Advancing WRF-Solar Model to Improve Solar Irradiance Forecast in Cloudy Environments

❖ One Goal

Improve the state of art *WRF-Solar* model for forecasting solar irradiance in *cloudy* environment

❖ Four Objectives

- **Improve cloud microphysics**
- **Improve radiative transfer**
- **Develop innovative analysis package**
- **Perform model evaluation**

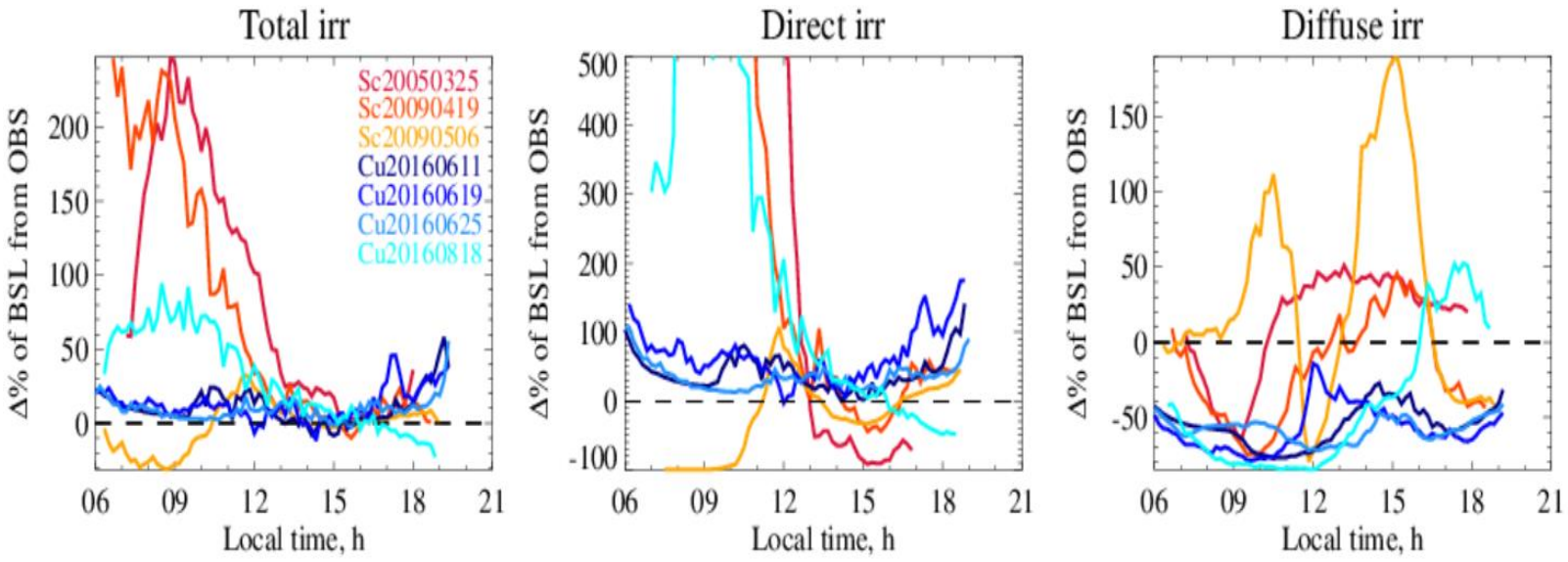
❖ Five Tasks

- **Four objectives + Data integration**

❖ BNL-NREL-SUNY Collaboration

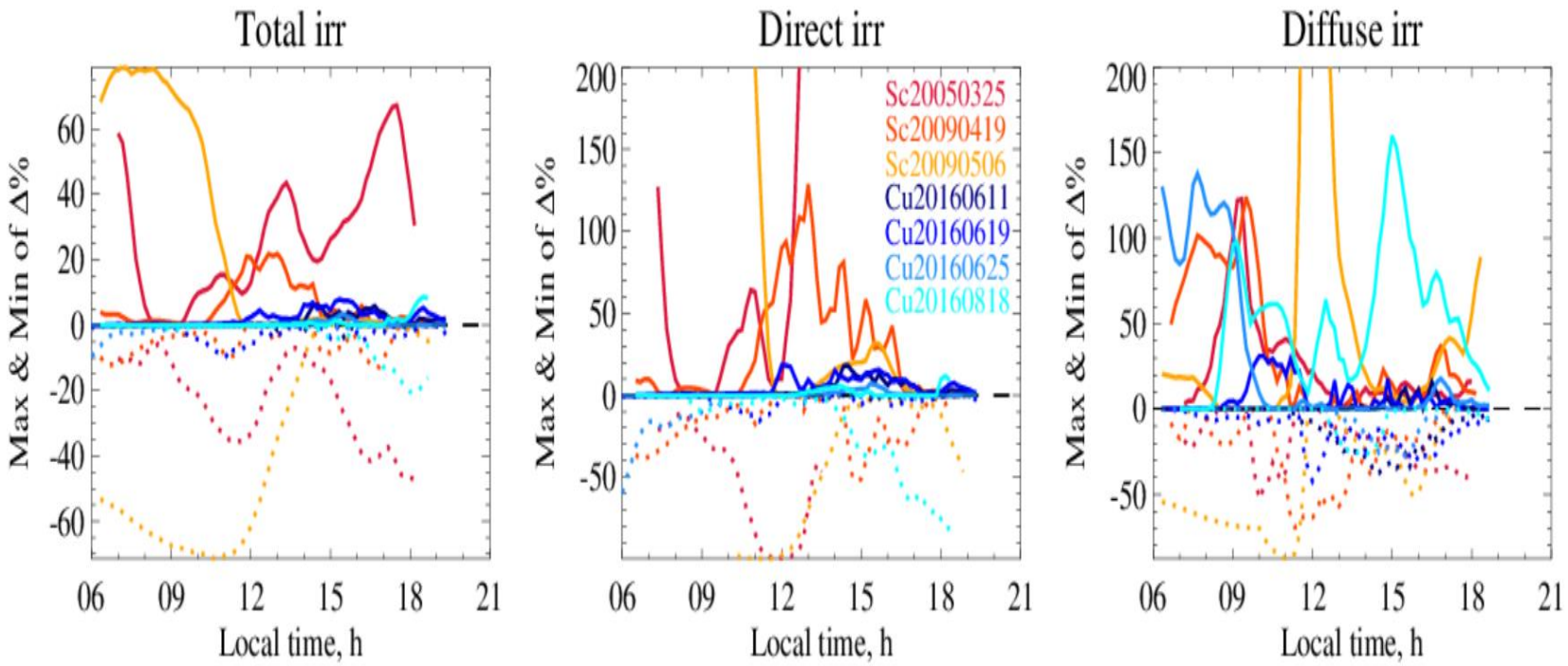
PI: Yangang Liu (Brookhaven National Laboratory)

Substantial Differences between Baseline Sim and Obs



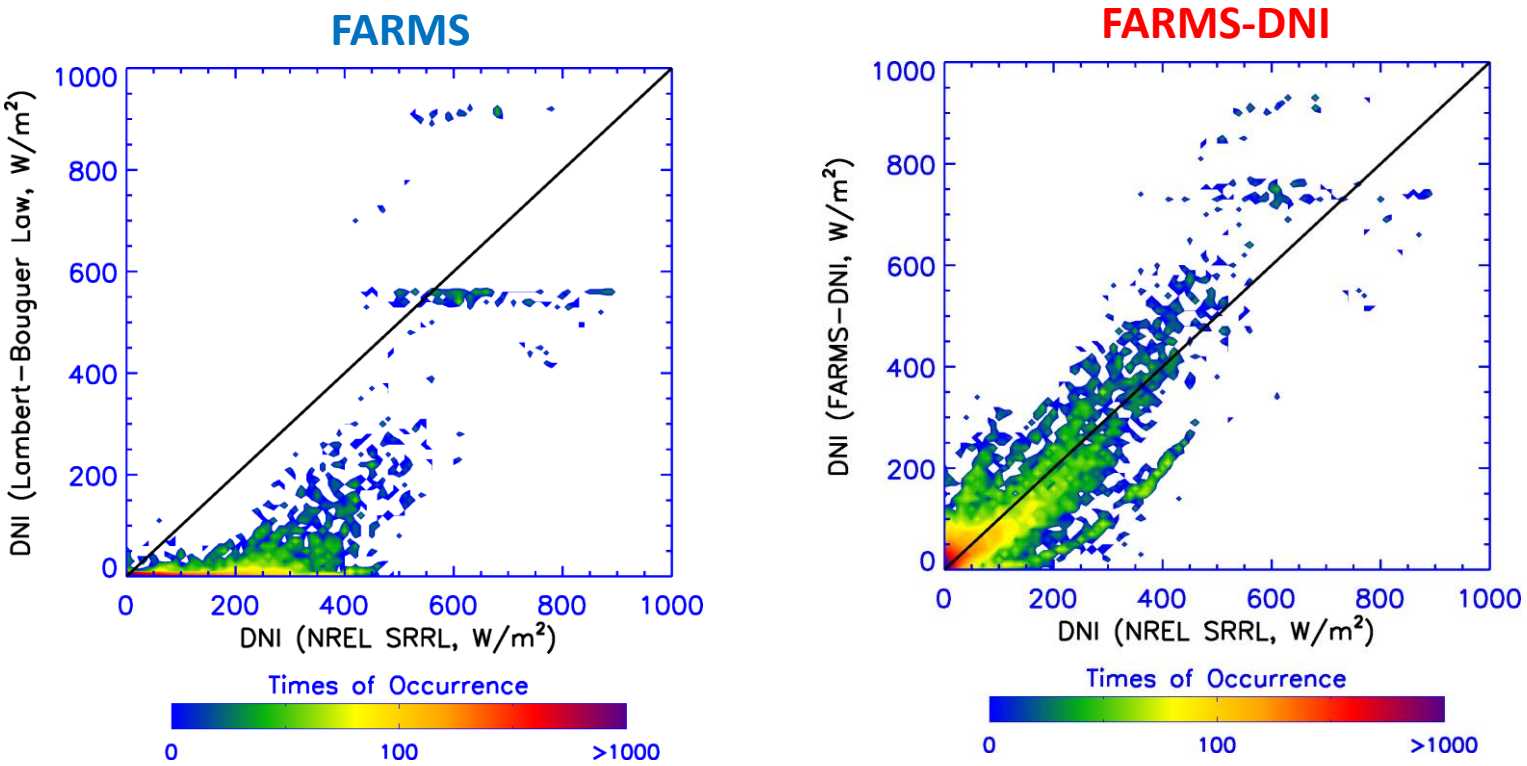
- Substantial model errors, esp. for direct solar radiation
- Error compensation between direct and diffuse radiation
- Details are case-dependent
- Cases at DOE ARM supersite at Southern Great Plains (SGP)
- Parameterizations for cloud microphysics & radiative transfer are responsible for (part of) the model errors

Effect of Cloud Microphysics Schemes on WRF-Solar



- Seven microphysics schemes tested
- Significant microphysics-induced model difference
- Larger differences correspond generally to higher total water contents
- Support proposed improvement in cloud microphysics parameterization

Updated FARMS: FARMS-DNI



- **Percentage error (PE) of FARMS and FARMS-DNI are -73.18% and 3.64%, respectively, which suggests a potential improvement of ~ 70%.**

- **Validation with one year (2017) surface-based measurements at NREL's Solar Radiation Research Laboratory (SRRL).**

$$PE = \frac{\sum_{i=1}^{n}(DNI_{model} - DNI_{measured})}{\sum_{i=1}^{n} DNI_{measured}} \times 100\%$$

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