Refining the Ideal Sky Model for CD/EoR Detection

[1]Shijiao Yin, [1]Huanyuan Shan, [2]Jinyang Lin

[1]Shanghai Astronomical Observation, CAS, Shanghai, China

[2]Xiamen University, Xiamen, China

yinshijiao@shao.ac.cn

Shanghai Astronomical Observatory,Chinese Academy of Sciences

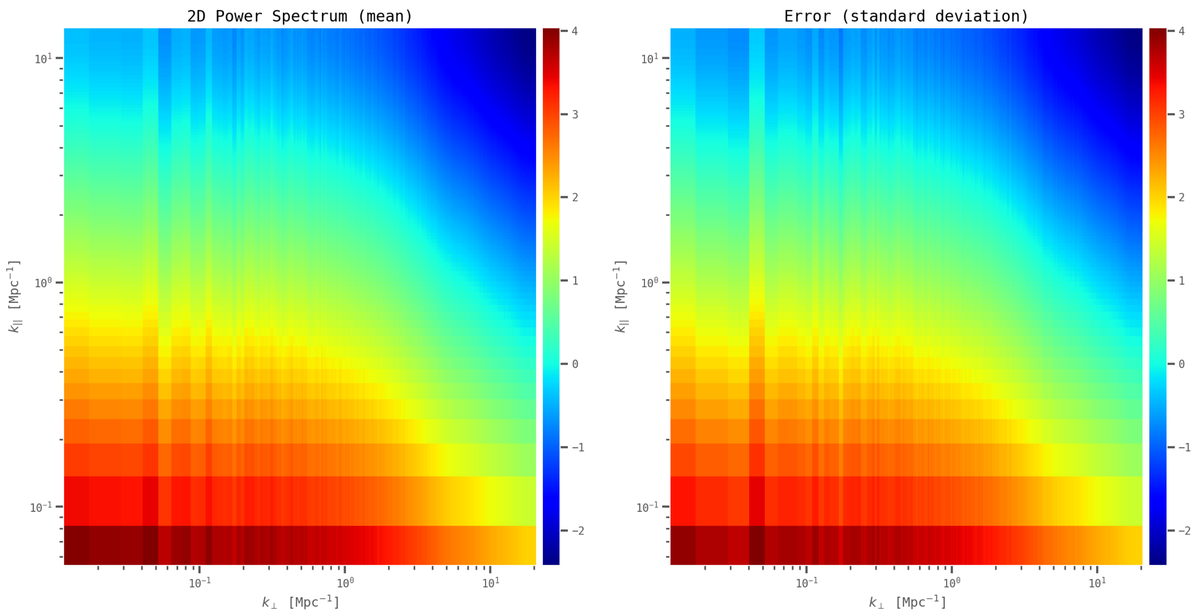
Introduction

Any calibration steps that rely on a sky model are susceptible to errors from an inaccurate or incomplete sky model. In order to establish the most suitable sky model, this work explore how the completeness of the sky model affect calibration results. This work present end-to-end simulations of a full EoR PS analysis utilizing the FHD/εppsilon pipeline, and simulate the observation depth by changing the luminosity threshold of sources contained in the sky model. The most suitable observation depth is determined by comparing the 2d PS after calibrations utilizing different sky models.

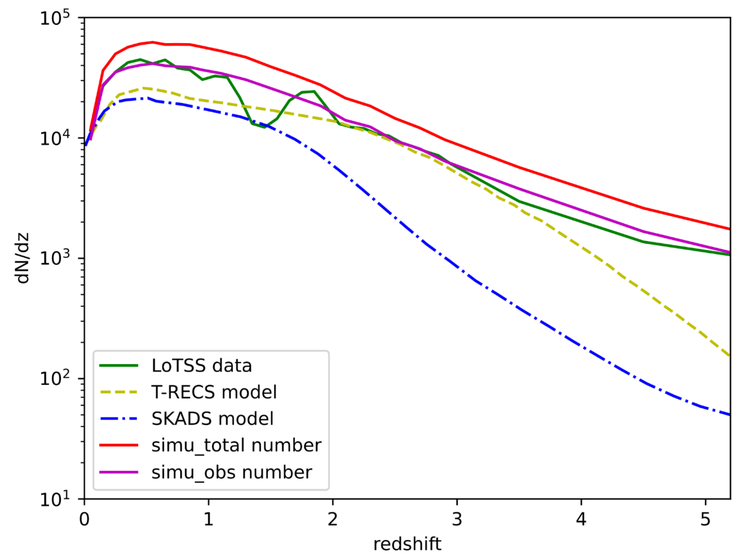
Sky Model

Simulated point sources based on the LOFAR Two-meter Sky Survey (LoTSS) are utilized as sky model in this work. This model:

- Divided sources into High Excitation Radio Galaxies, Low Excitation Radio Galaxies, Radio-Quiet Active Galactic Nuclei, and Star-Forming Galaxies;
- Remodeled the luminosity function of these source types to reflect their evolution with redshift, and adjusted total intensity number counts, source sizes and star formation rate;
- Is closer to actual observations across all redshifts..

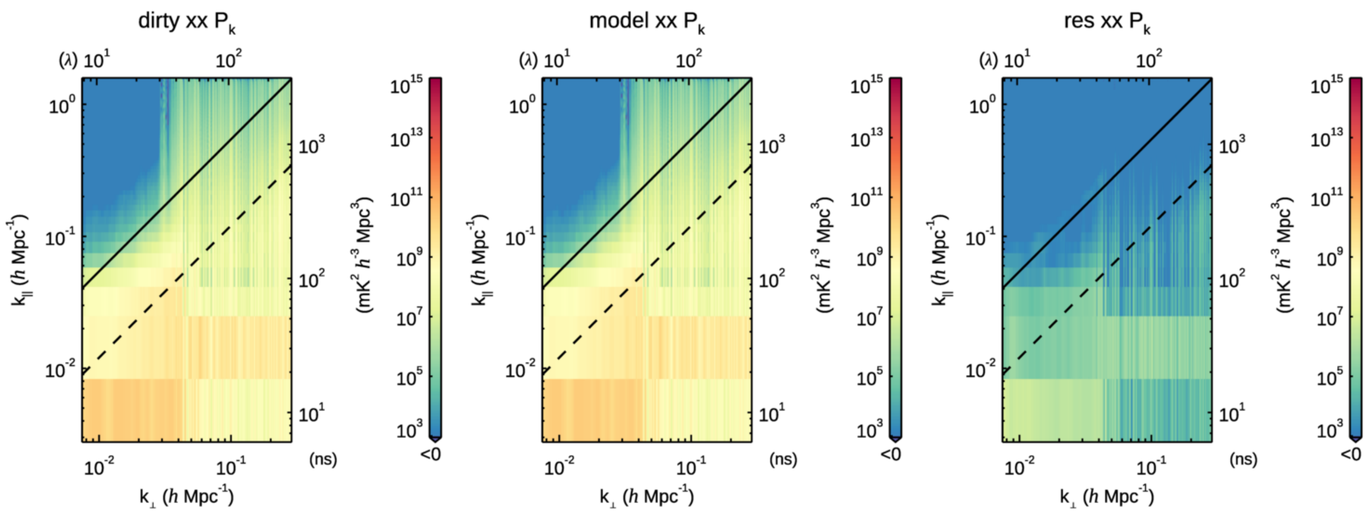


A 2d PS of a catalog of sources with clustering effects.

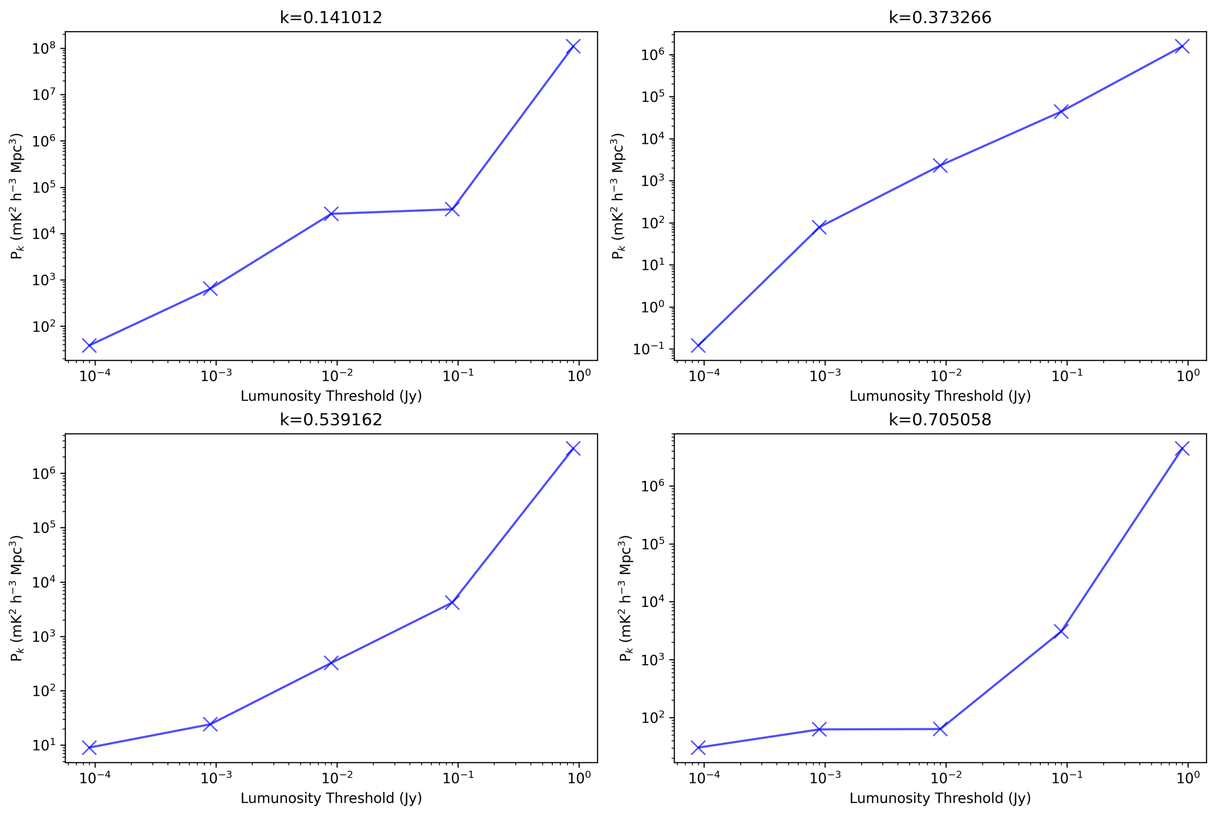


The redshift distribution of radio sources.

Results



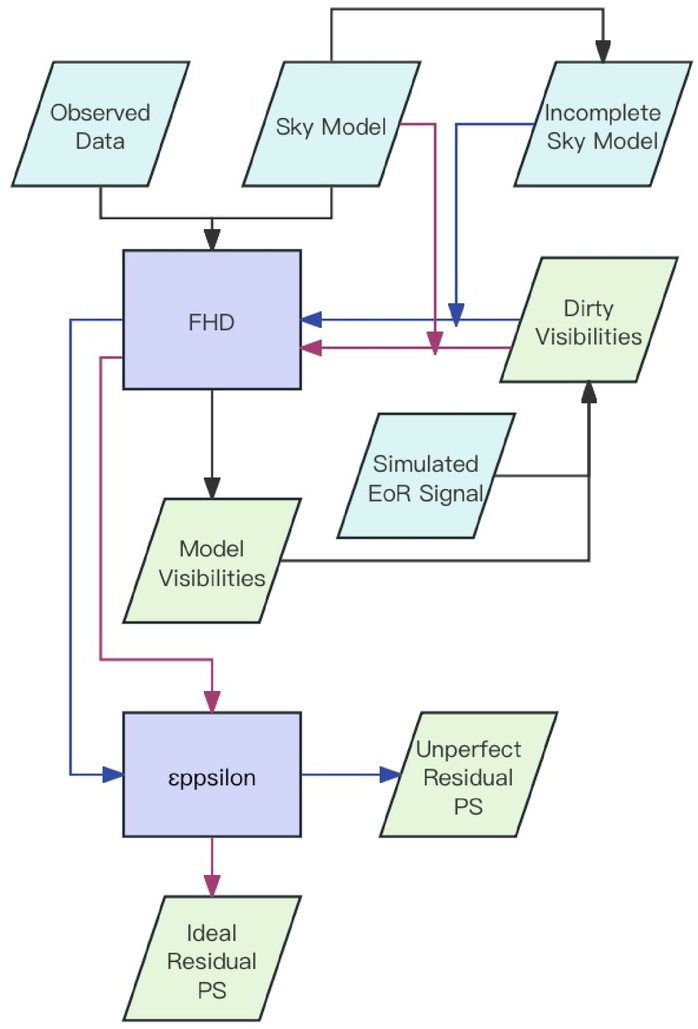
The results of the simulation pipeline with a perfect sky model. Calibrating and subtracting all the 54959 sources used in modeling.



The deviations between the ideal residual PS and the imperfect residual PS at different k values. The imperfect residual PS are produced by incomplete sky model constructed by 39497, 3223, 381, 55, 4 sources, with luminosity threshold of $9 \times 10^{-5} Jy$, $9 \times 10^{-4} Jy$, $9 \times 10^{-3} Jy$, $9 \times 10^{-2} Jy$, $9 \times 10^{-1} Jy$.

Simulation

FHD/εppsilon pipeline is used as an in situ simulation.



Future Work

- More results with different thresholds
- Find out where PS devivation converges
- Improve the eor model
- Consider the effect of source location;
- Consider the effect of observation error.