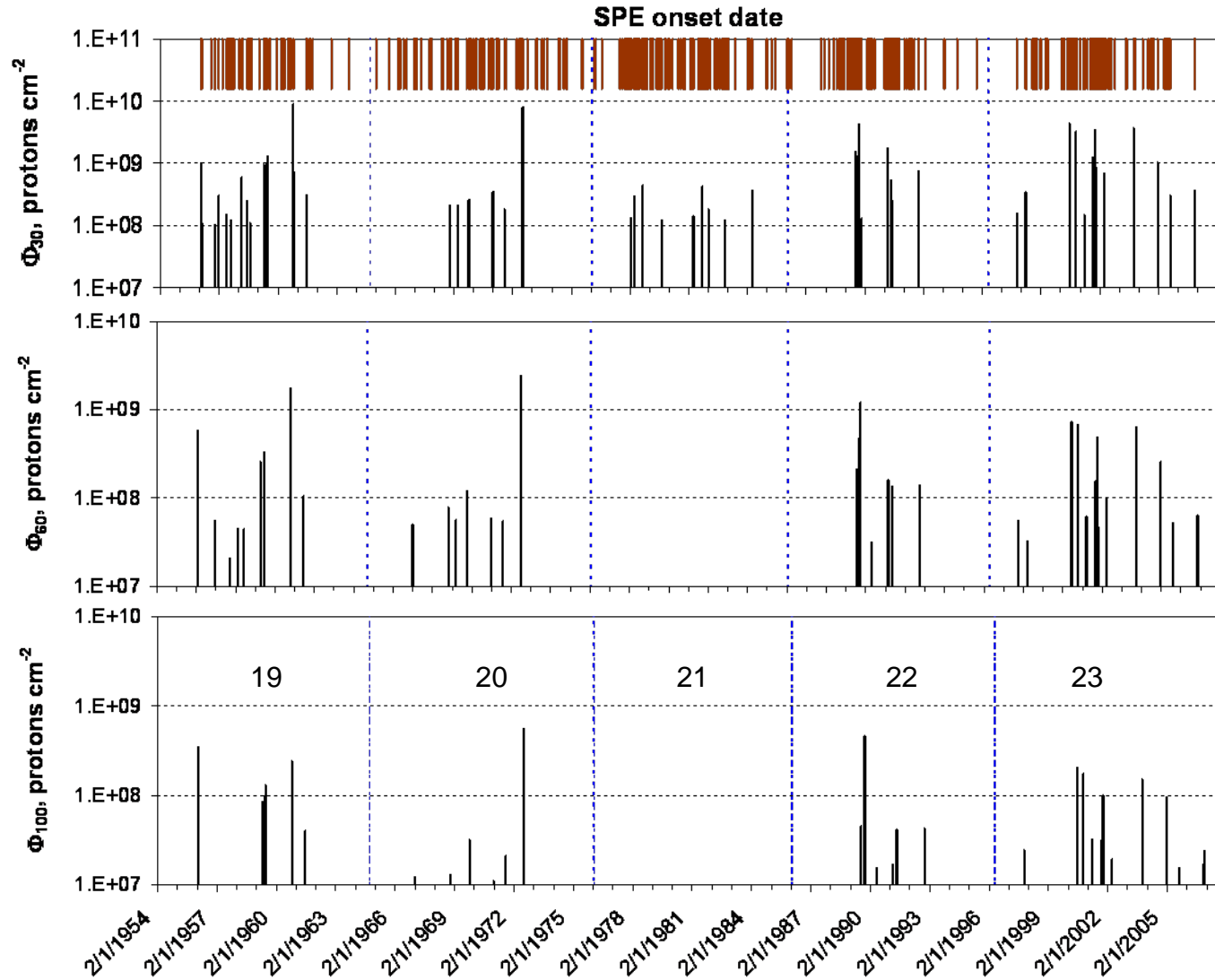


# Probabilistic Solar Particle Flux Forecast Modeling

Myung-Hee Y. Kim and Francis A. Cucinotta

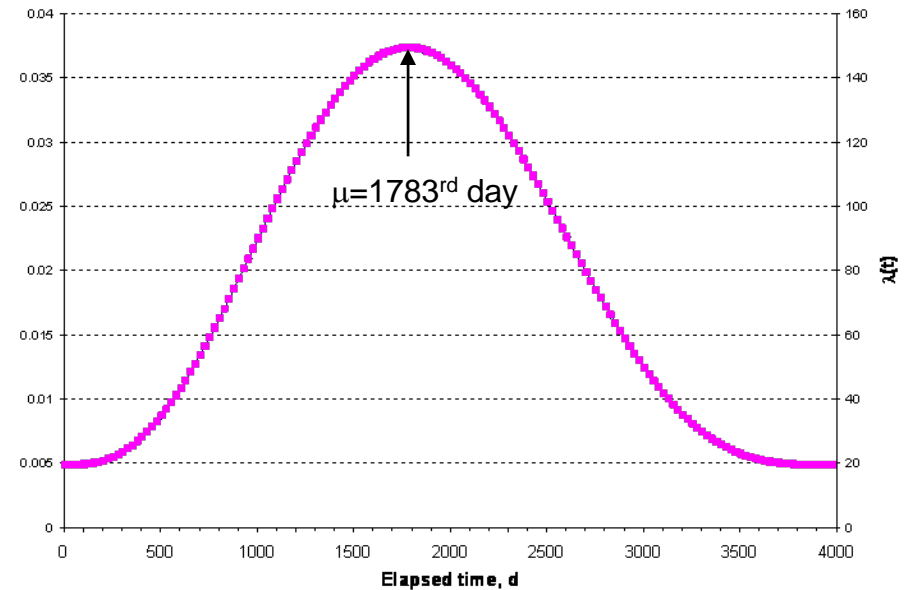
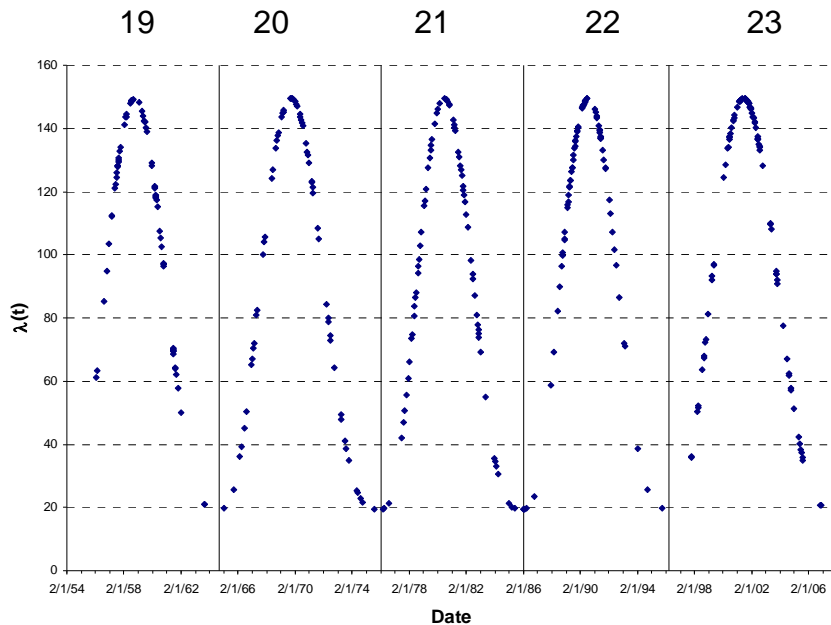
# SPE Database for the Recent Solar Cycles



# Model-based Prediction of SPE Frequency based on the Measurements of SPE Flux

**Propensity of SPEs:** Hazard Function of Offset  $\beta$  Distribution Density Function

$$\lambda(t) = \frac{\lambda_0}{4000} + \frac{K}{4000} \frac{\Gamma(p+q)}{\Gamma(p)\Gamma(q)} \left(\frac{t}{4000}\right)^{p-1} \left(1 - \frac{t}{4000}\right)^{q-1} \quad \text{for } (0 \leq t \leq 4000)$$



Typical Nonspecific Future Cycle

# Approaches

1. Cumulative frequency distribution of recorded SPEs
2. Model for the realistic application and the dependence of multiple SPEs:
  - Non-constant hazard function defined for the best propensity of SPE data in space era
  - Non-homogenous Poisson process model for SPE frequency in an arbitrary mission period
  - Cumulative probability of SPE occurrence during a given mission period using fitted Poisson model
3. Simulation of  $\Phi_{30, 60, \text{ or } 100}$  distribution for each mission periods by a random draw from Gamma distribution