ERTHOS

PV Panel Variability Effects using PVLib

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2023 PMPMC Workshop (May 10, 2023)

Erthos – Earth Mount Solar PV Systems

- Panels lie directly on Earth
- Panels follow natural contour of ground
- What is the effect of panel slope variation on performance?

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Main Calculation Steps

1. Obtain irradiance
   - GHI, DNI, DHI = site.get_clearsky(date_time) or TMY
2. Determine POA irradiance on each panel
   - POA_irradiance = irradiance.get_total_irradiance()
3. Generate IV curve for each panel
   - module_info = pvsystem.retrieve_sam('cecmod')[module_name]
   - IL, I0, Rs, Rsh, nNsVth = pvsystem.calcparams_desoto()
   - curve_info = pvsystem.singlediode()
4. Add voltages for each panel in a string over the range of currents
   - string_i = np.linspace(0, module_imax, resolution)
   - module_v = interpolate(string_i, curve_info)
5. Add currents of each string over range of voltages
   - array_v = np.linspace(0, string_vmax, resolution)
   - string_i = f_interp(array_v, string_iv)
6. Determine Pmp and compare it to nominal value

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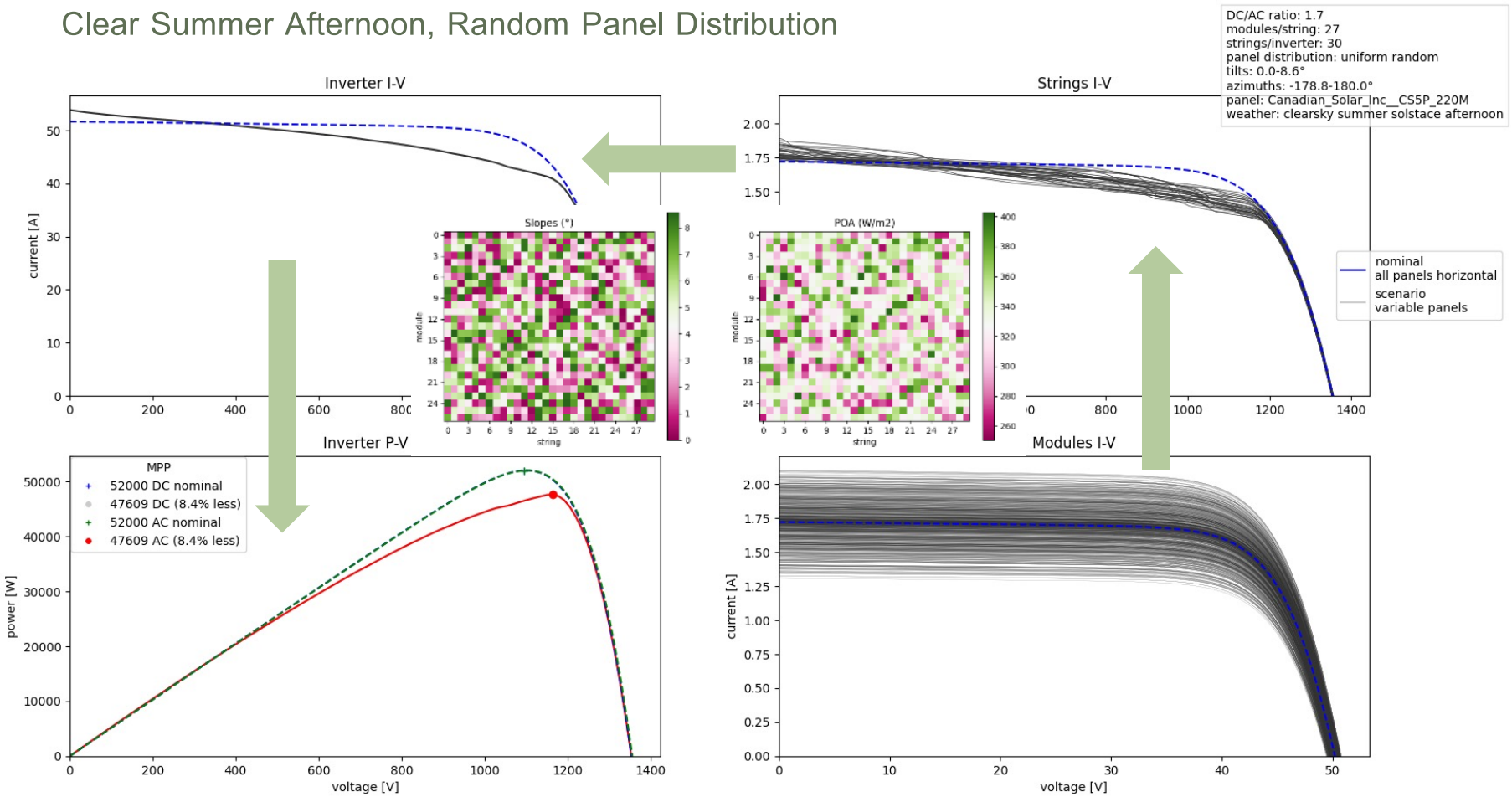
Panel Variability Effect

Clear Summer Afternoon, Random Panel Distribution



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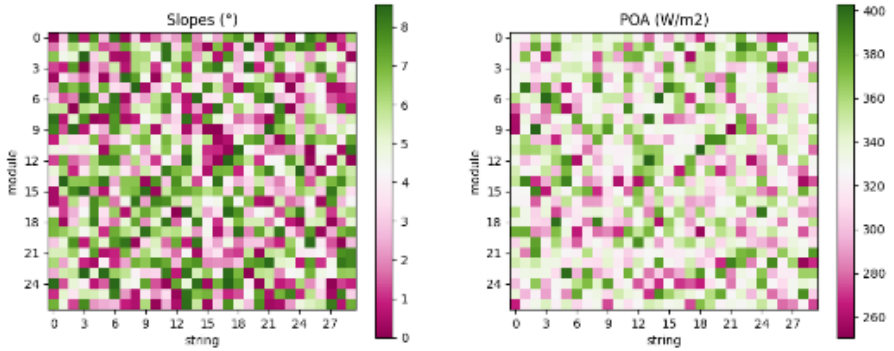
Panel Configuration Scenarios

Clear Summer Afternoon, panel tilts up to 8.6°

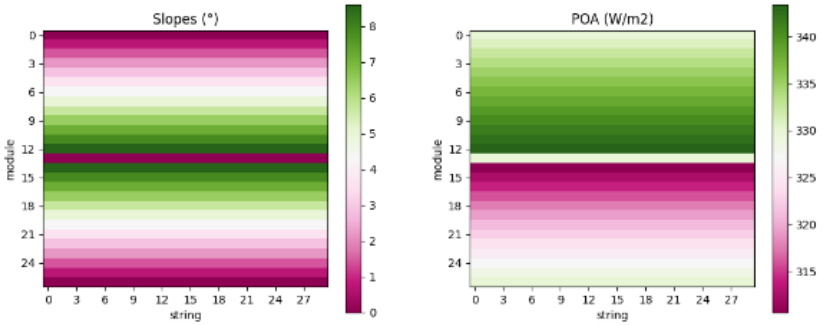
Random module distribution

- Random slope (0-8.6°)
- Random azimuth (-180°-180°)



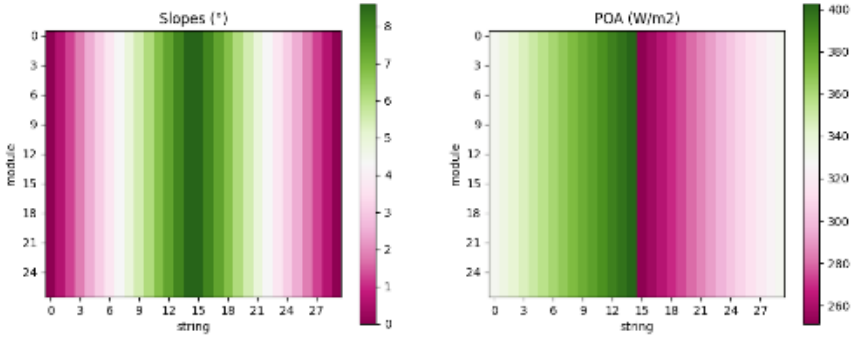
Bi-linear module distribution

- All variation along modules in a string
- Each string is identical



Bi-linear string distribution

- All variation is from string to string
- All modules in a string are identical



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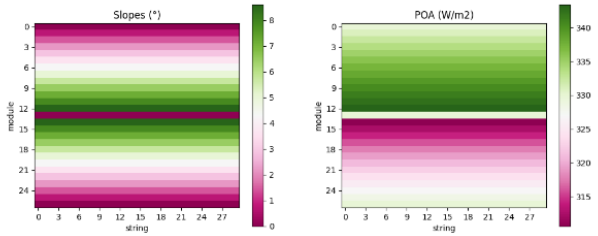
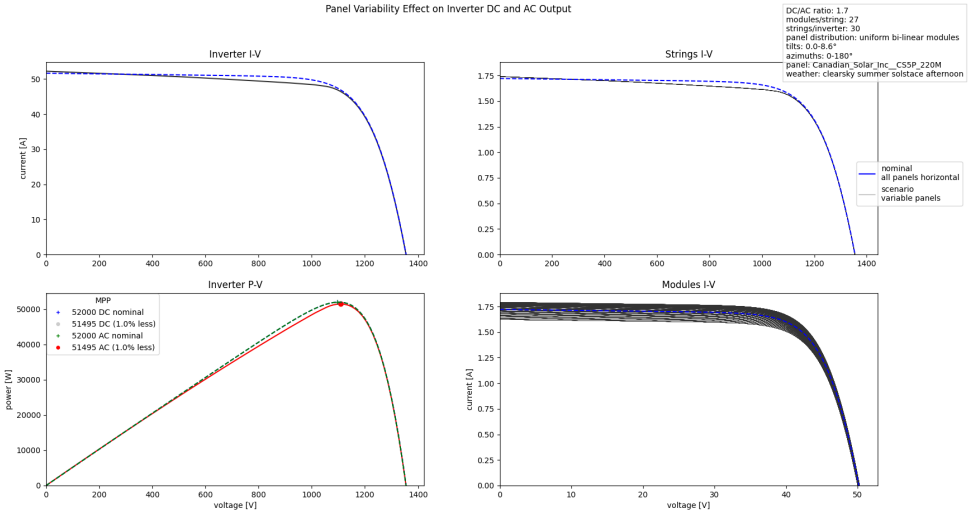
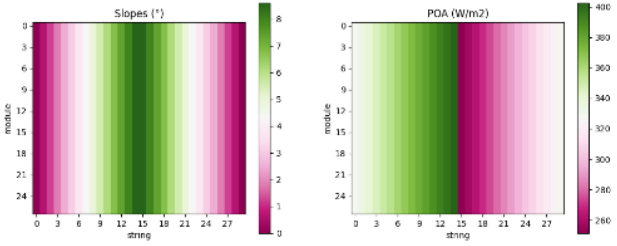
Panel Variability Effect - Clear Summer Afternoon

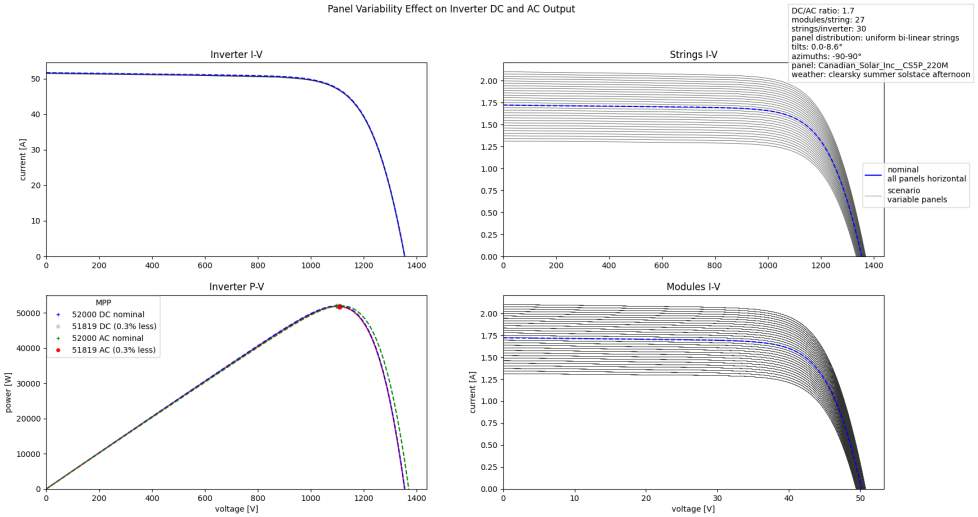
Bi-linear panel distribution





Bi-linear string distribution





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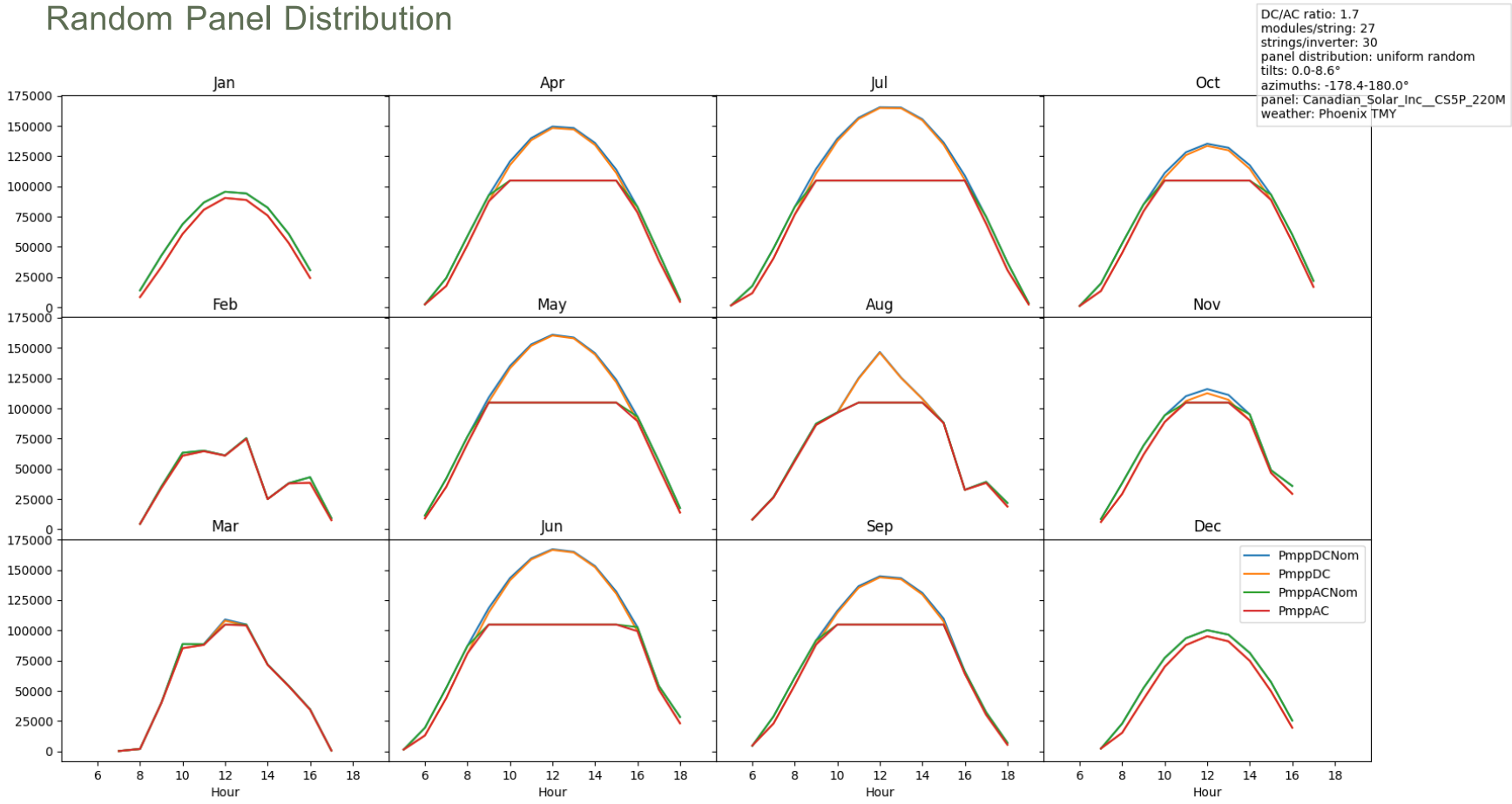
Daily Trends 1st of each Month

Random Panel Distribution



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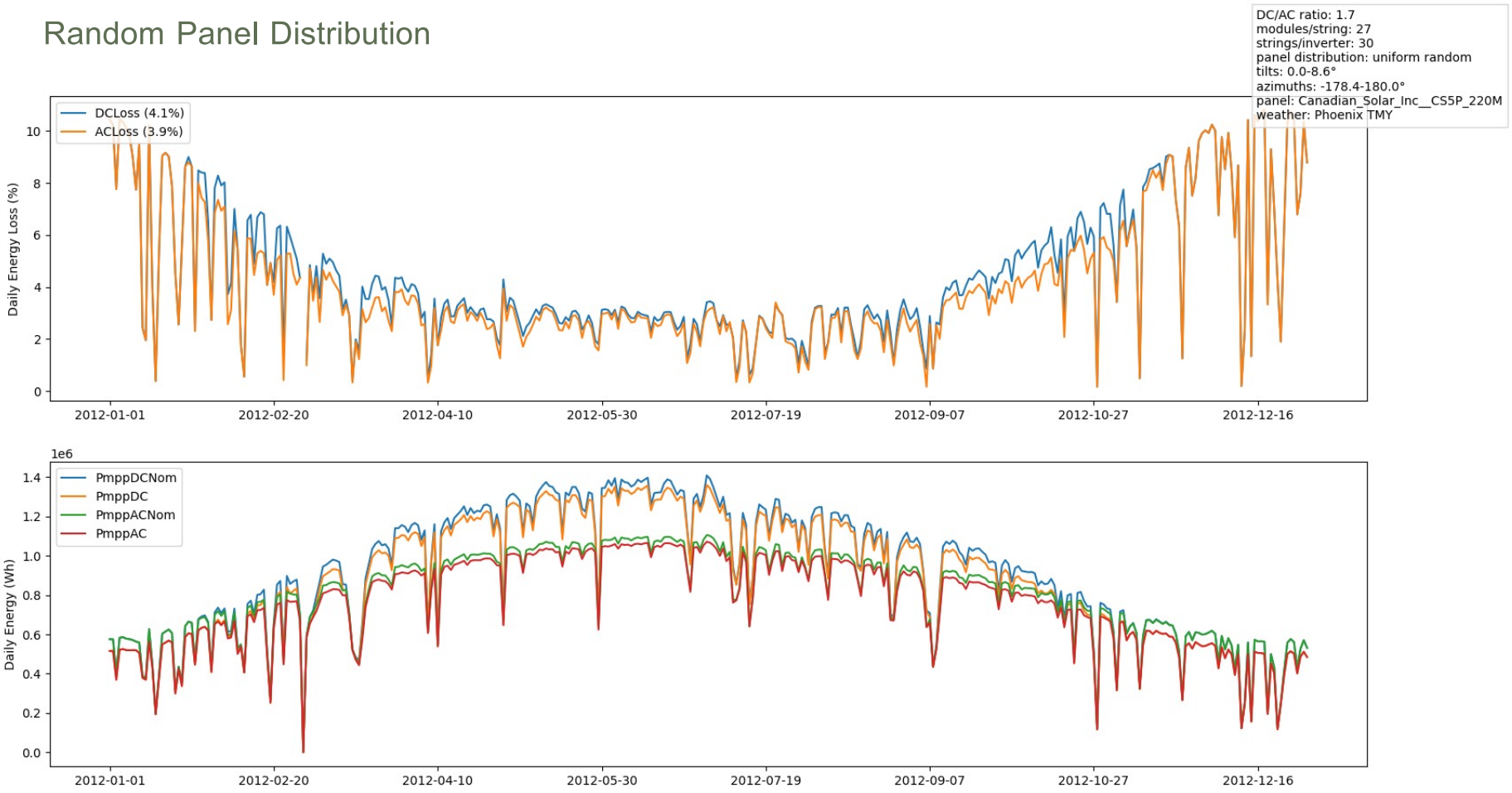
Daily Energy and Loss due to Panel Variability

Random Panel Distribution



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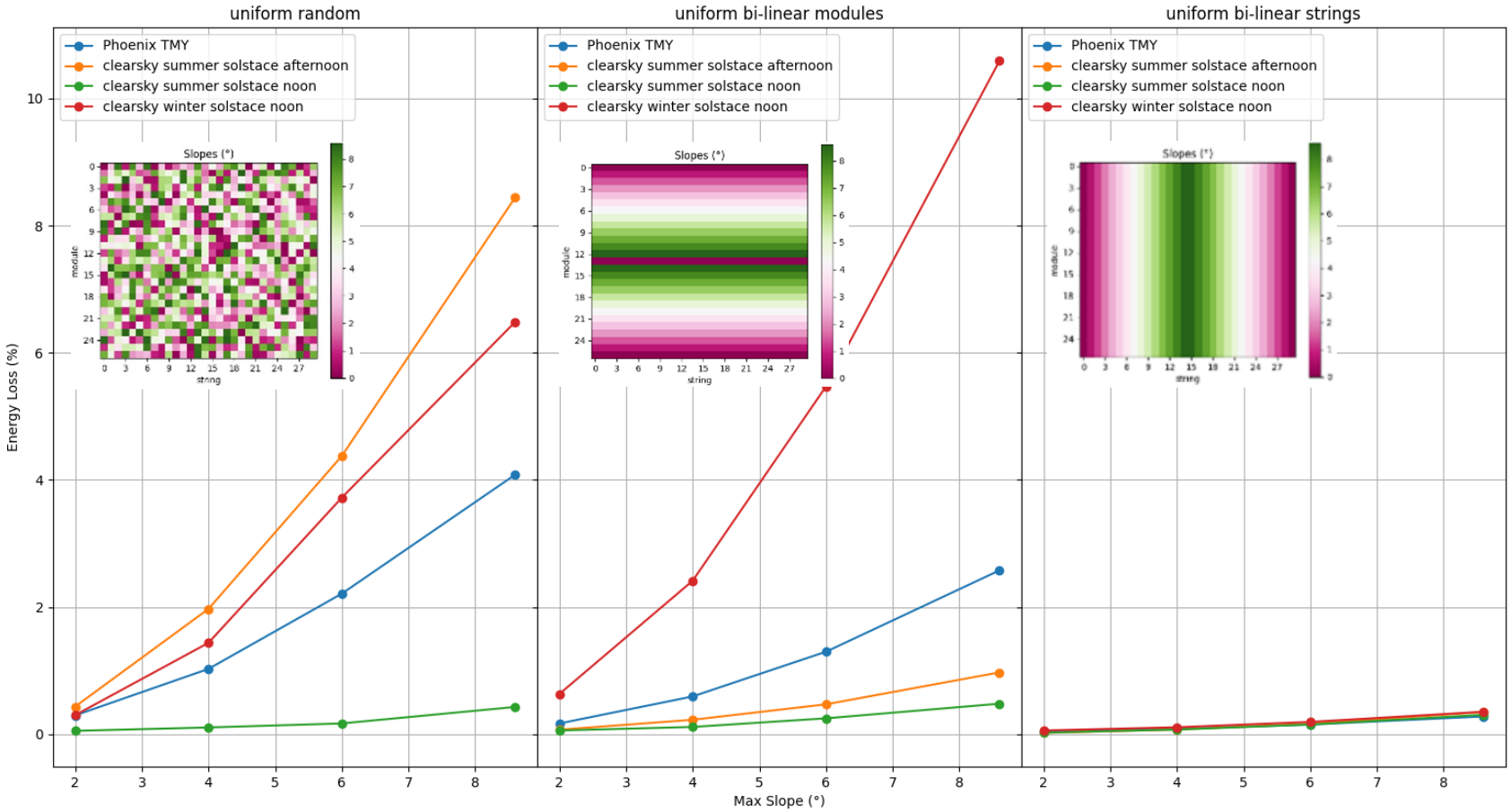
DC Energy Loss vs. Max Panel Tilt for Various Tilt Distributions and Weather Scenarios



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Thank You

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