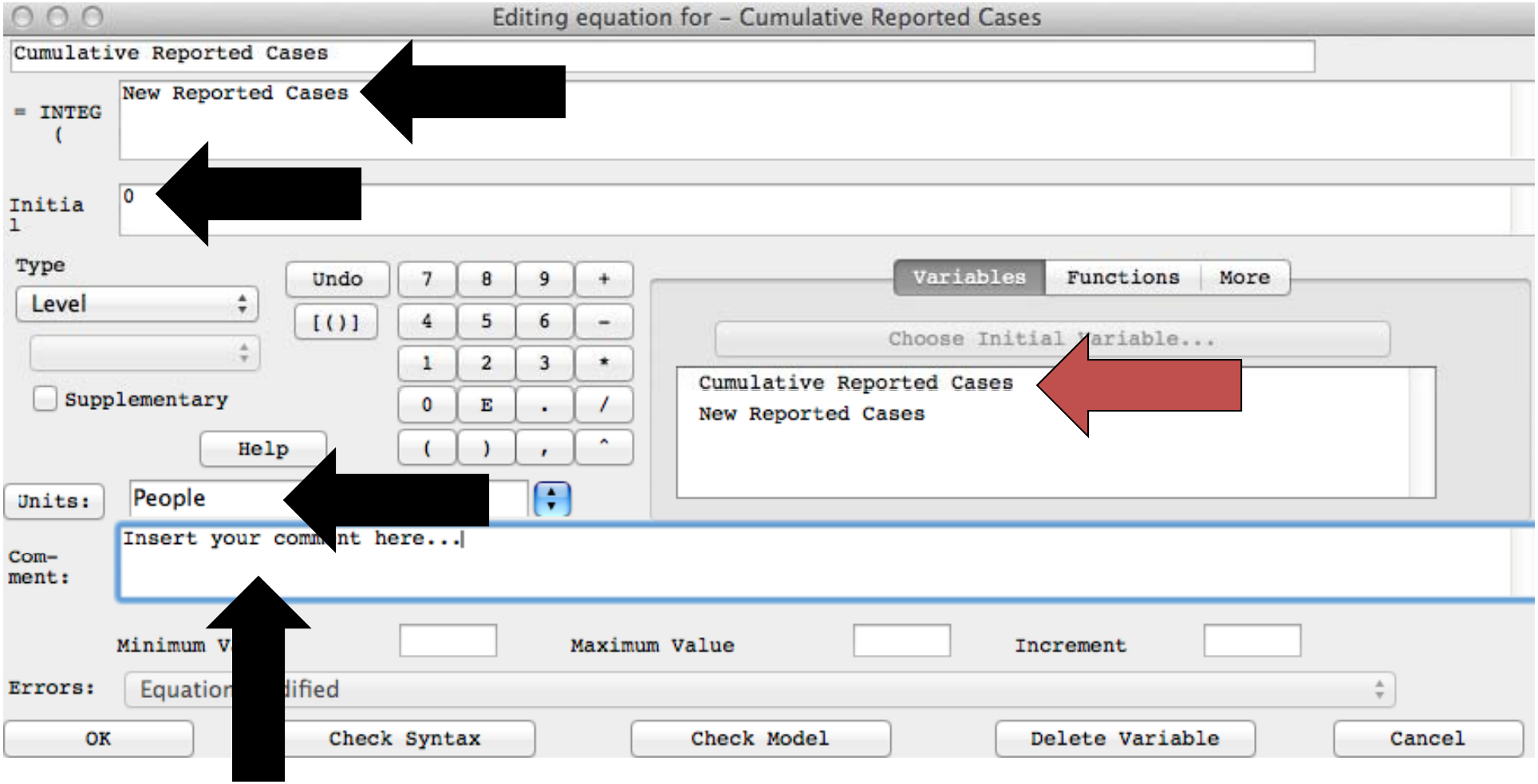
Step 25: Add Causal Link and Polarity



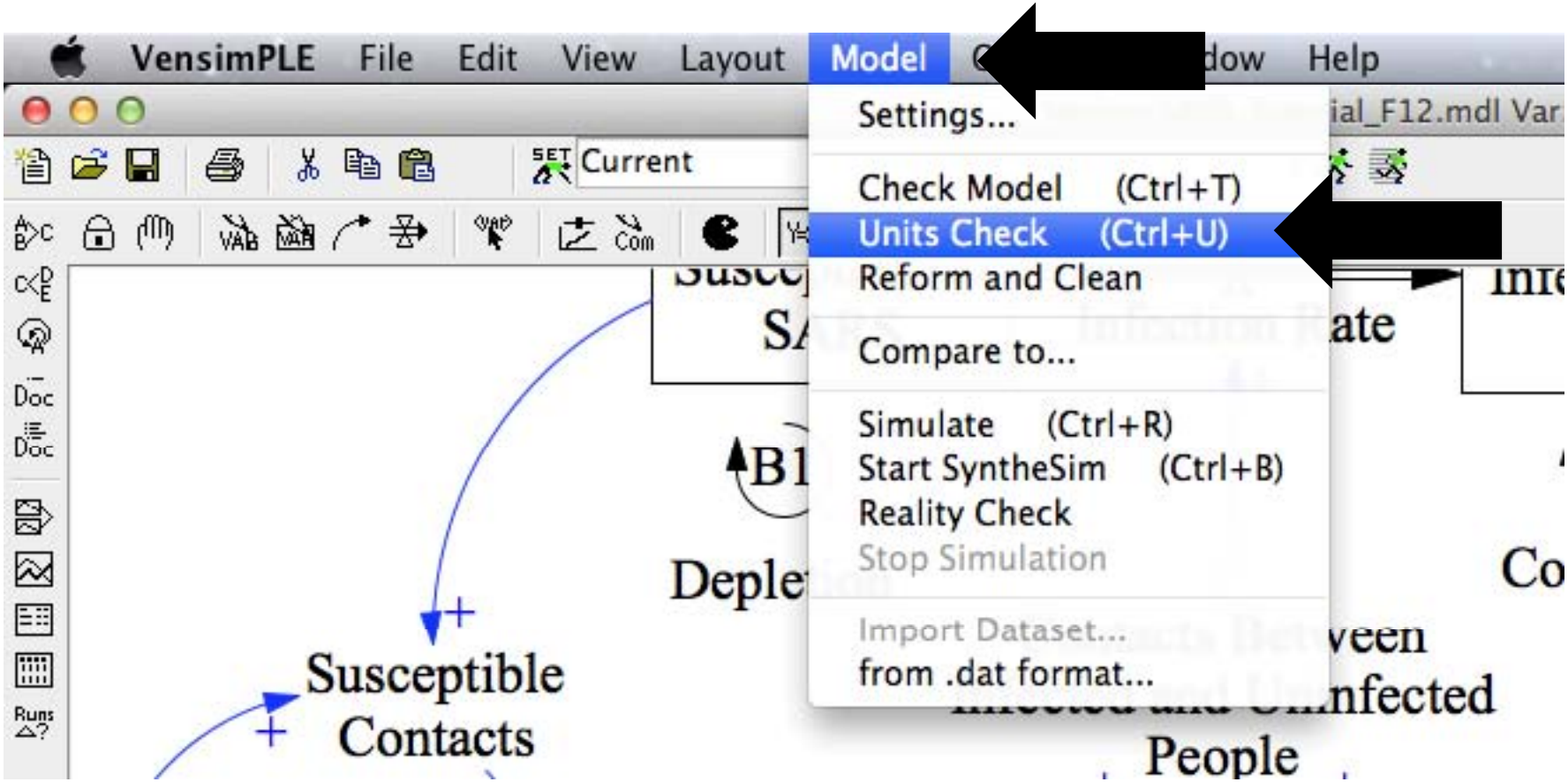
Step 26: Define New Reported Cases



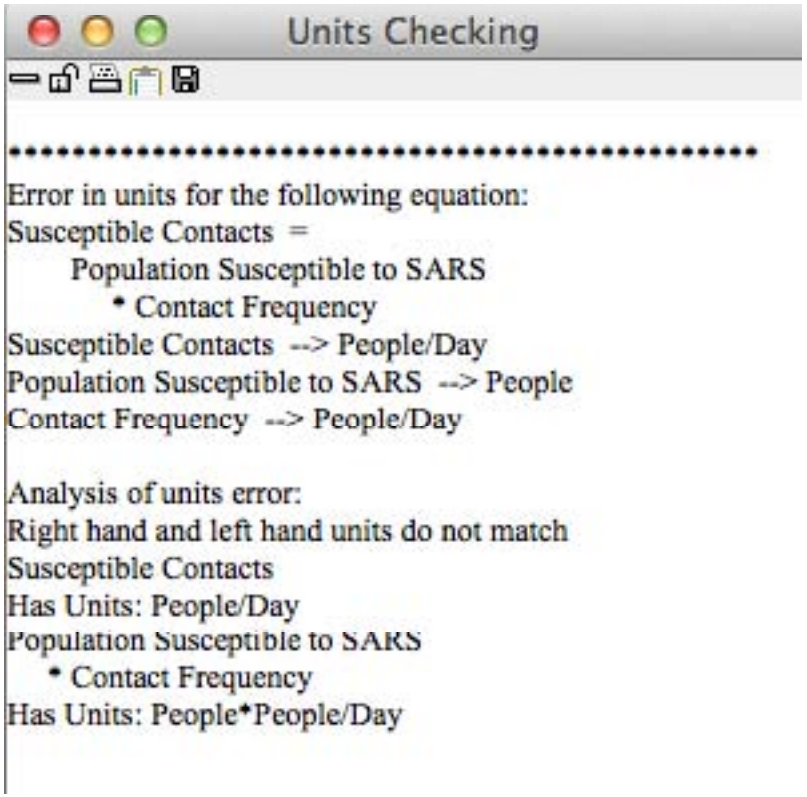
Step 27: Define Cumulative Reported Cases



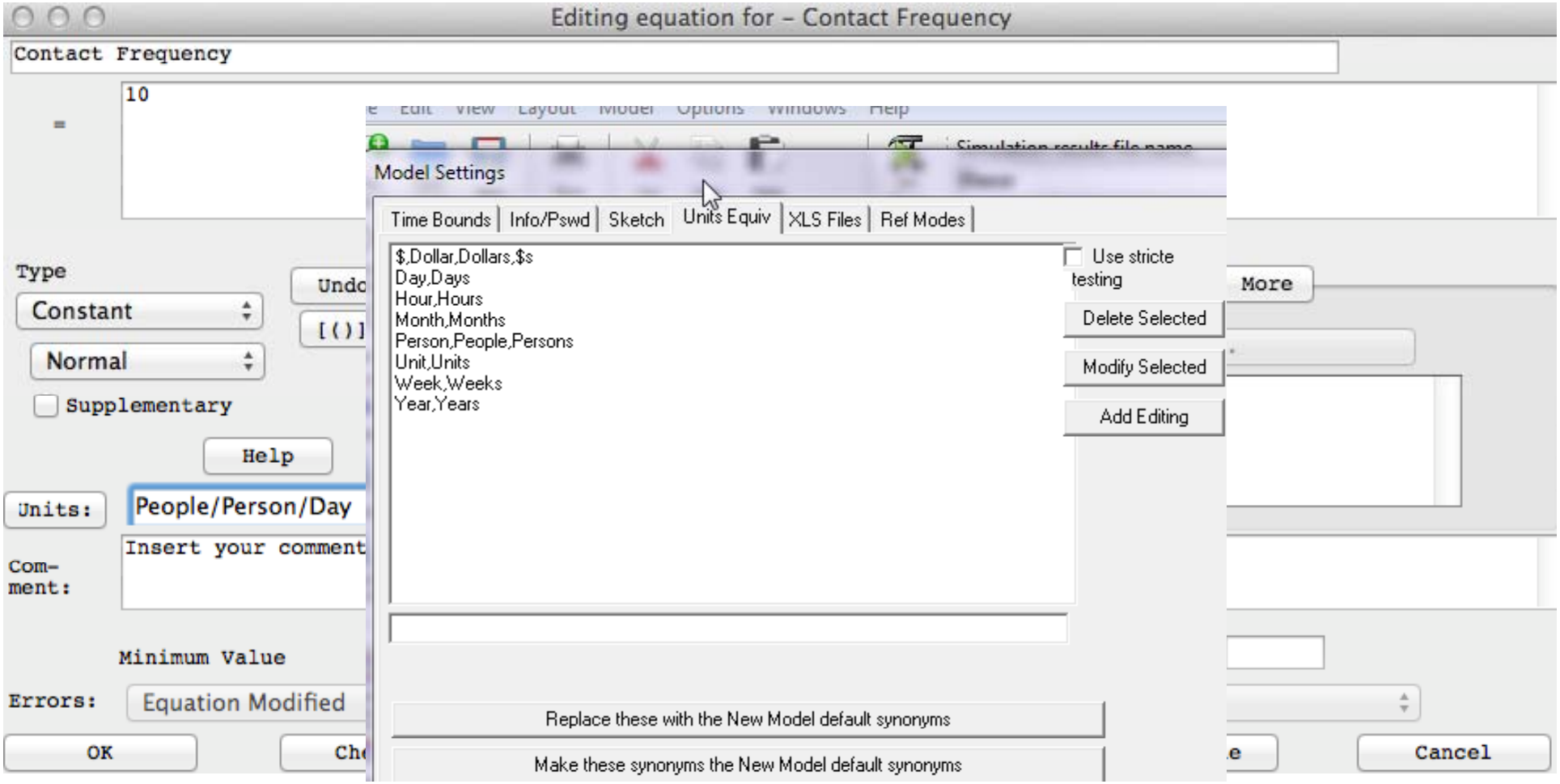
Step 28: Units Check



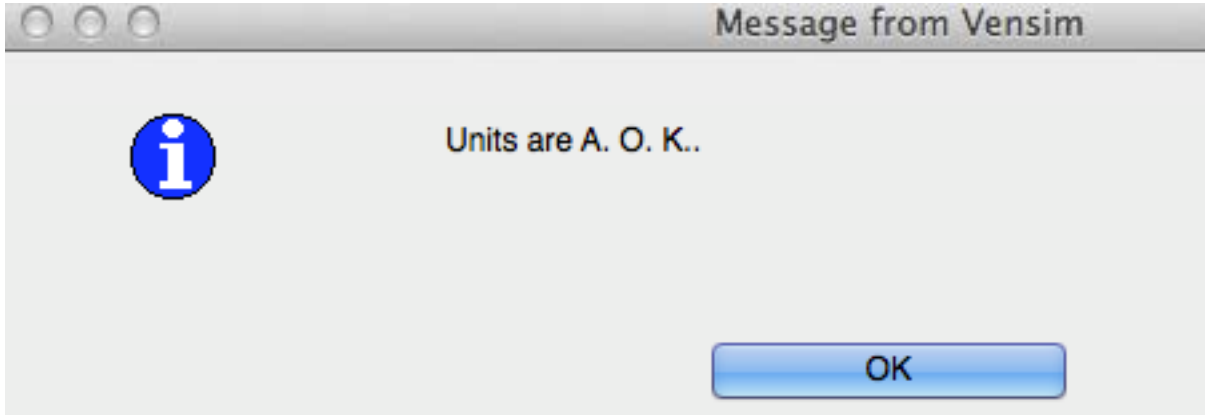
Step 29: Error!!!



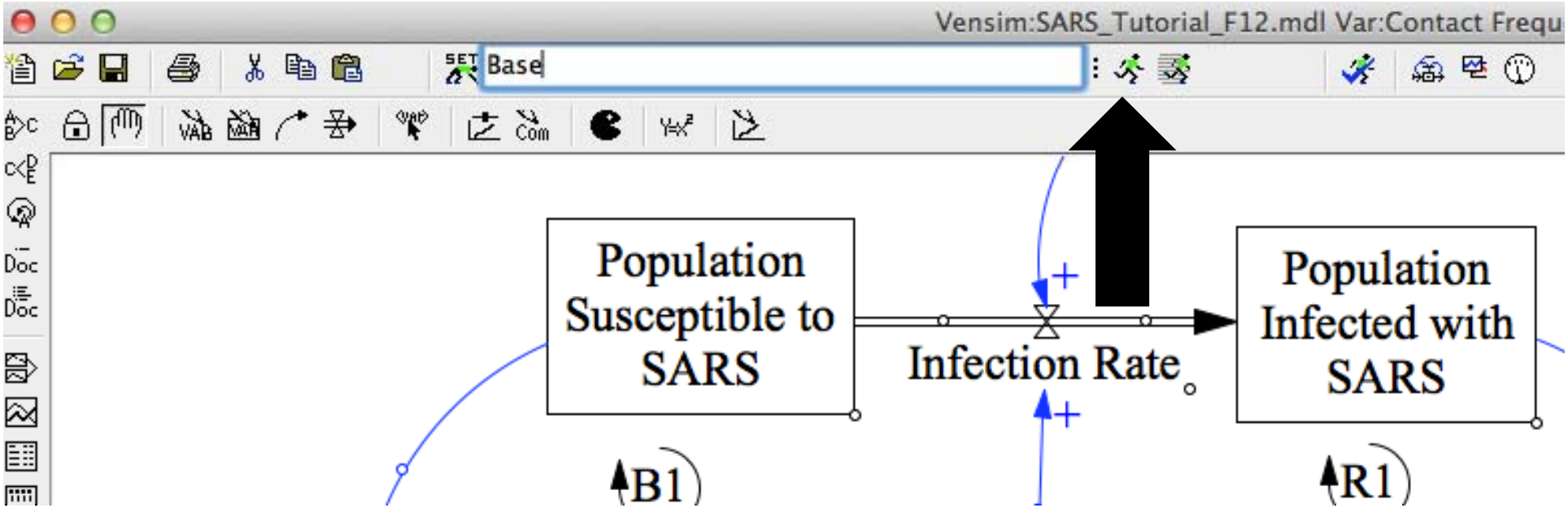
Step 30: Redefine Contact Frequency



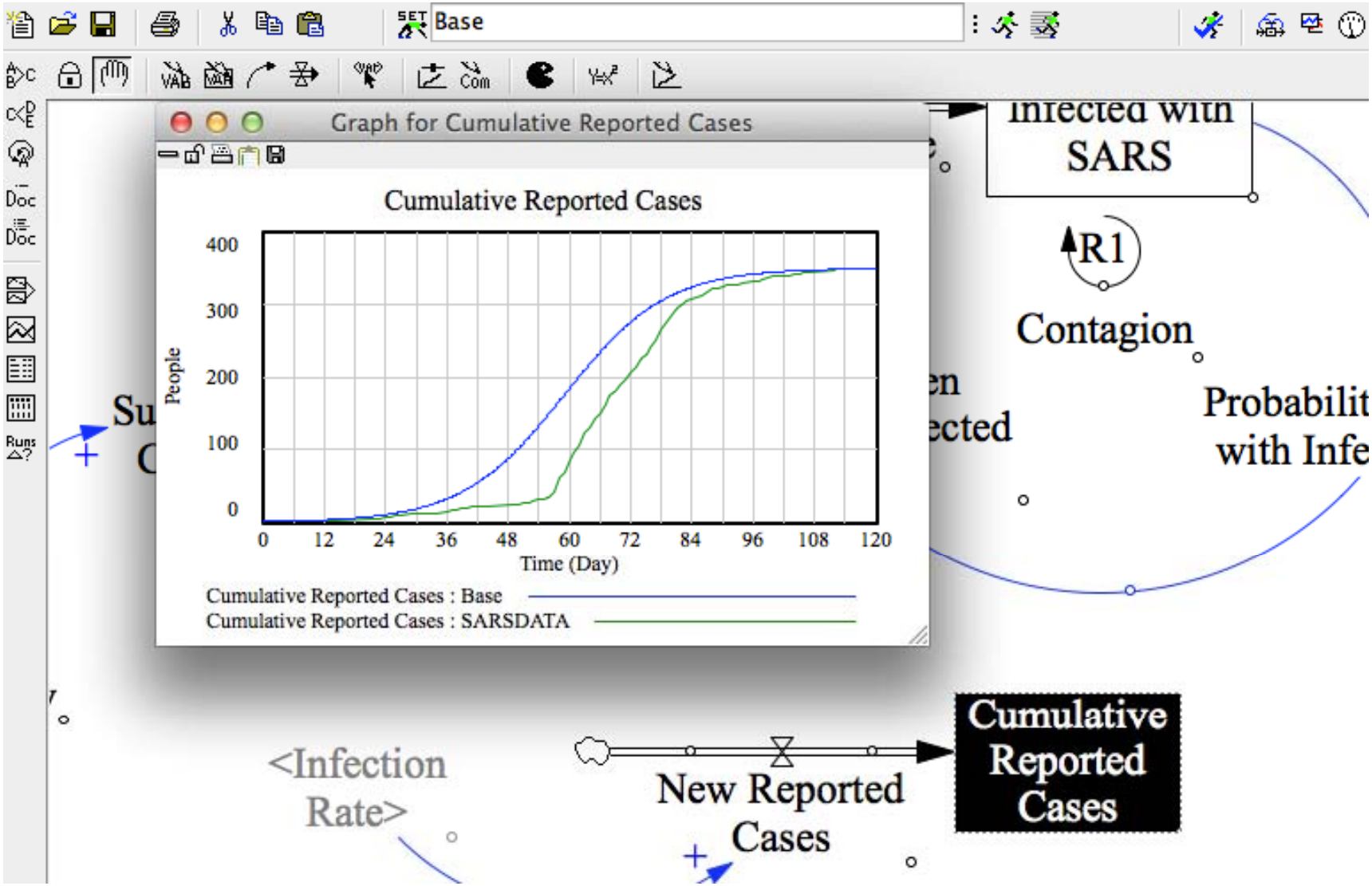
Step 31: Units Check – A. O. K.



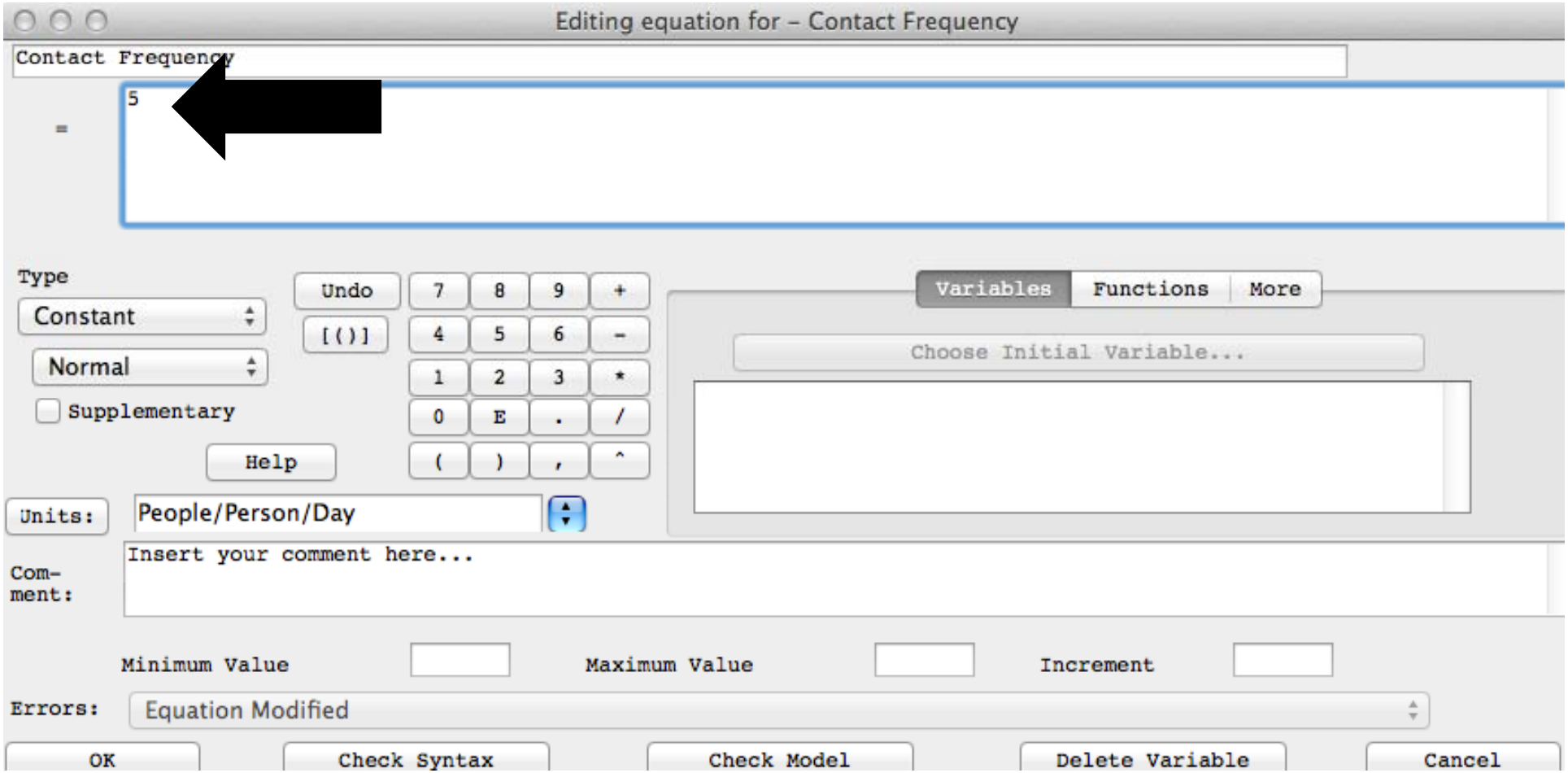
Step 32: Rename Case – “Base” and Run



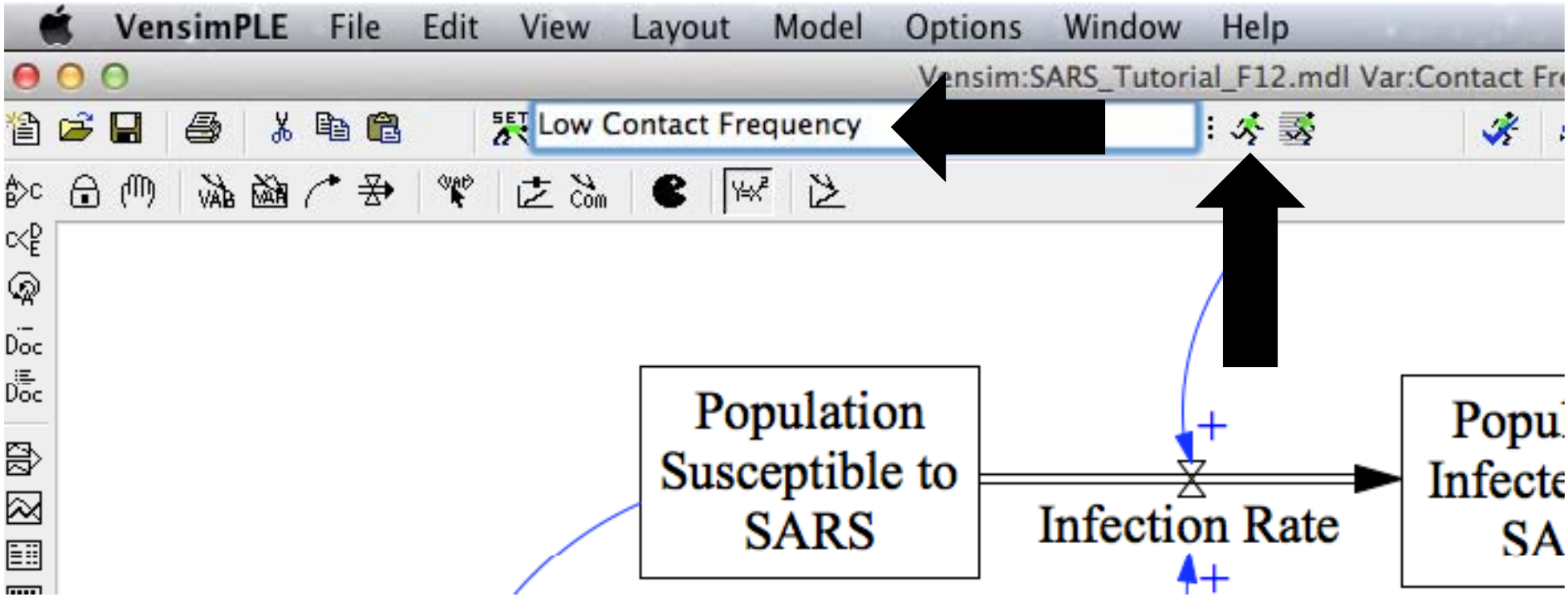
Step 33: Plot Cumulative Reported Cases



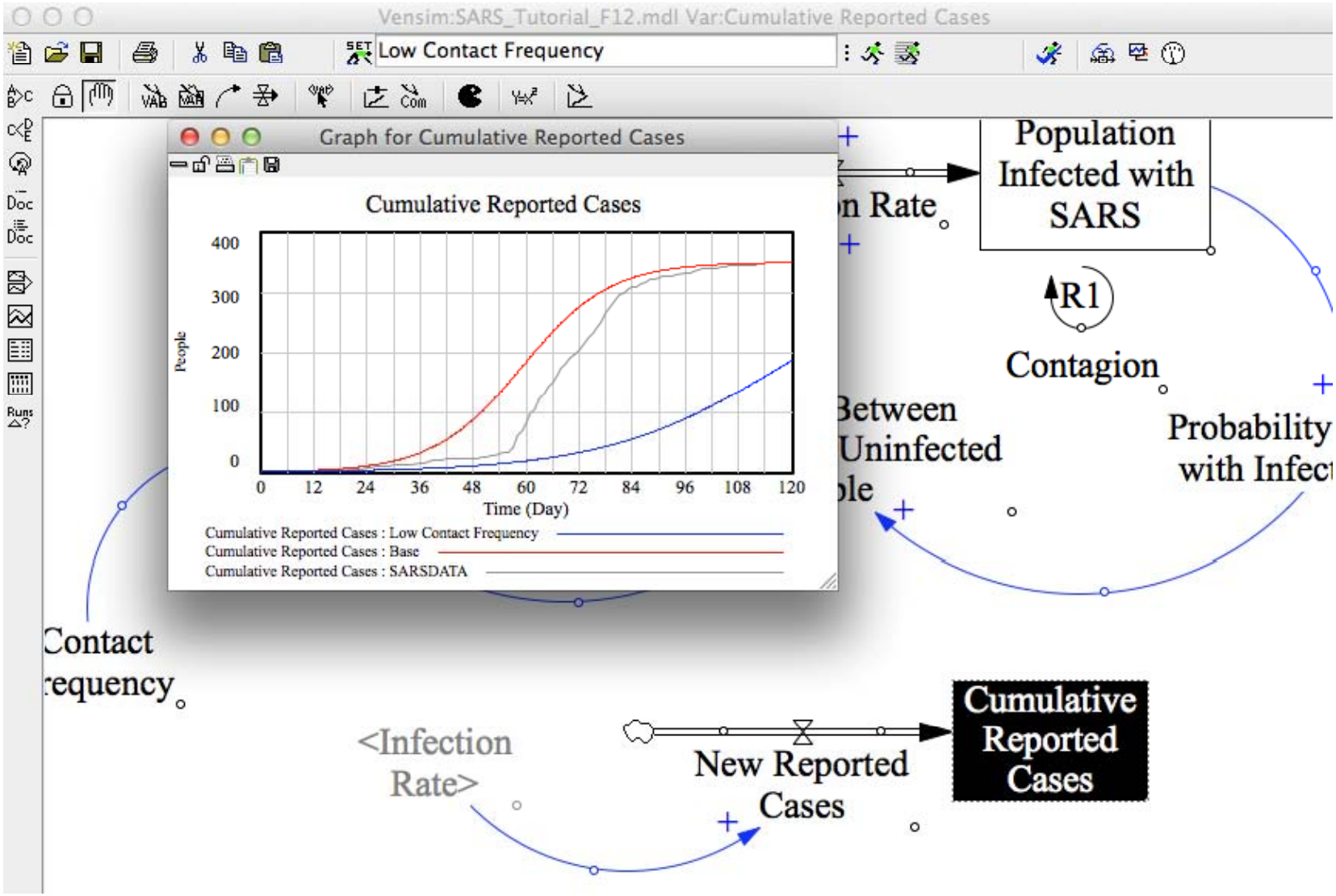
Step 34: Try Lowering Contact Frequency



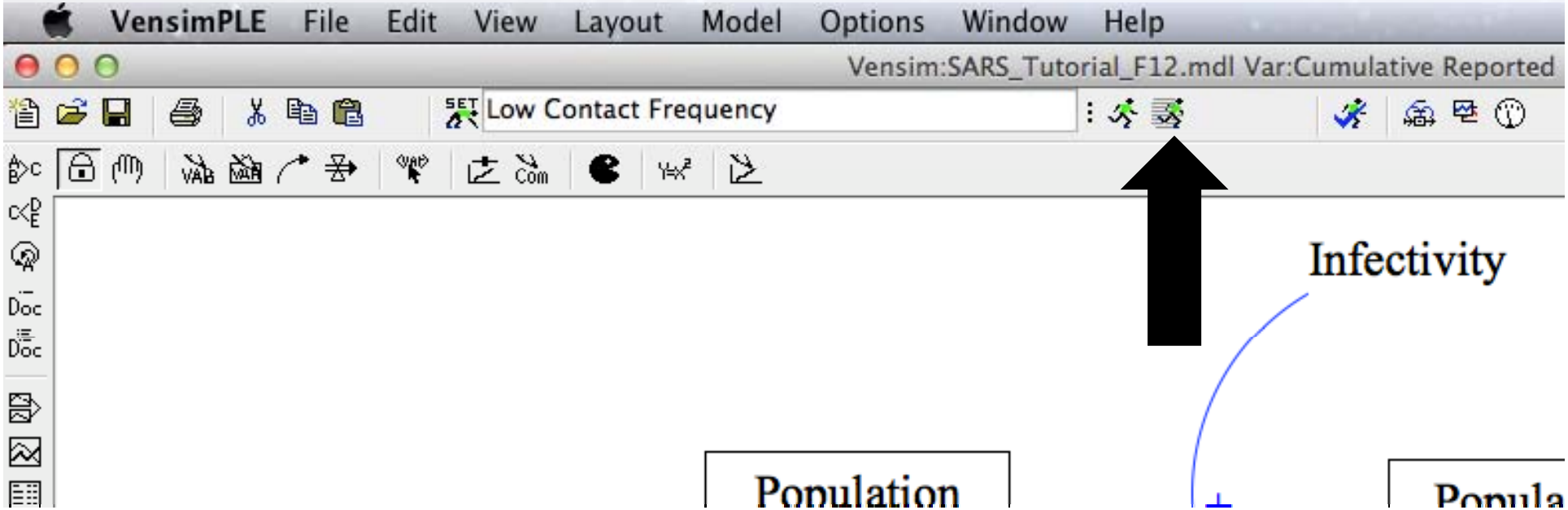
Step 35: Change Run Name



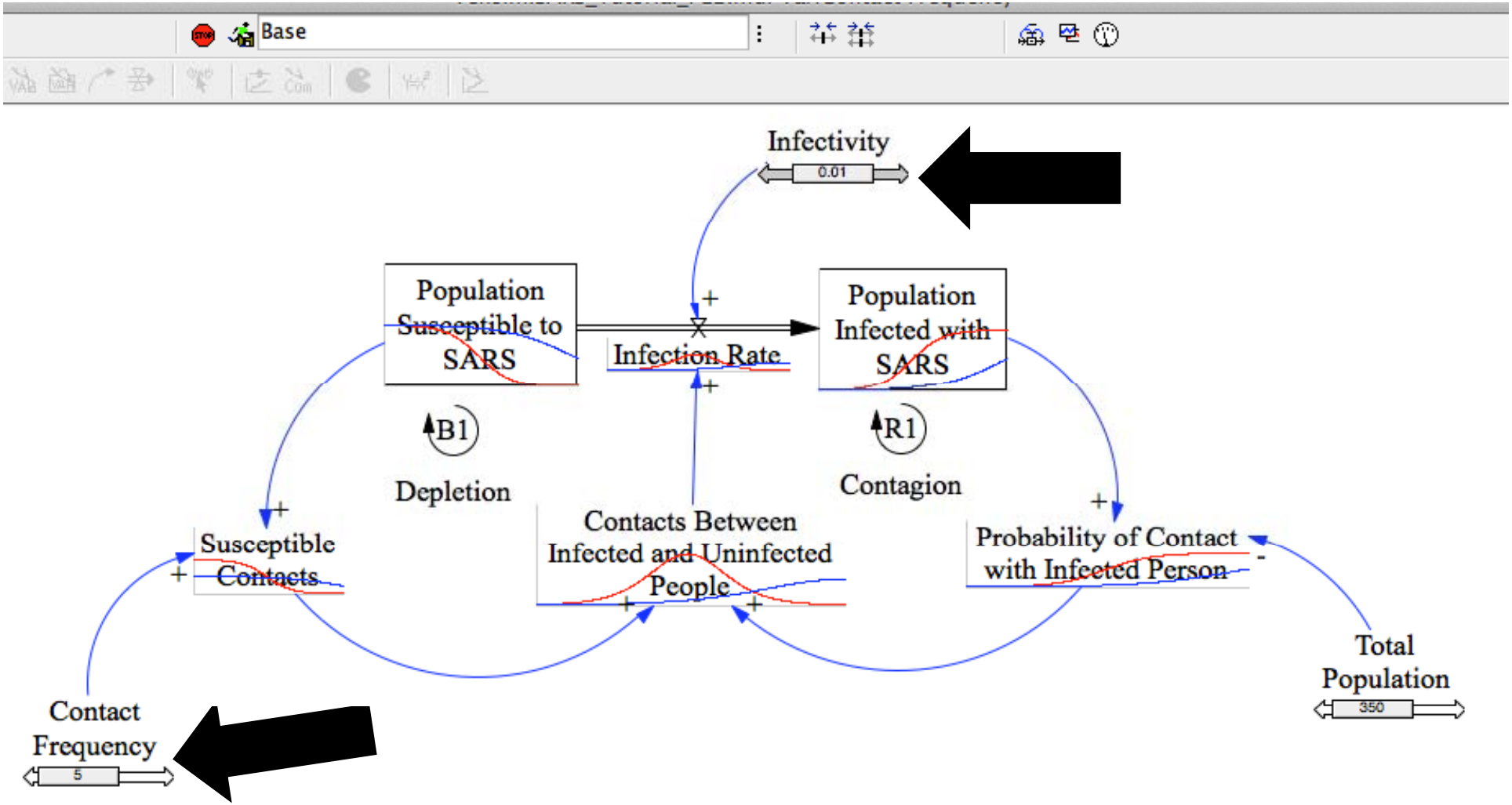
Step 36: Displaying Multiple Runs



Step 37: Synthesim



Amazing!!!


Base
Infectivity
0.01
Population Susceptible to SARS
Infection Rate
Population Infected with SARS
B1
Depletion
R1
Contagion
Susceptible Contacts
Contacts Between Infected and Uninfected People
Probability of Contact with Infected Person
Total Population
350
Contact Frequency
5

15.871 Introduction to System Dynamics
Fall 2013