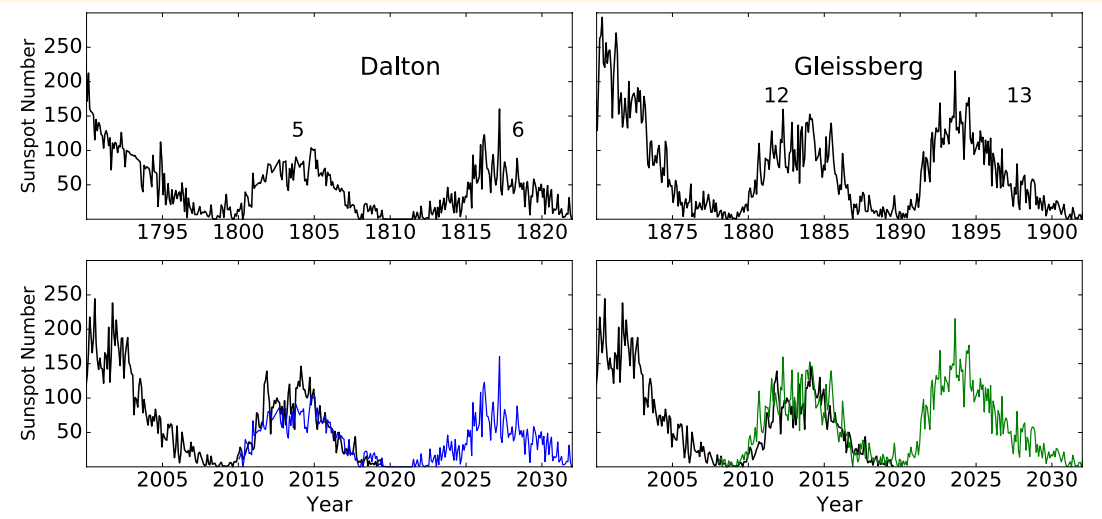


Cosmic Rays and the Weakening Solar Cycle

"The weaker solar cycle leads to an increase in cosmic rays – and a reduction in astronaut duration"

- The sunspot cycle has been trending weaker since the 1950s.
- Galactic Cosmic Ray doses will probably exceed their already high values.
- The Sun will be less effective in protecting astronauts from energetic cosmic radiation, limiting the durations of long-term missions.



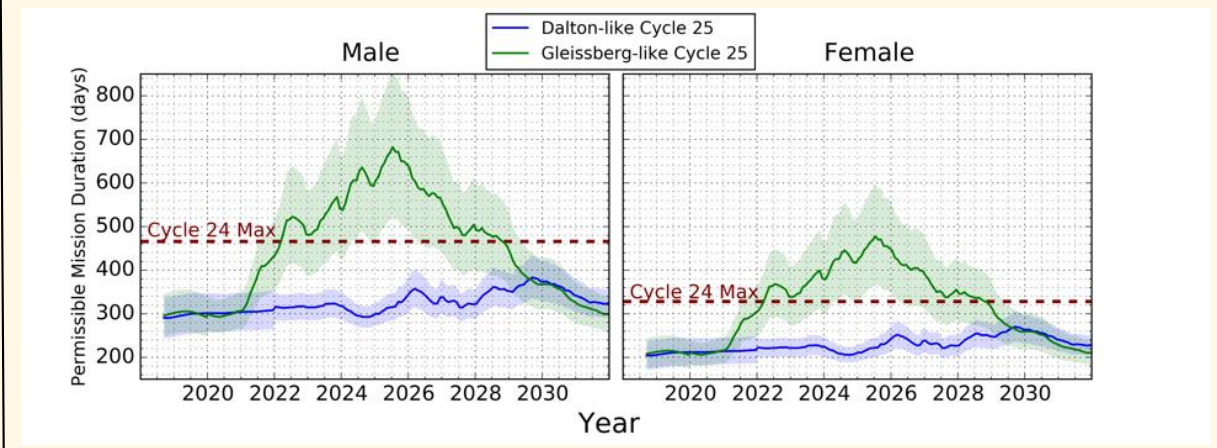
The modern persistent decline in solar activity resembles past secular minima.

["Galactic Cosmic Radiation in Interplanetary Space Through a Modern Secular Minimum"](#), published in *Space Weather*, considers the radiation levels and permissible mission durations in deep space.



The PI of the LEADER SSERVI project is Rosemary Killen (695) of NASA Goddard Space Flight Center.

- In the 1990s, astronauts could travel through space for as much as 1000 days before they reached NASA safety limits on radiation exposure.
- Based on UNH models of accumulated dose, in the coming years, cosmic rays could limit trips to as little as 290 days for 45-year old male astronauts and 204 days for females.
- Transit from Earth to Mars and back is 540 days.



- For long-term missions, solar maximum is safer since galactic cosmic radiation falls to lower levels.
 - Lunar missions are less limiting as transiting to the Moon and back takes a shorter time than the values found here, and shielding is provided by the lunar mass.
- F. Rahmanifard, et al., Galactic Cosmic Radiation in Interplanetary Space Through a Modern Secular Minimum, *Space Weather*, 10.1029/2019SW002428.
<https://spaceweatherarchive.com/2020/08/11/cosmic-rays-are-about-to-get-worse/>