

Differences in stochastic properties between IGS- and NGL-derived position time series

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Research questions:

1. Do the results of the available GNSS solutions differ from each other?
2. Where might the potential differences come from?
3. Which data set should be preferred?



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ORIGINAL ARTICLE



Impact of alignment strategy to the reference frame on the 3D annual station motions from different GNSS solutions

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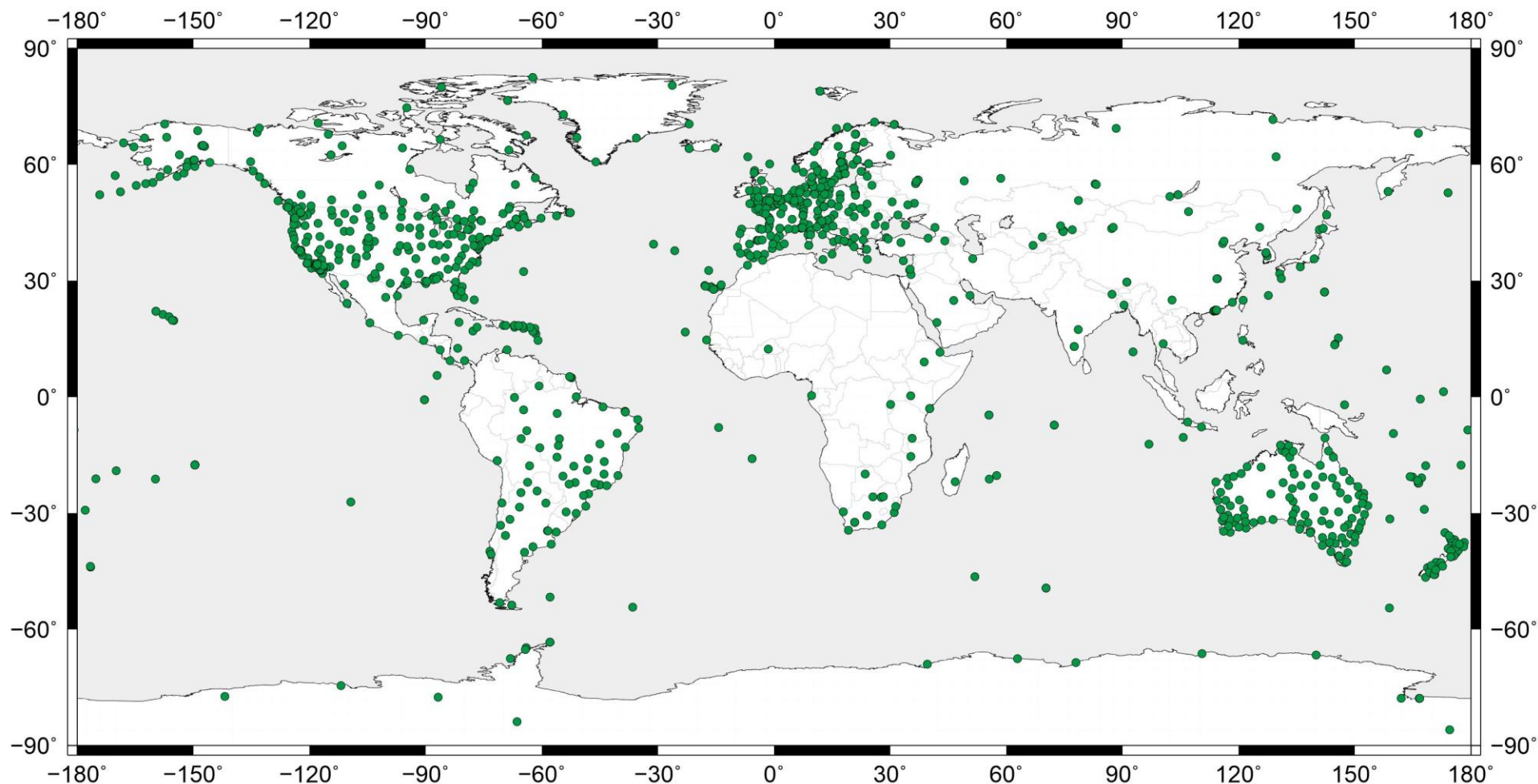
Input data:

1029 GNSS

permanent stations:

- IGS repro3 NS solution;
- NGL PPP solution (IGS14).

Pre-processing of
vertical 1-day
sampling position time
series.



Deterministic model:

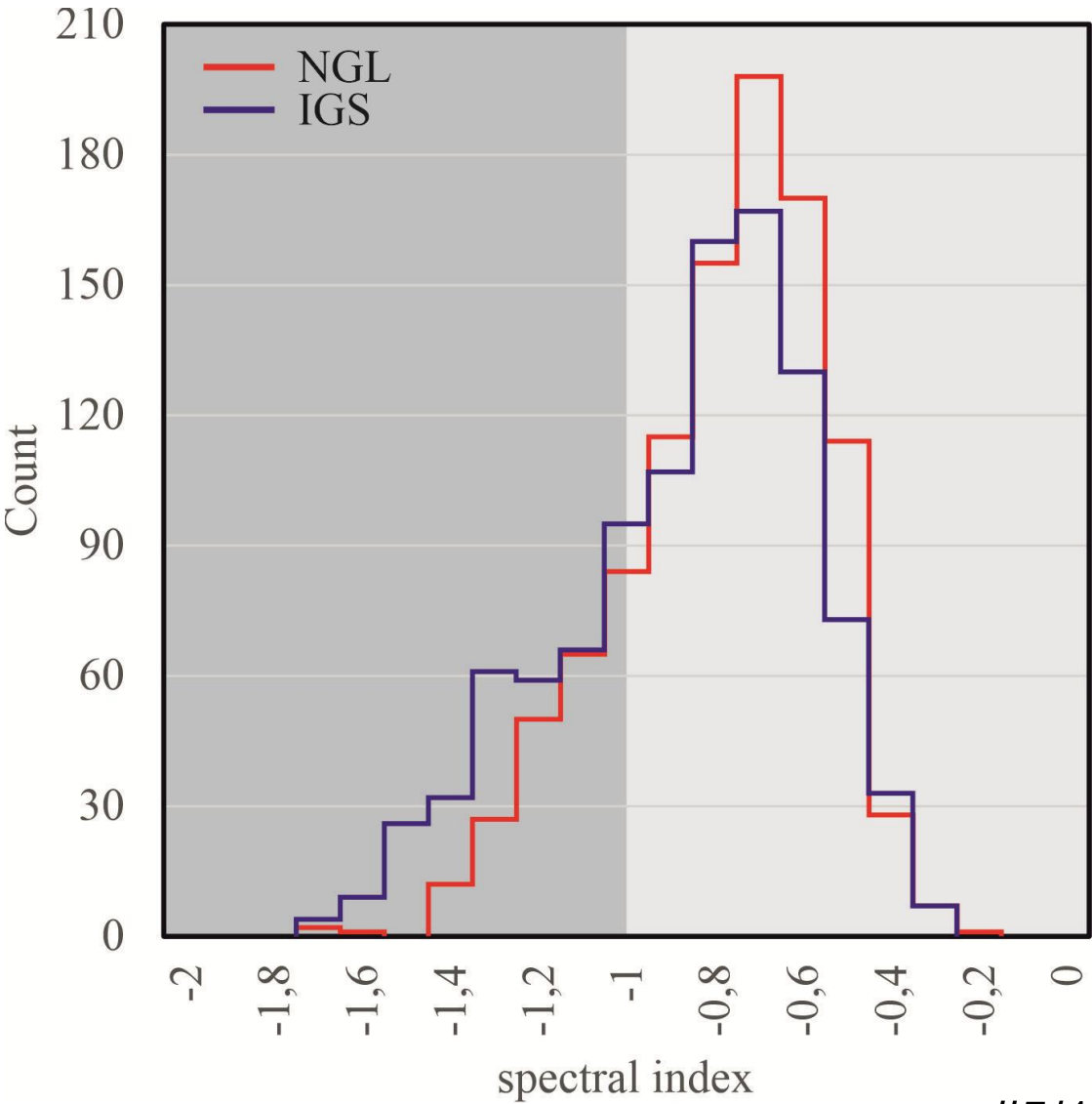
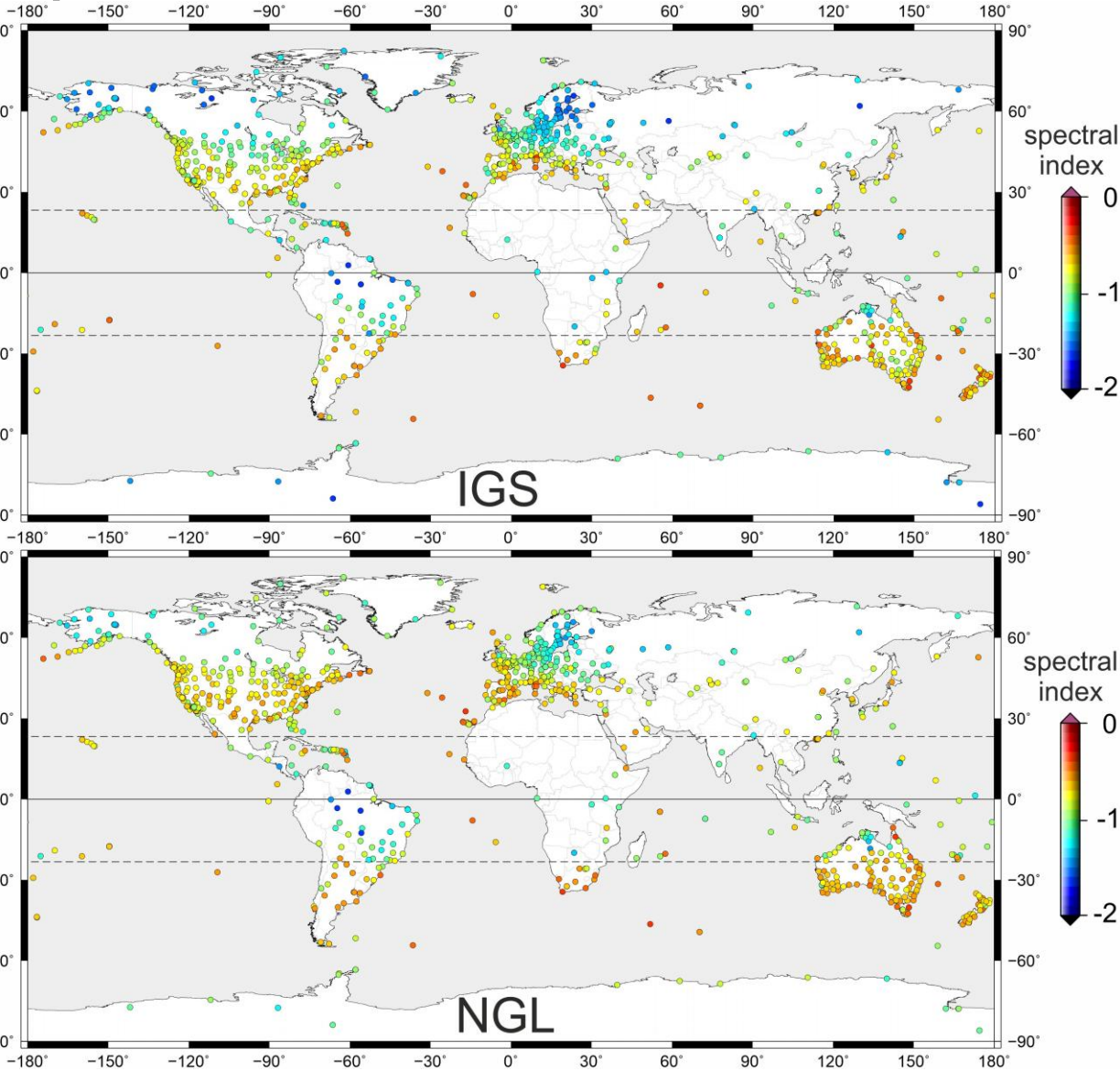
- (non-)linear trend;
- annual and its 8 overtones;
- draconitic and its 8 overtones;
- same epochs of offsets for both data sets.

Finally, only common epochs (**same observation time**) were selected.

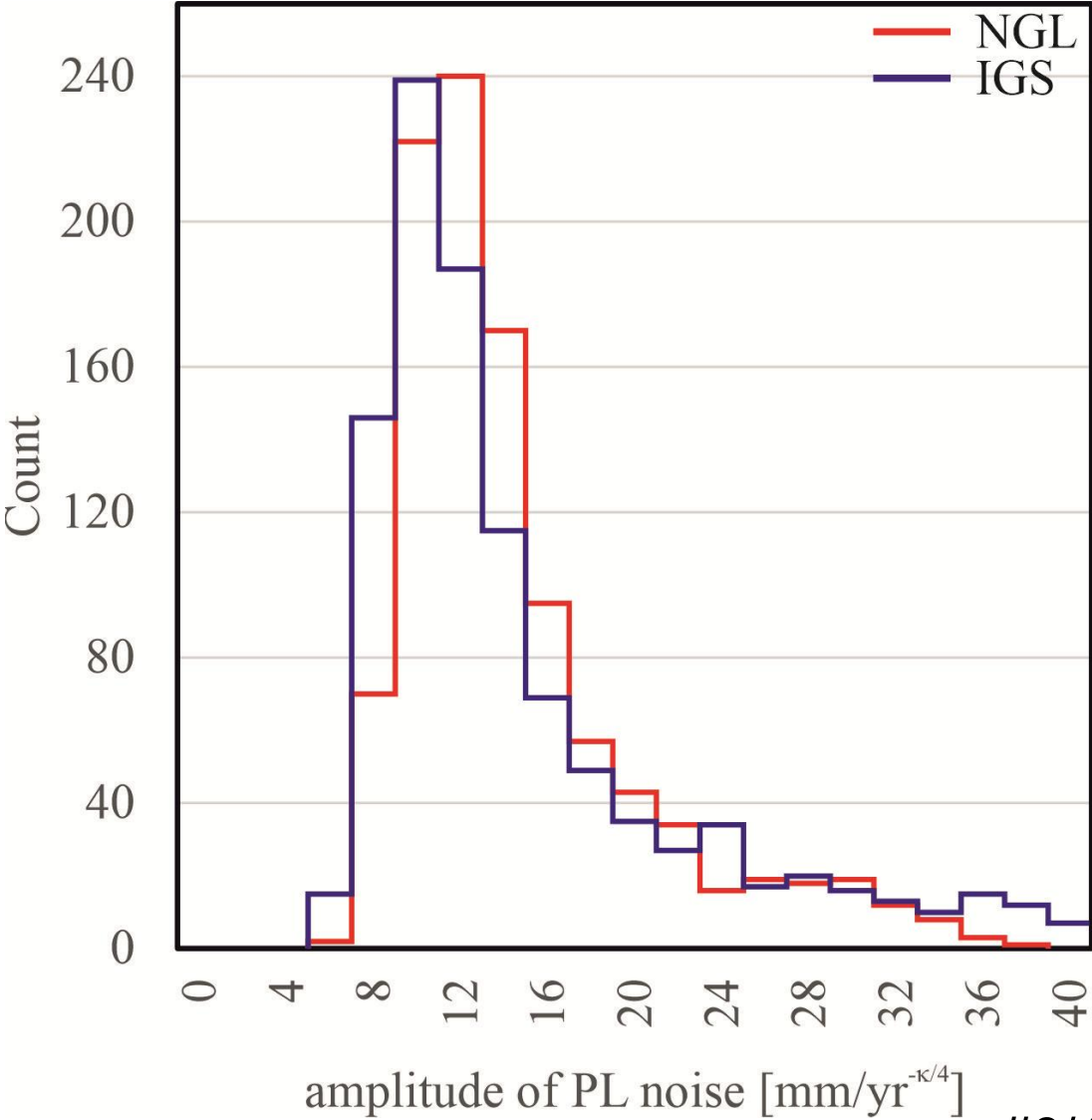
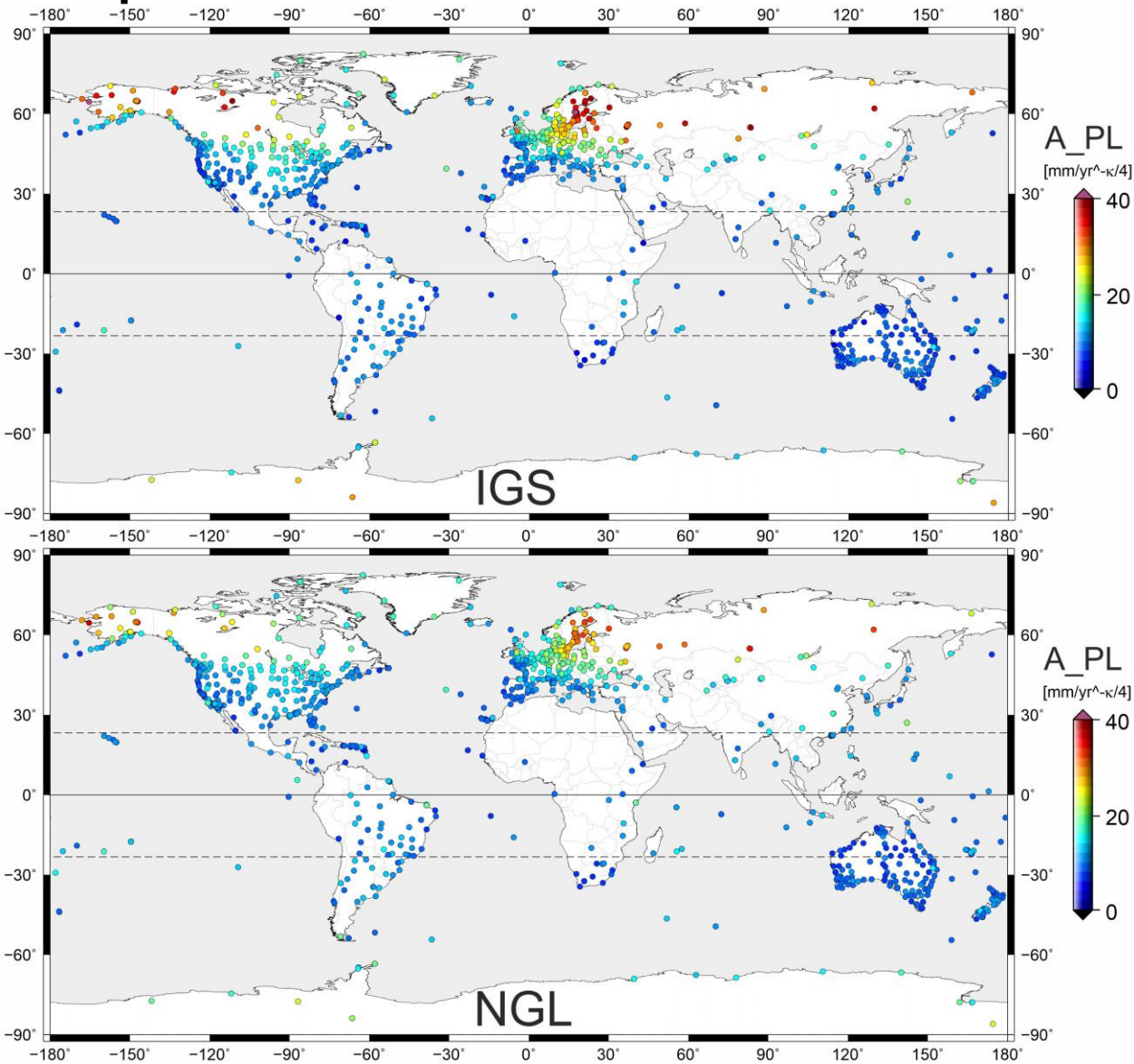
Restricted Maximum Likelihood Estimation (Hector software) with 3 main outcomes:

1. spectral index κ (white, flicker, random-walk),
2. amplitude of colored noise,
3. fraction of power-law noise.

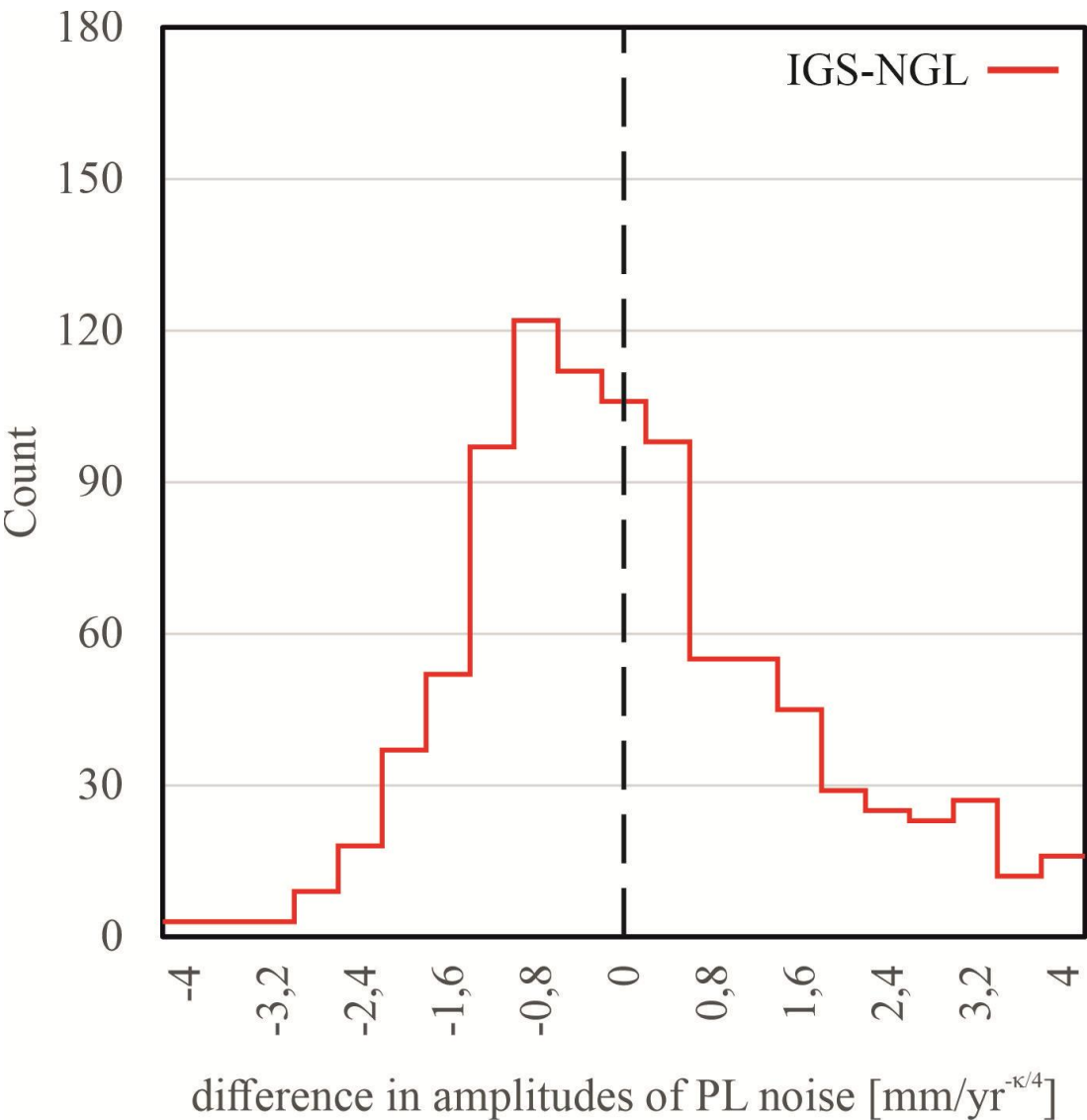
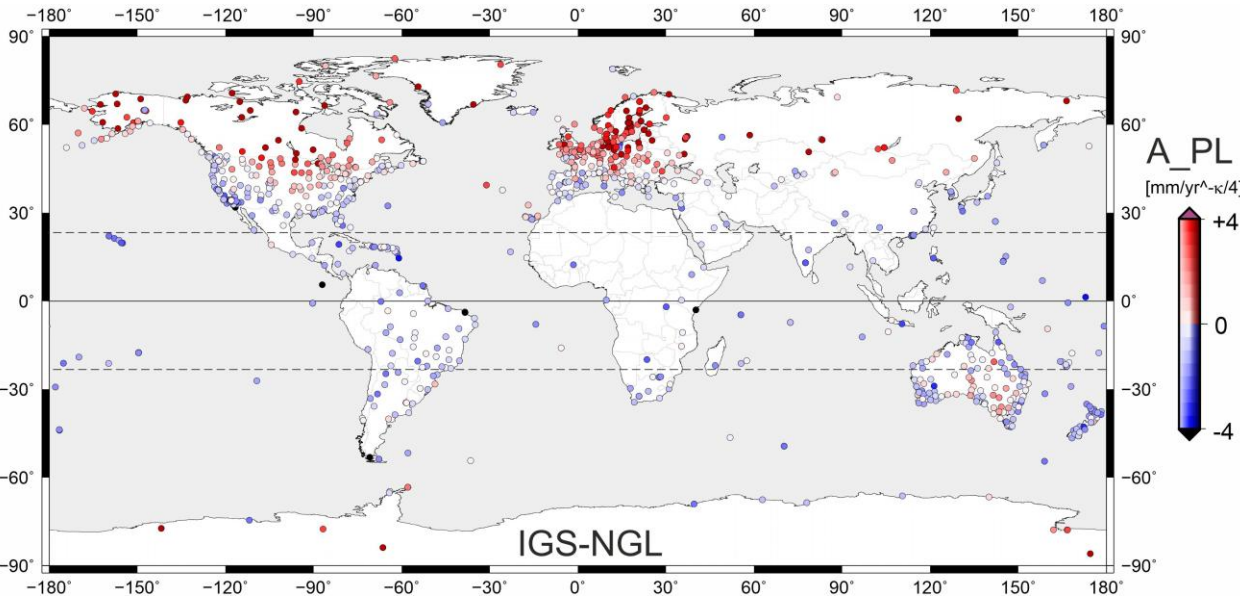
Spectral indices:



Amplitudes of colored noise:



Amplitudes of colored noise:



Additional solutions:

Since the official repro3 solution („**IGS**”) is aligned by NNR+NNT constraints to IGSR3 via the well-distributed IGSR3 core network, the additional solutions are:

- “**IGa**” which is repro3 solution aligned by NNR+NNT+NNS constraints to IGSR3 via the same IGSR3 core network;
- “**IGb**” which is repro3 solution aligned by NNR+NNT+NNS constraints to IGSR3 via the same set of reference stations as used by Jet Propulsion Laboratory (JPL);
- “**IGc**” which is repro3 solution aligned by NNR+NNT+NNS constraints to IGb14 via the same set of reference stations as used by JPL.

NNR: No-Net-Rotation

NNT: No-Net-Translation

NNS: No-Net-Scale

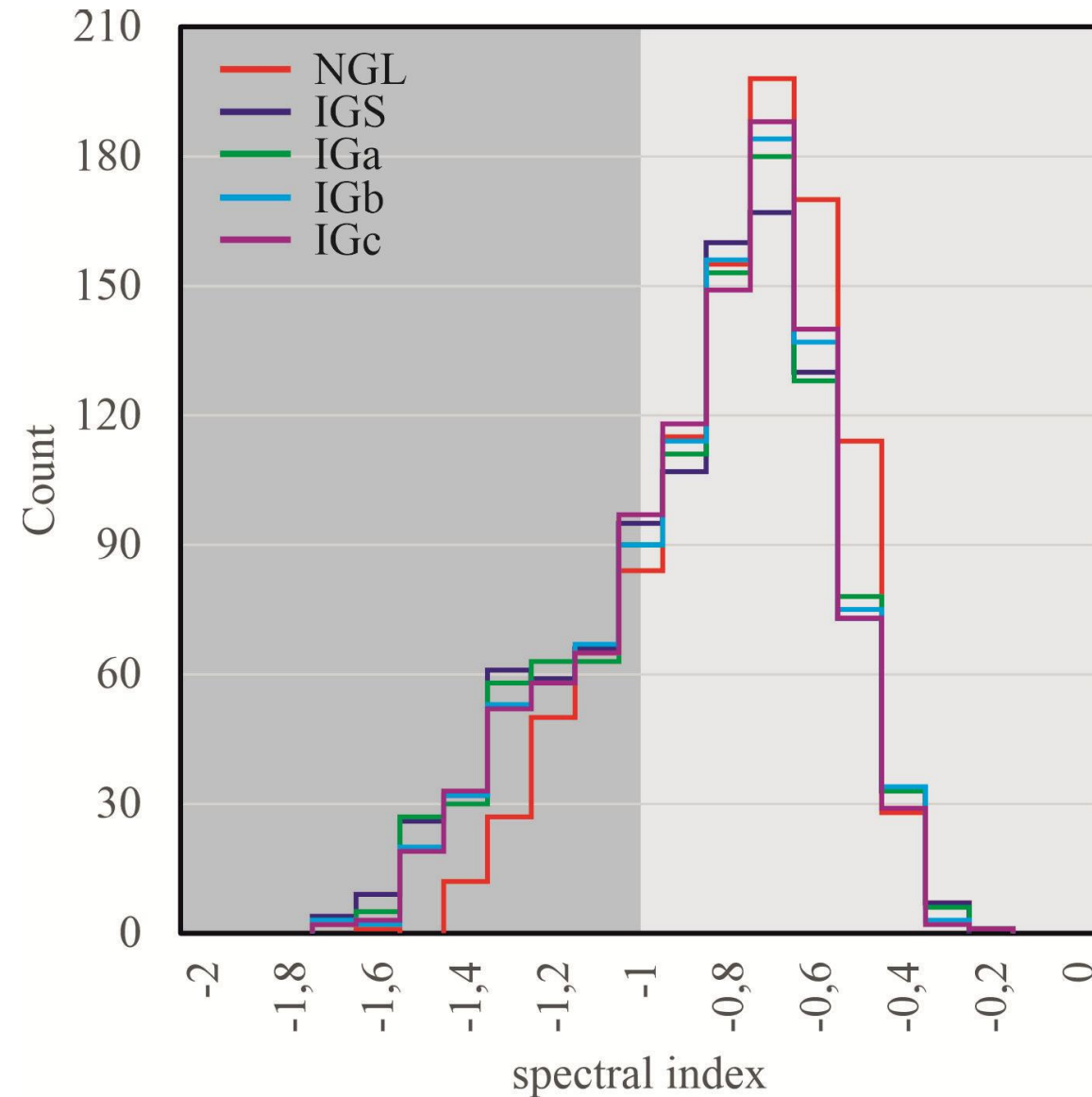
IGSR3: IGS reference frame used to align repro3 solutions

IGb14: IGS reference frame used by JPL to align their orbit and clock products

Differences in spectral indices:

Medians:

$$\kappa_{\text{IGS}} < \kappa_{\text{IGa}} < \kappa_{\text{IGb}} < \kappa_{\text{IGc}} < \kappa_{\text{NGL}}$$



Environmental loadings:

1. **NTAL, NTOL, HYDL** and **SLEL** from Earth System Modelling Group of GeoForschungsZentrum Potsdam (ESM GFZ).

NTAL: atmospheric non-tidal loading

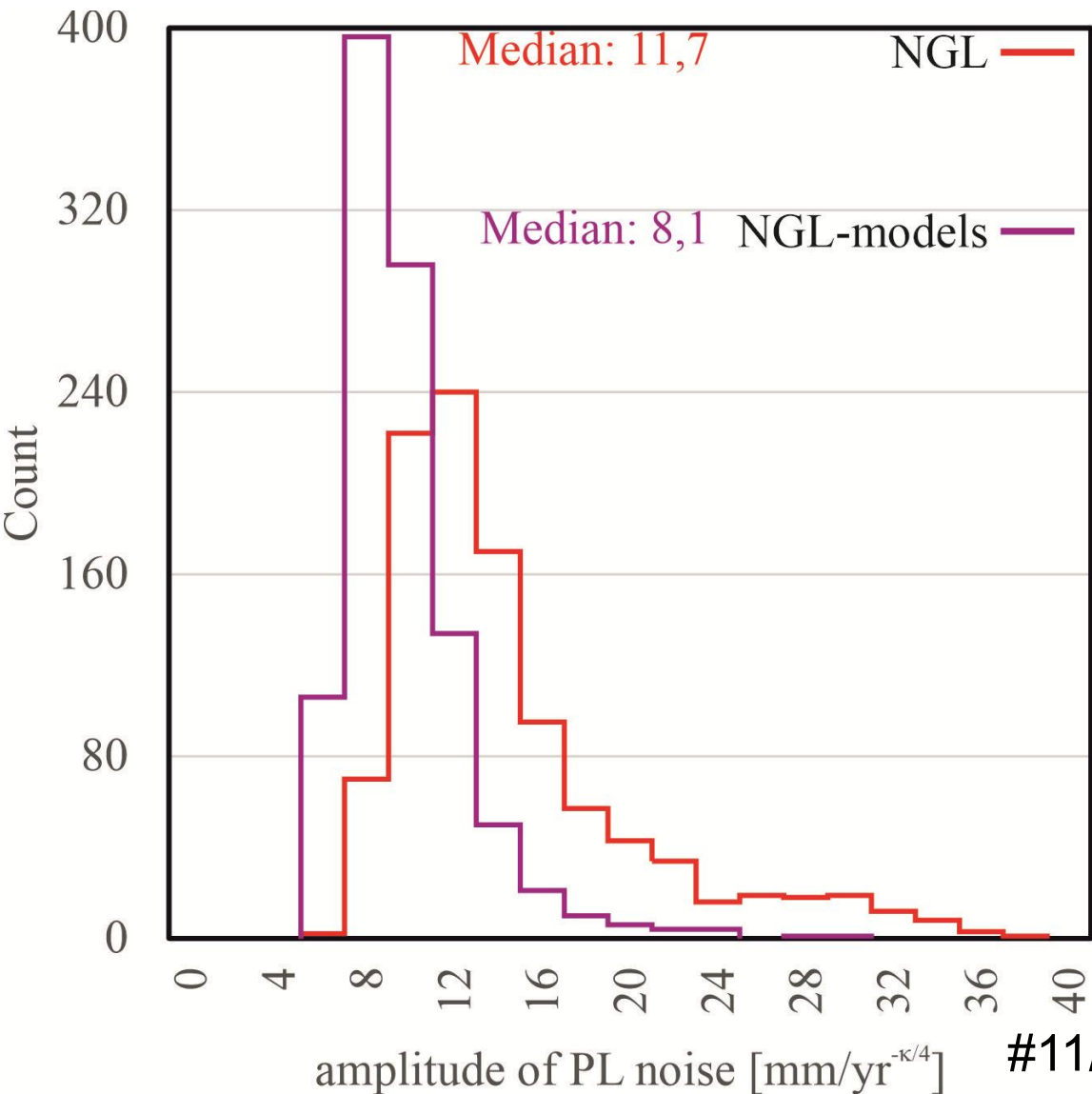
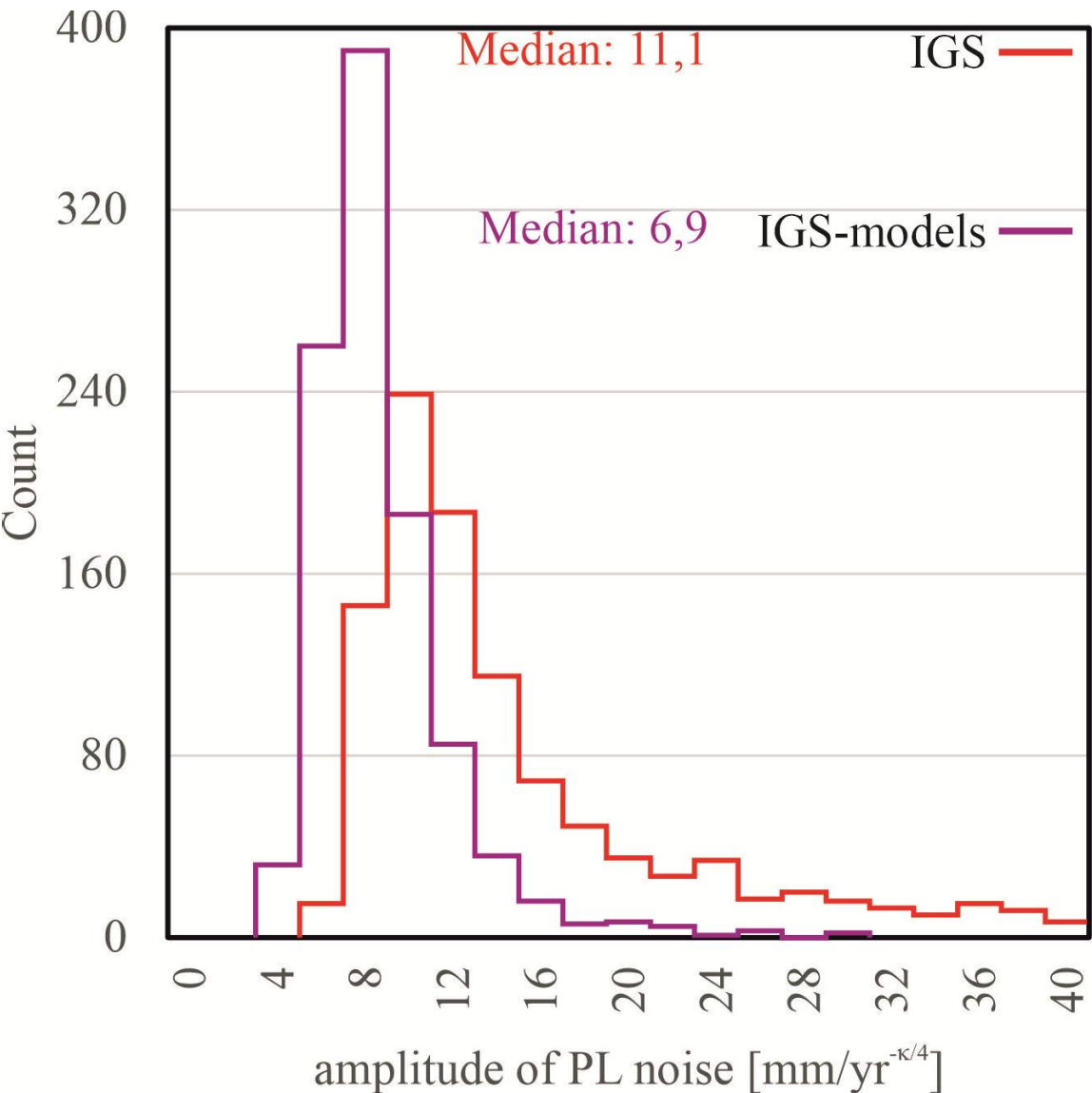
NTOL: ocean non-tidal loading

HYDL: hydrological loading

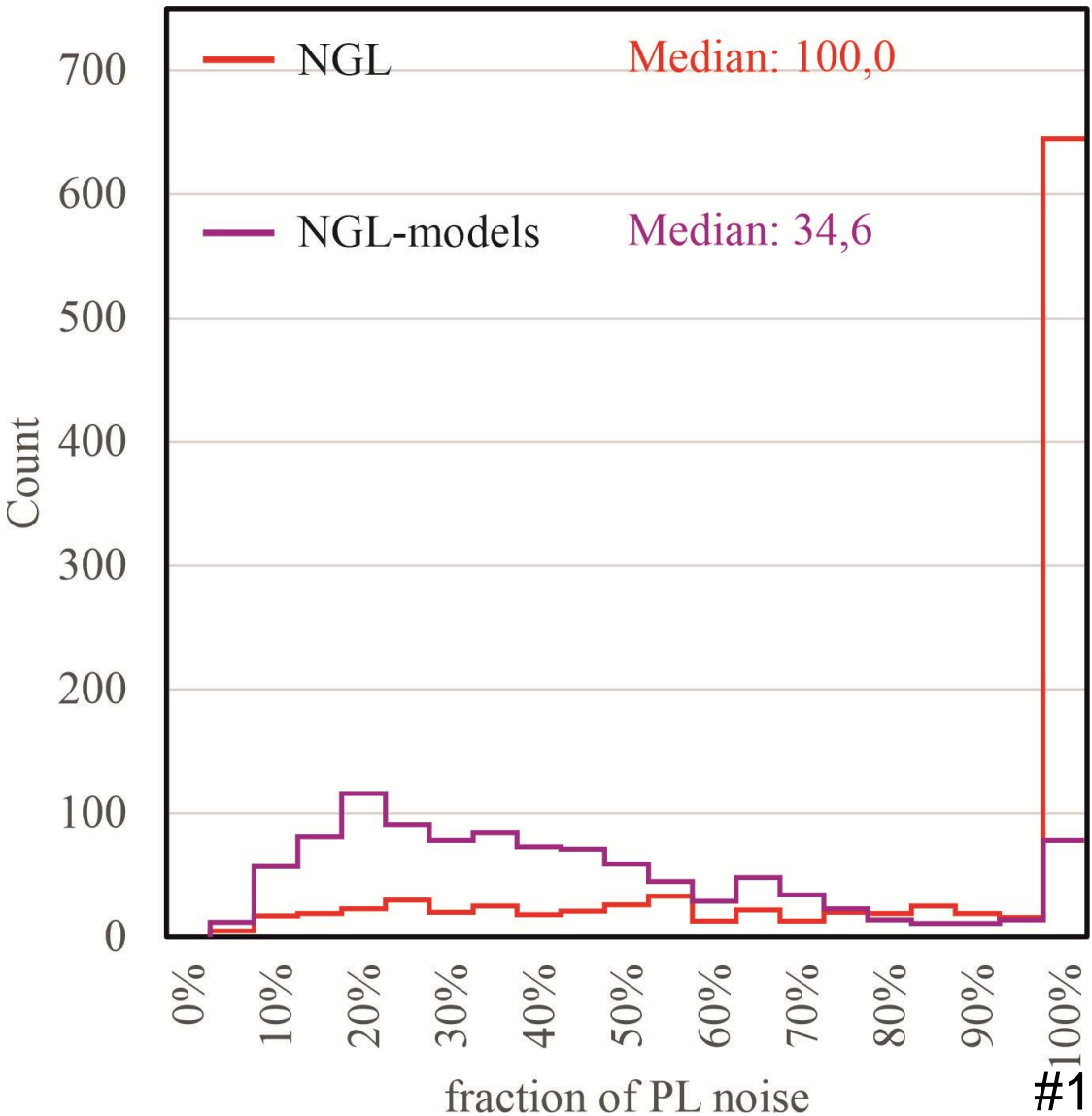
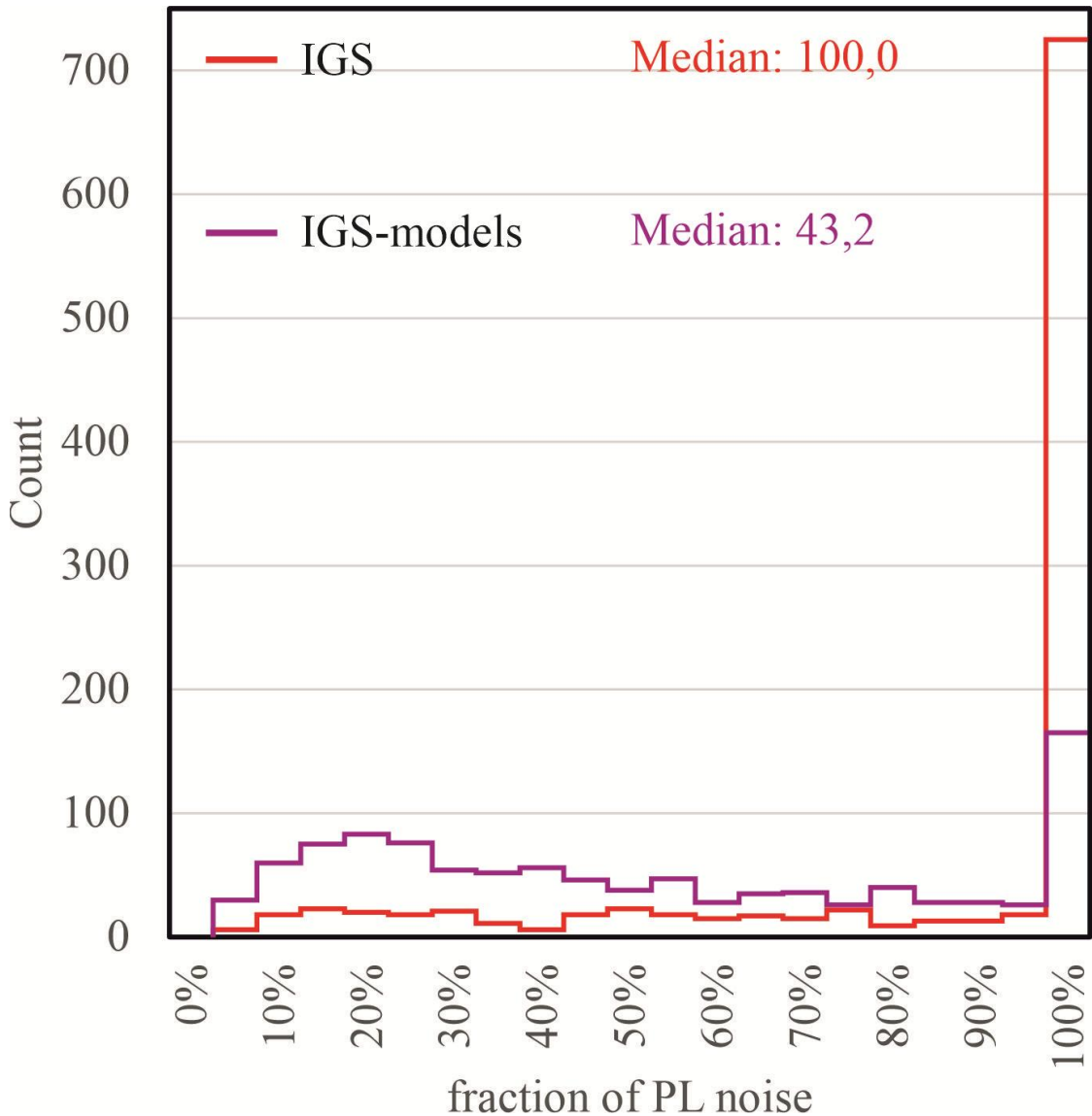
SLEL: barystatic sea-level change

1. NTAL,
2. NTOL,
3. HYDL+SLEL,
4. sum of ALL models.

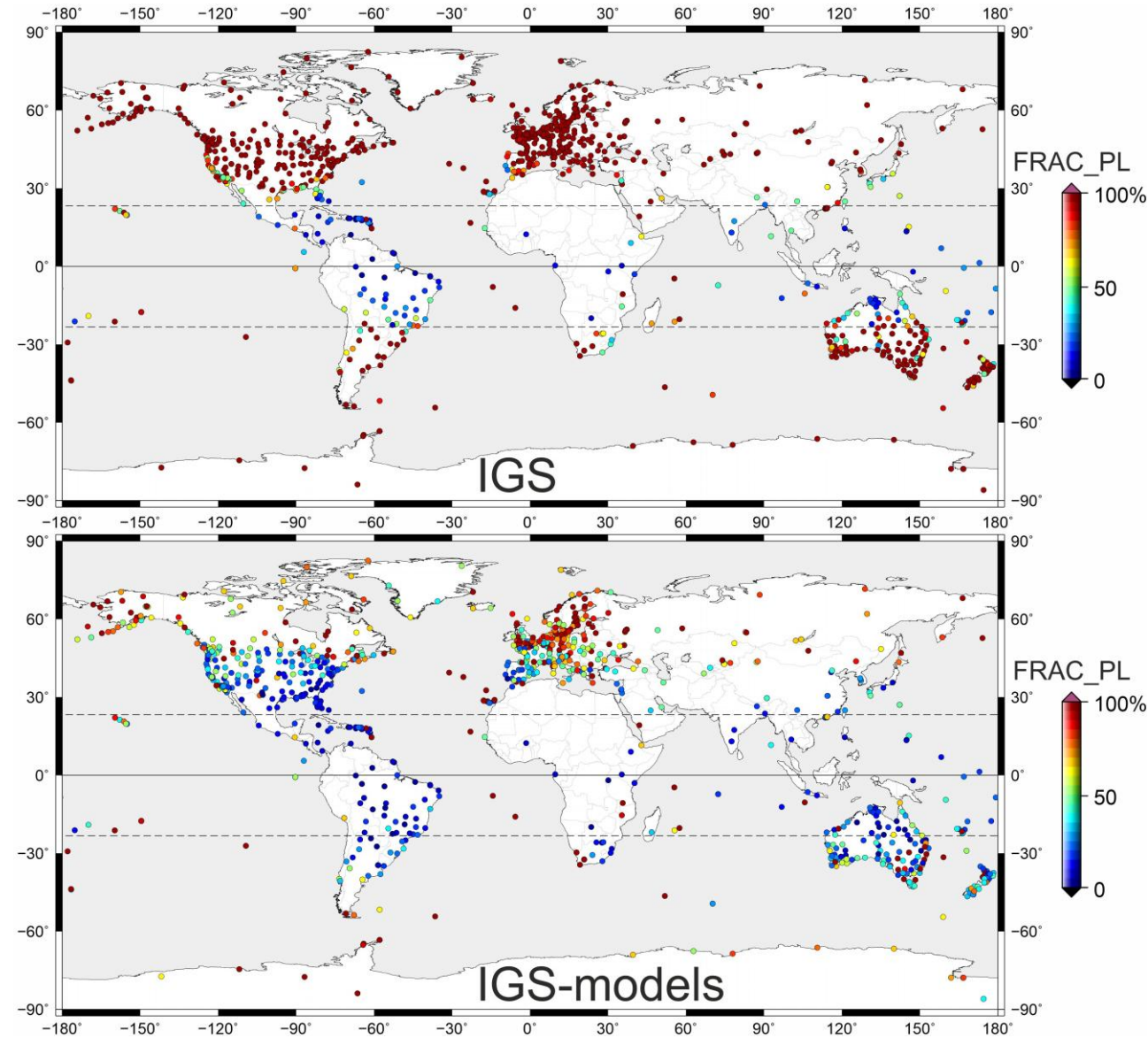
Environmental loadings:



Environmental loadings:



Environmental loadings:



Research questions:

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Plans for future analyses:

1. NGL's PPP expressed in IGS20.
2. Global degree-0 and degree-1 patterns (i.e., global scale variations, translations and rotations).

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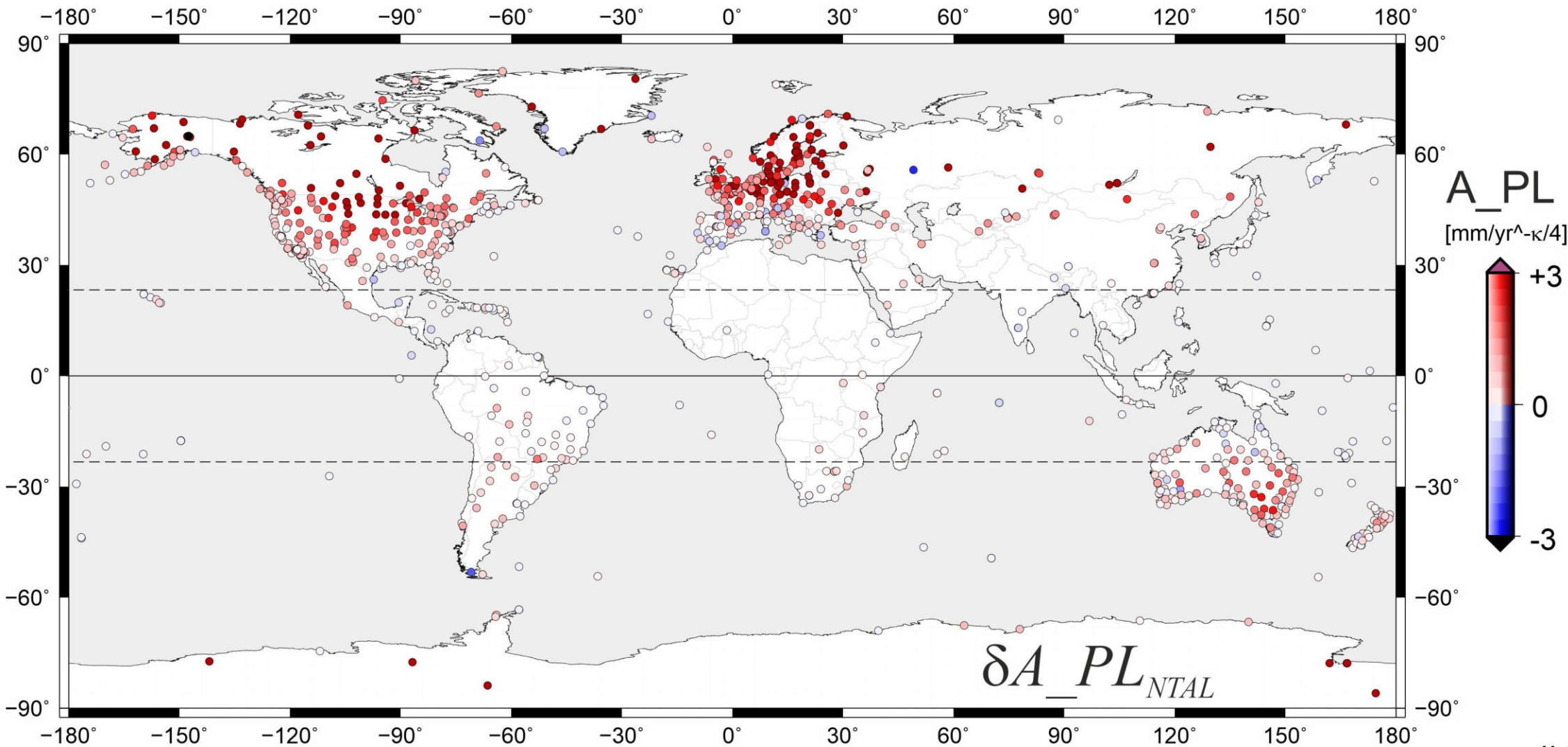
paul.rebischung@ign.fr

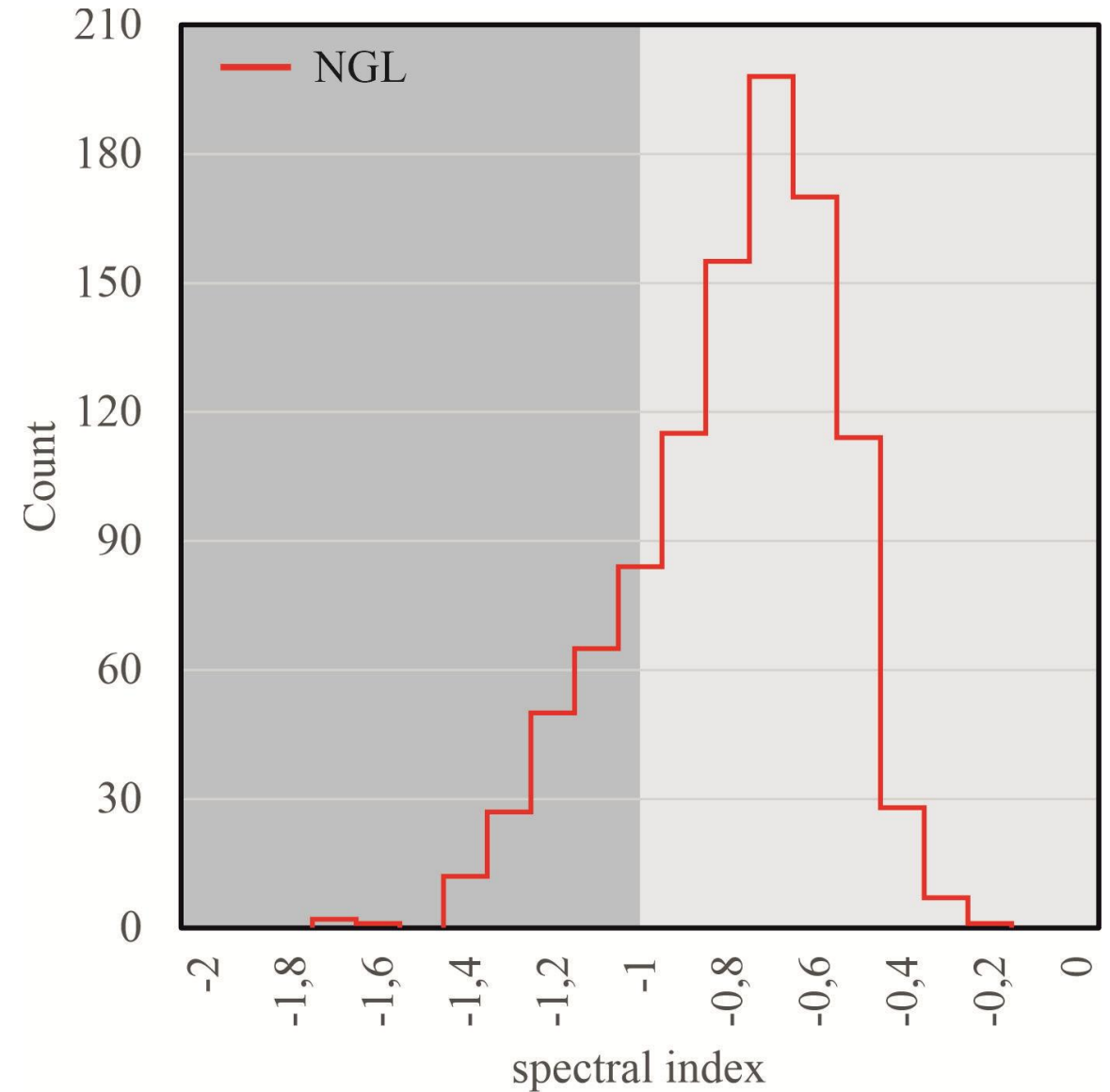
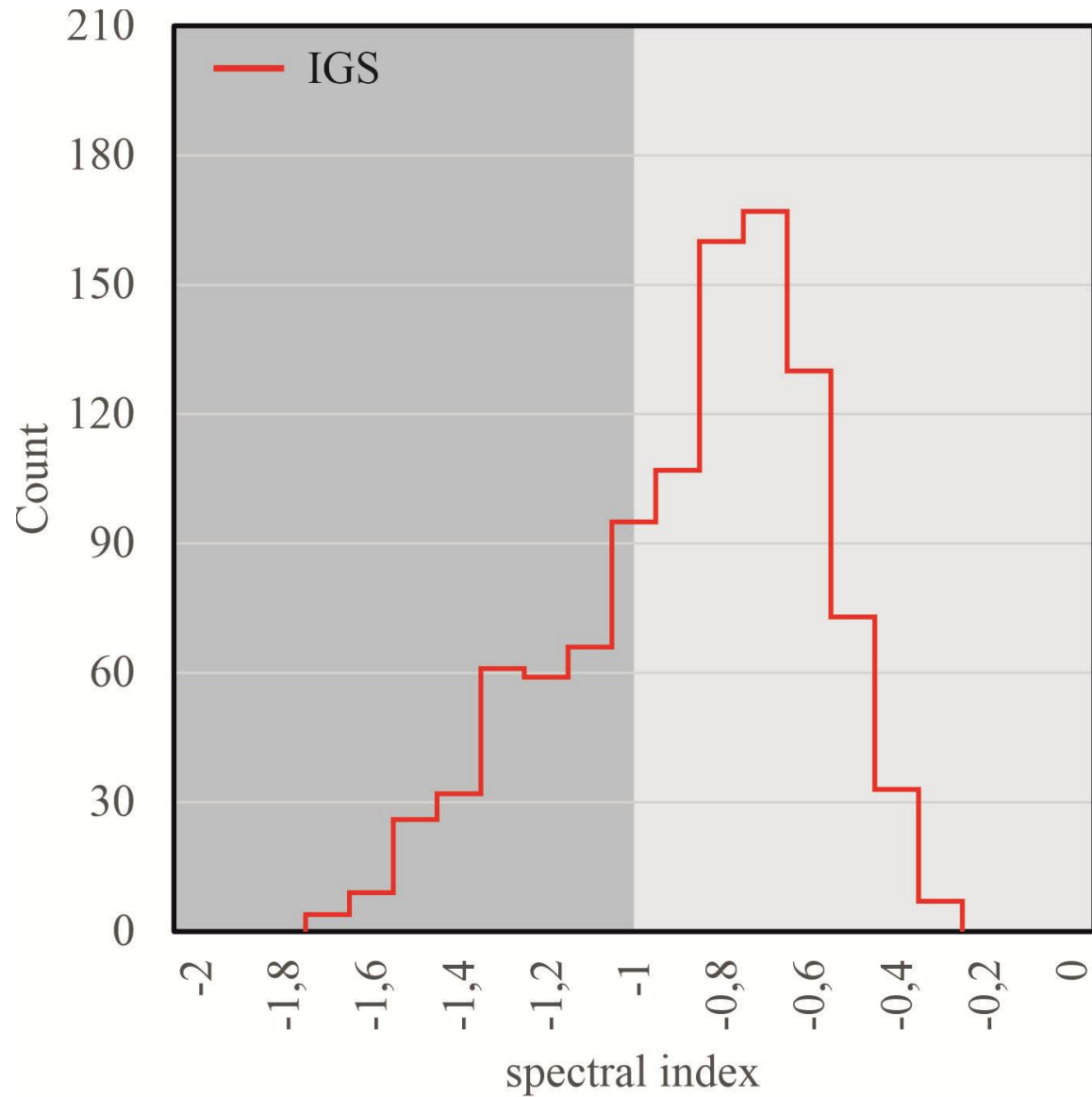
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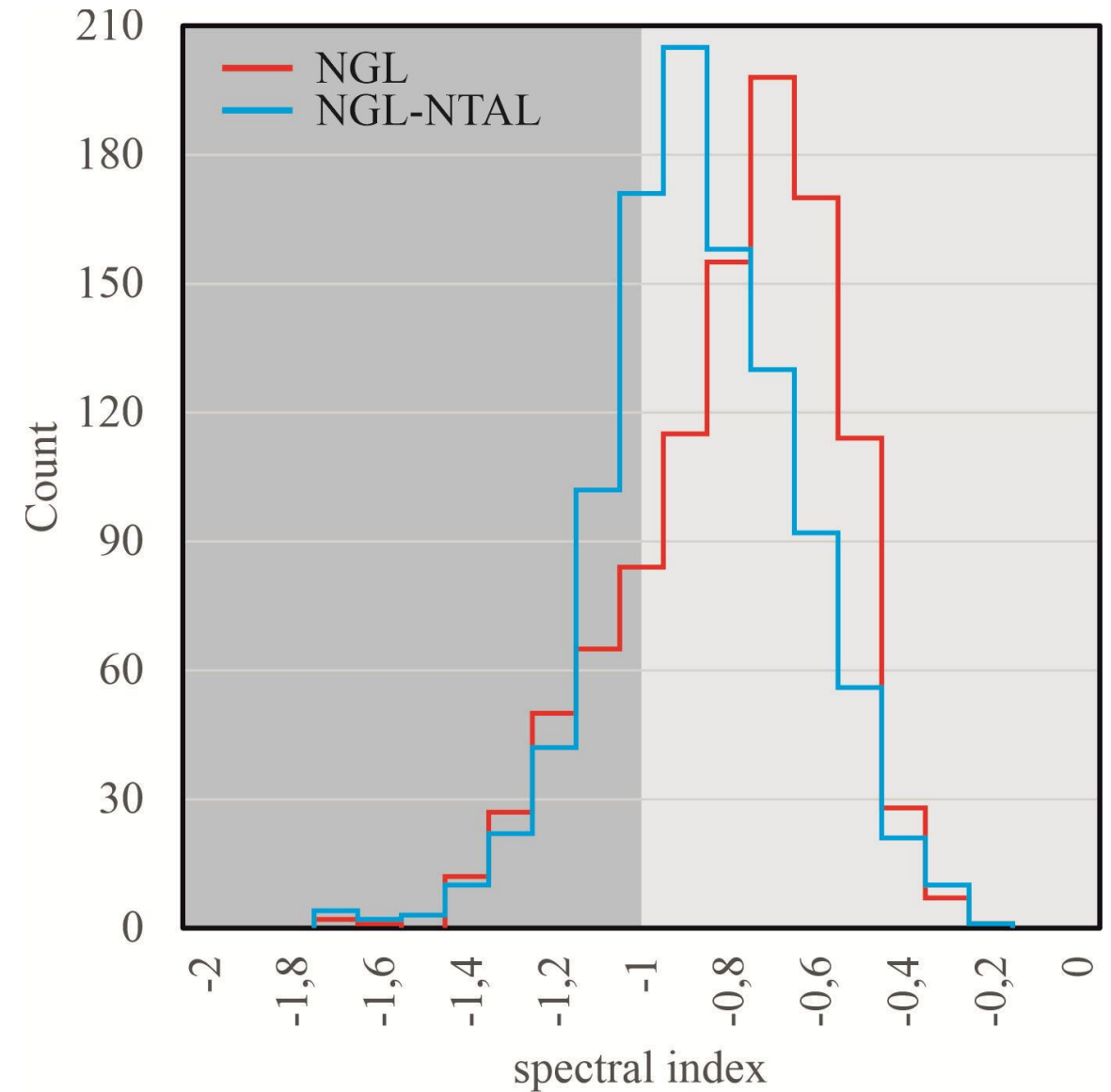
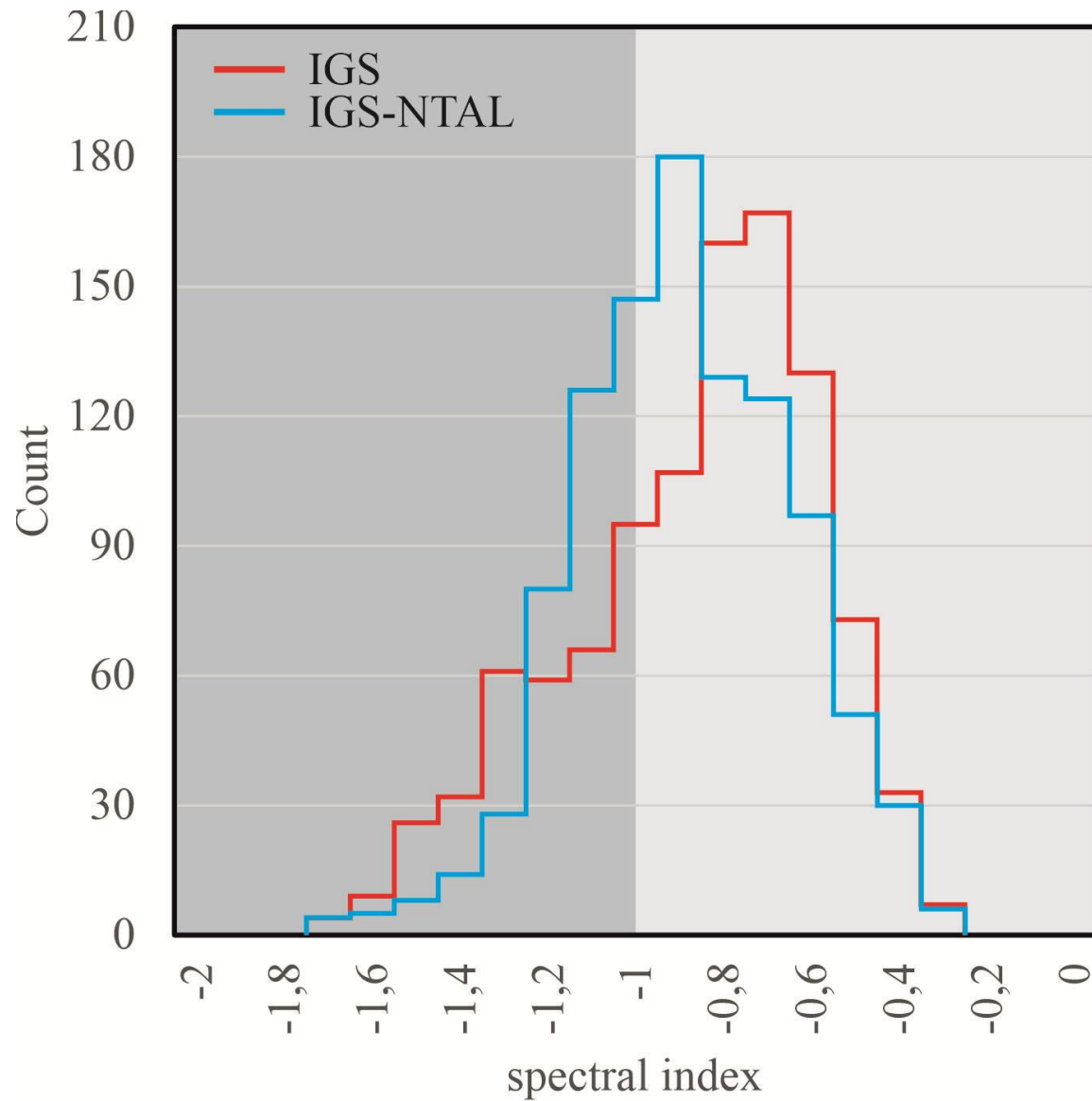
**THANK YOU VERY MUCH
FOR YOUR ATTENTION!**

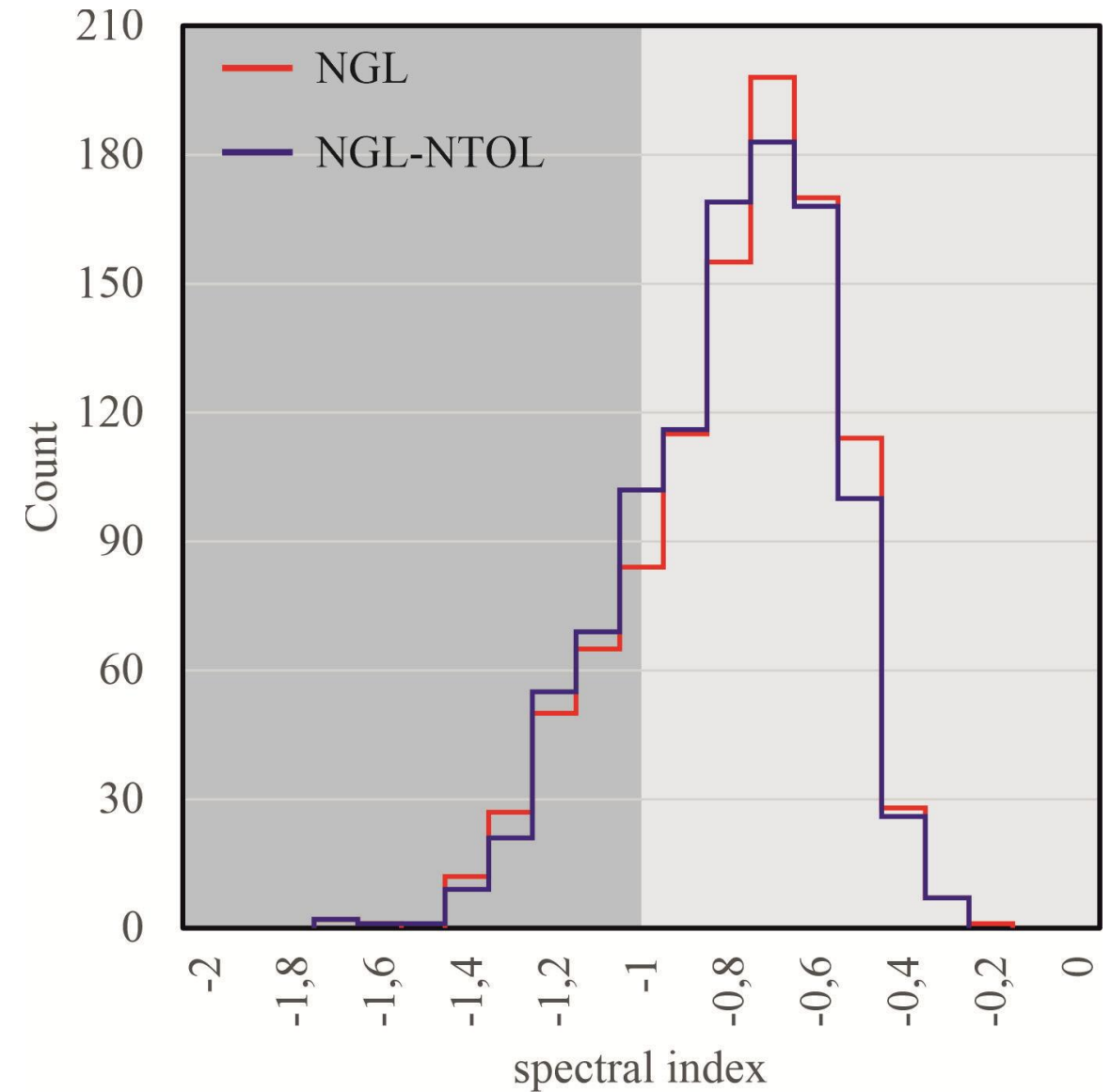
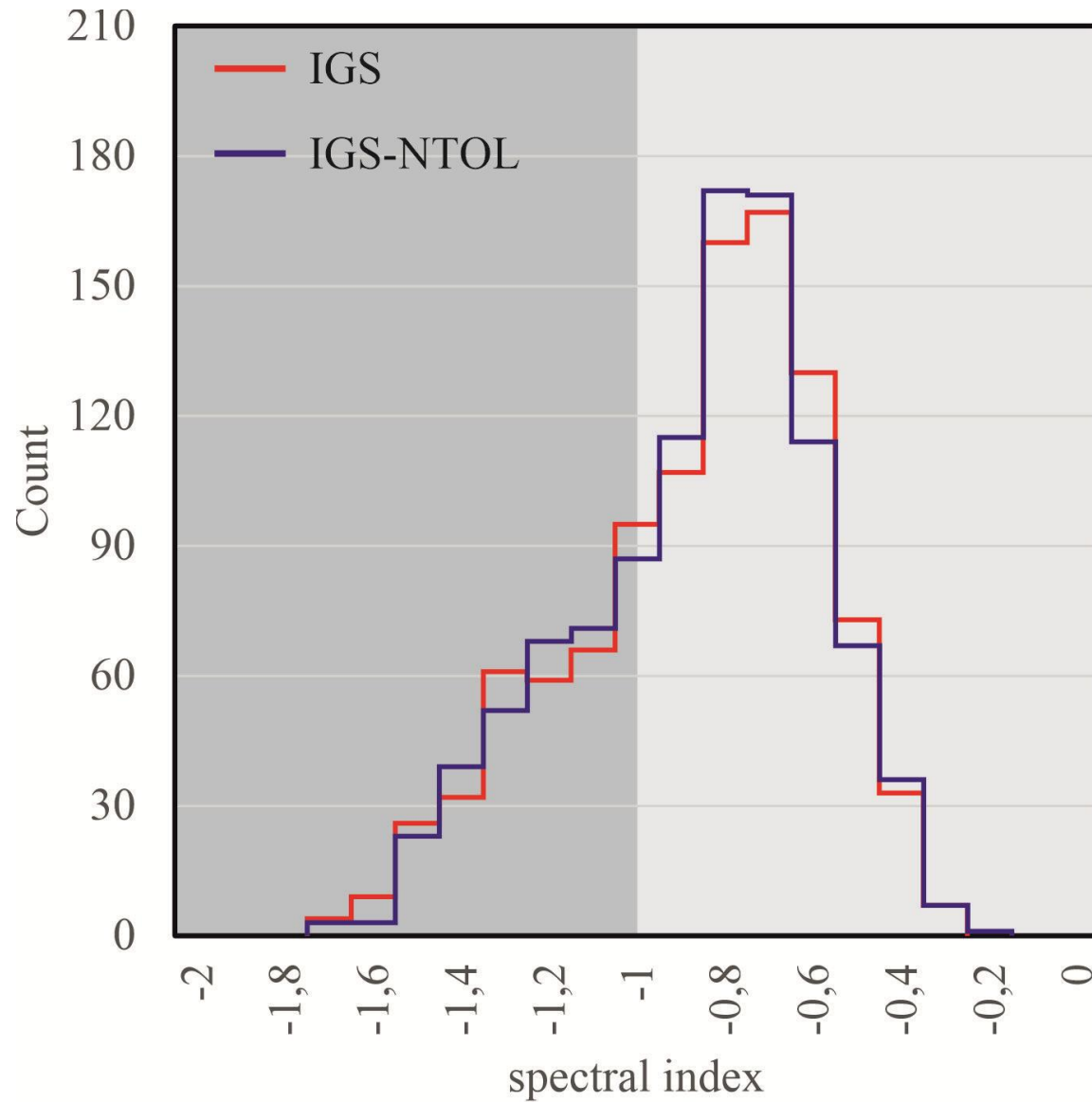
Environmental loadings:

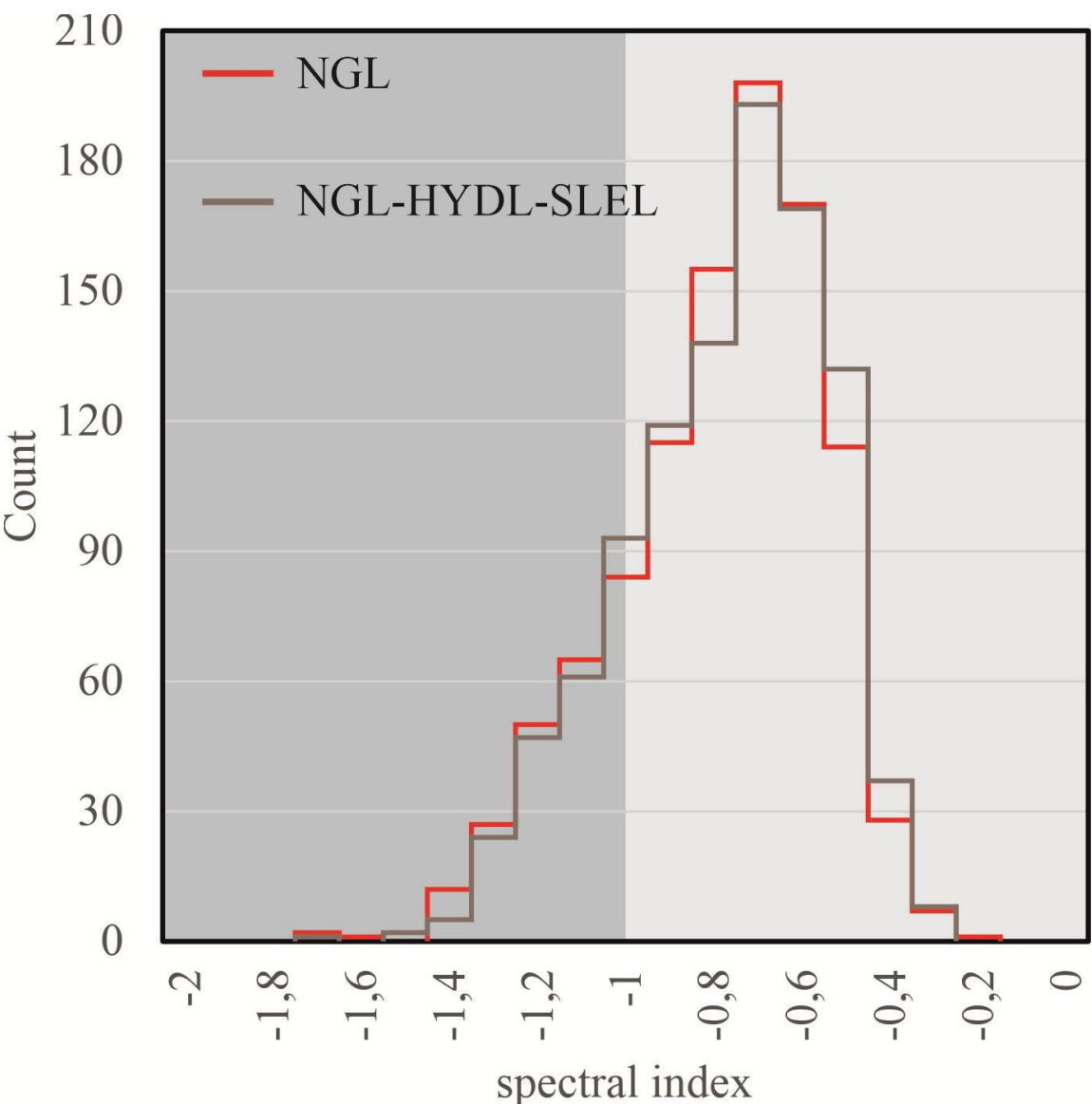
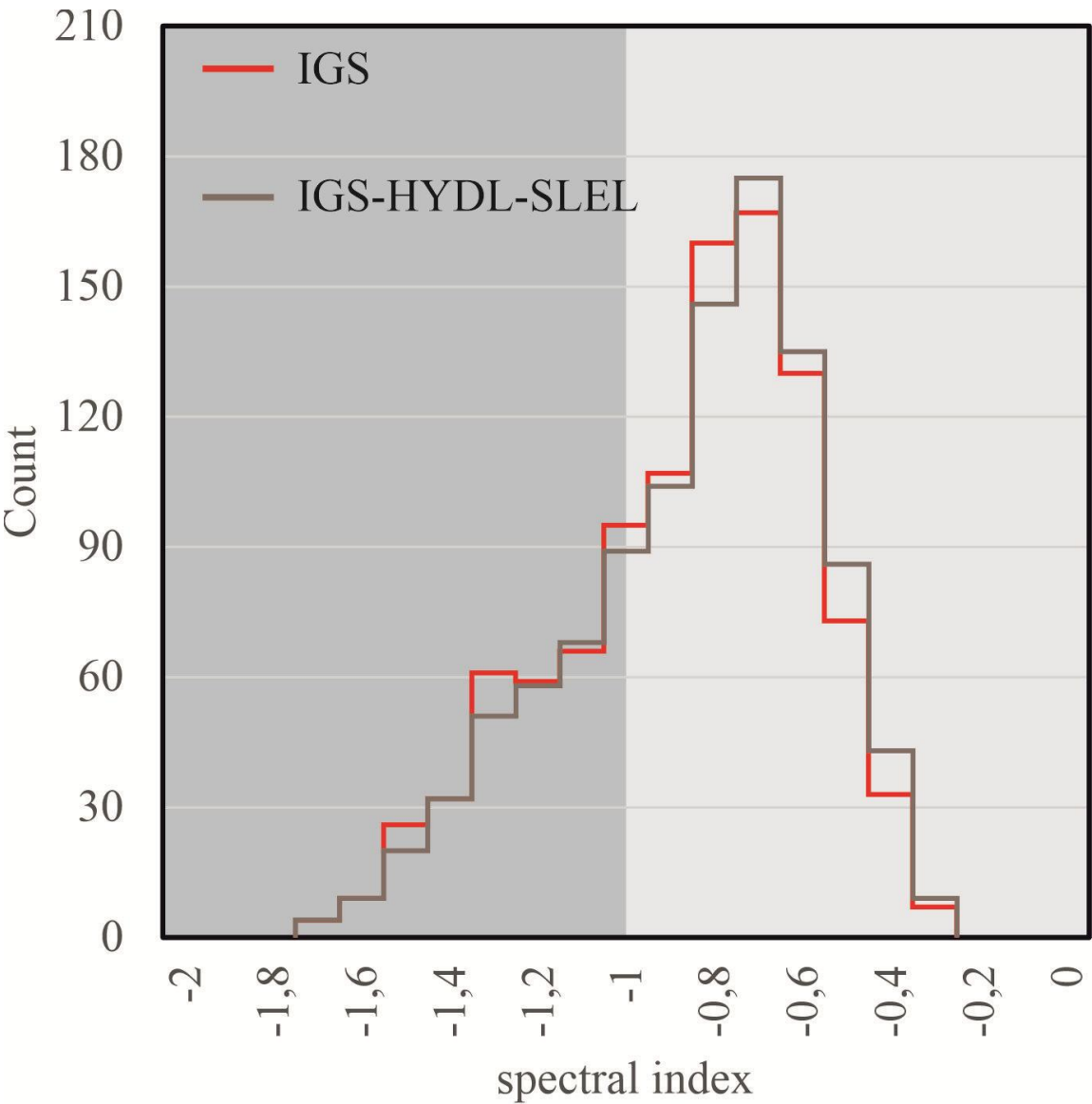
$$\delta A_PL_{NTAL} = (A_PL_{IGS} - A_PL_{NGL}) - (A_PL_{IGS-NTAL} - A_PL_{NGL-NTAL})$$

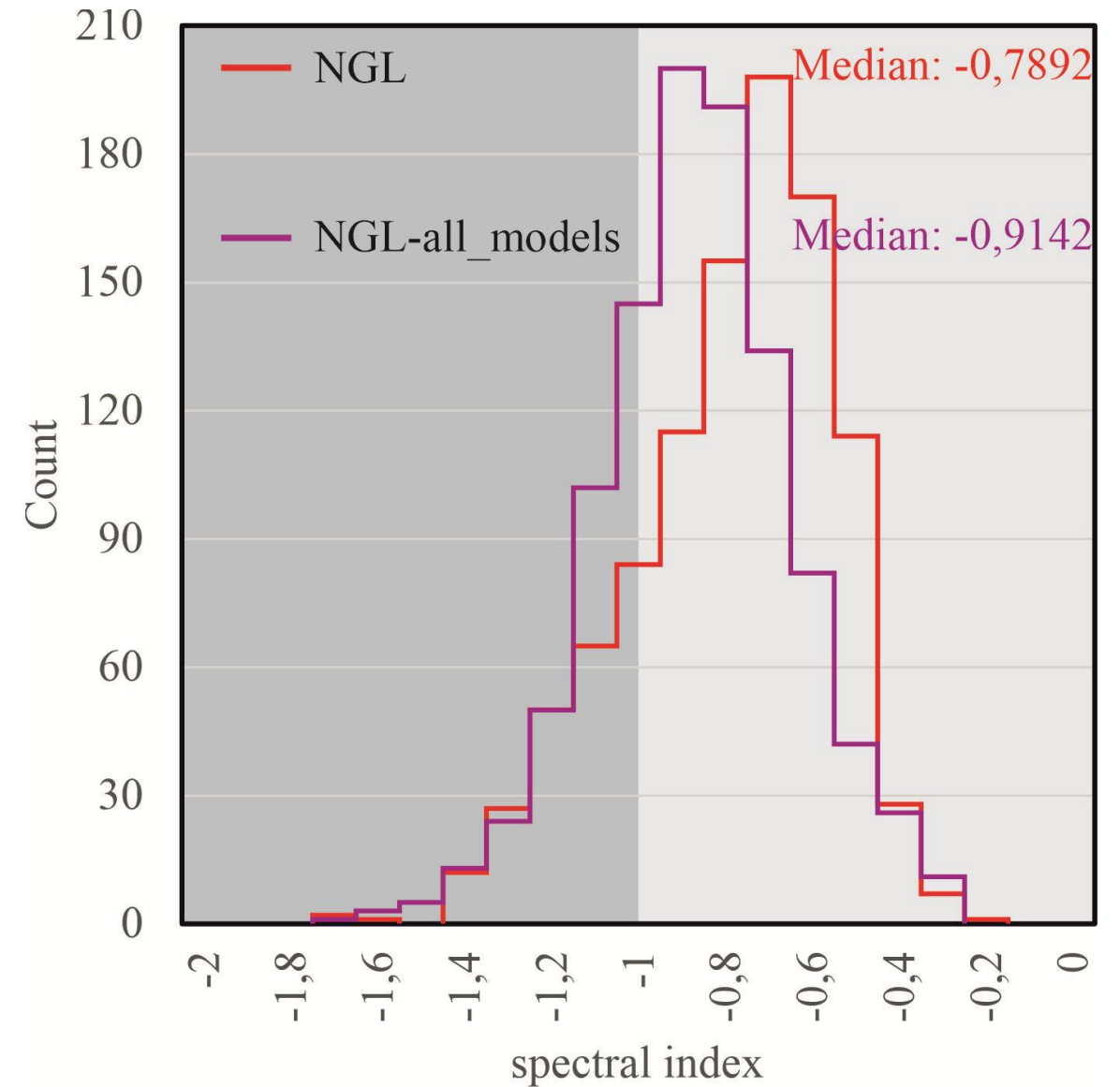
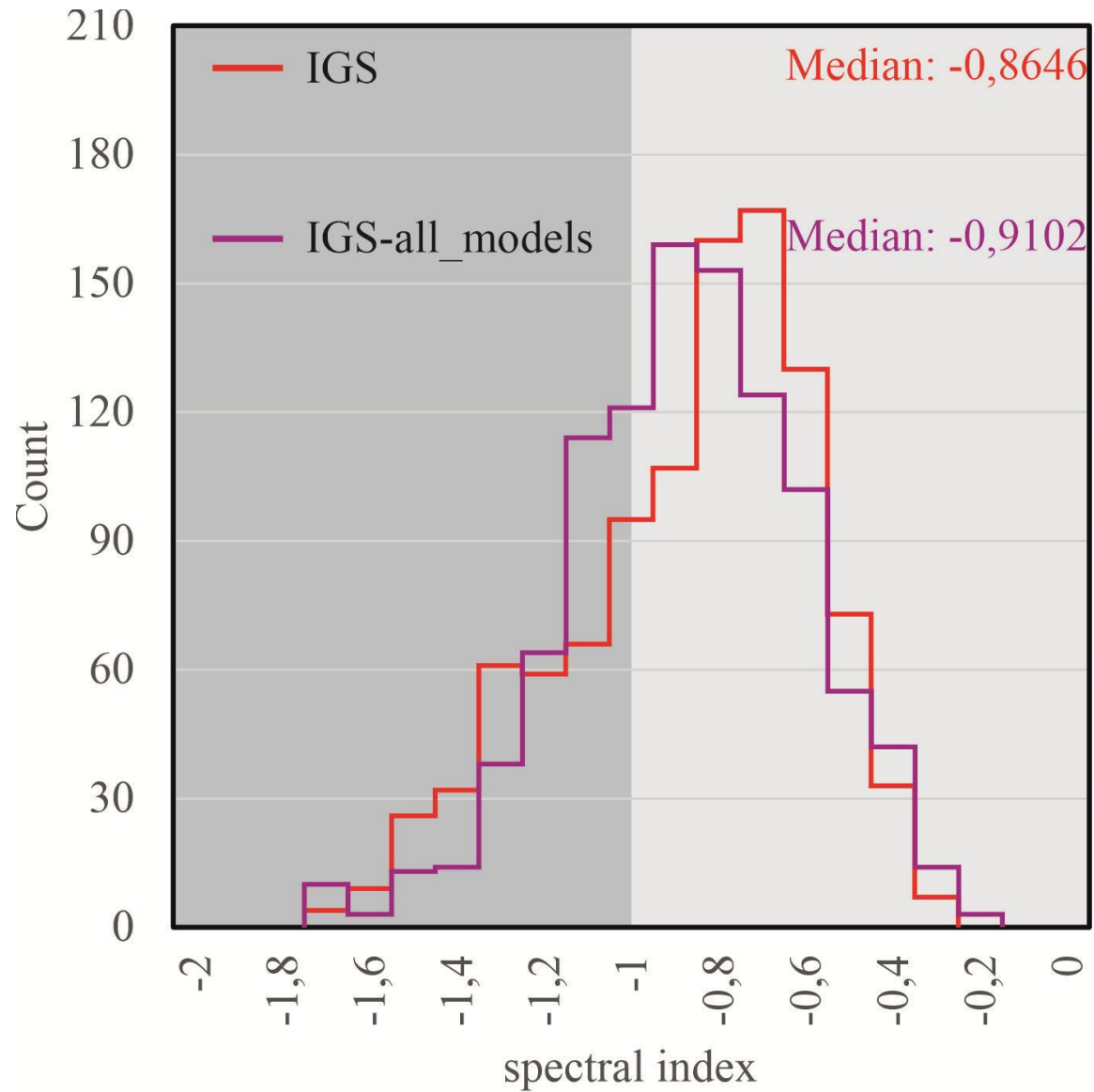


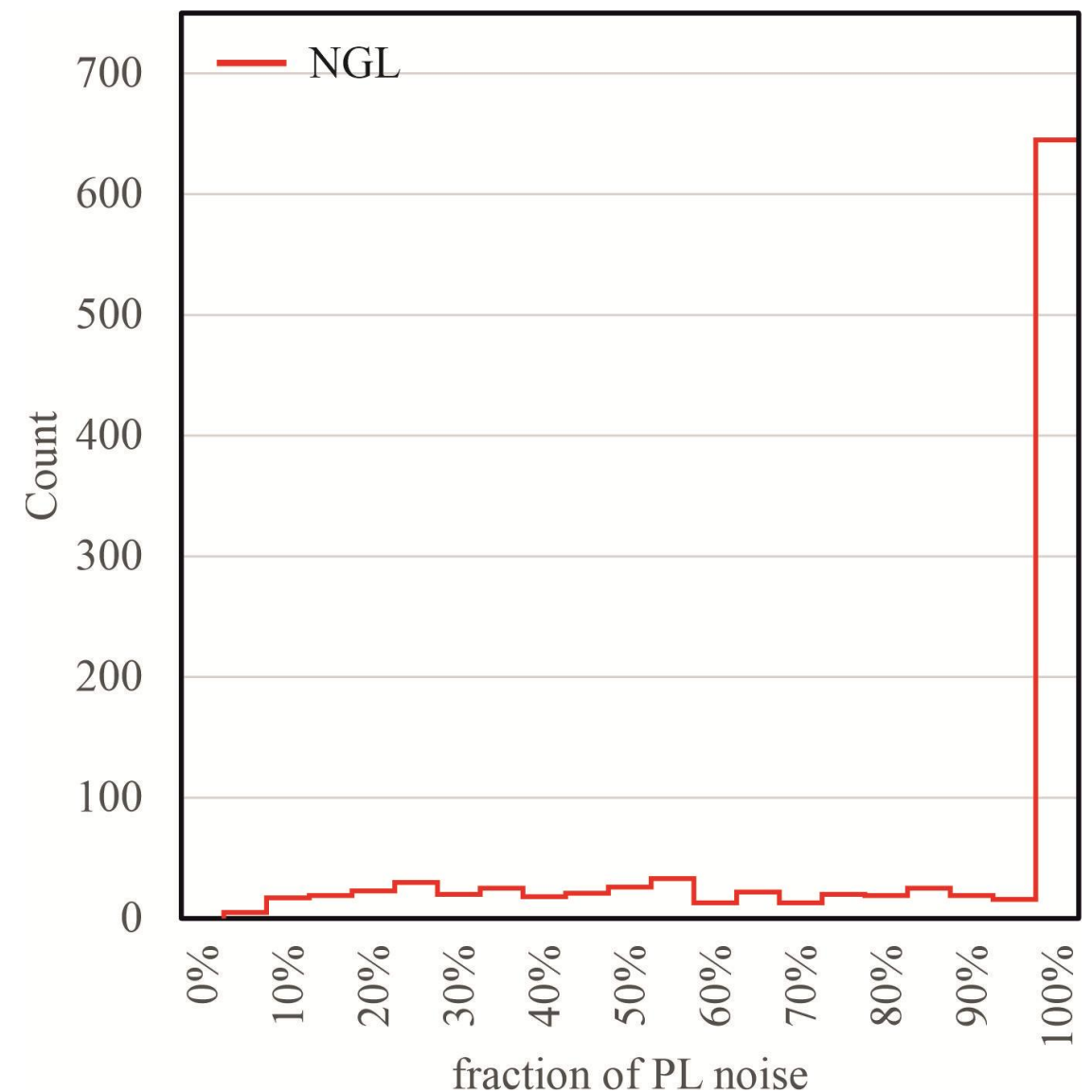
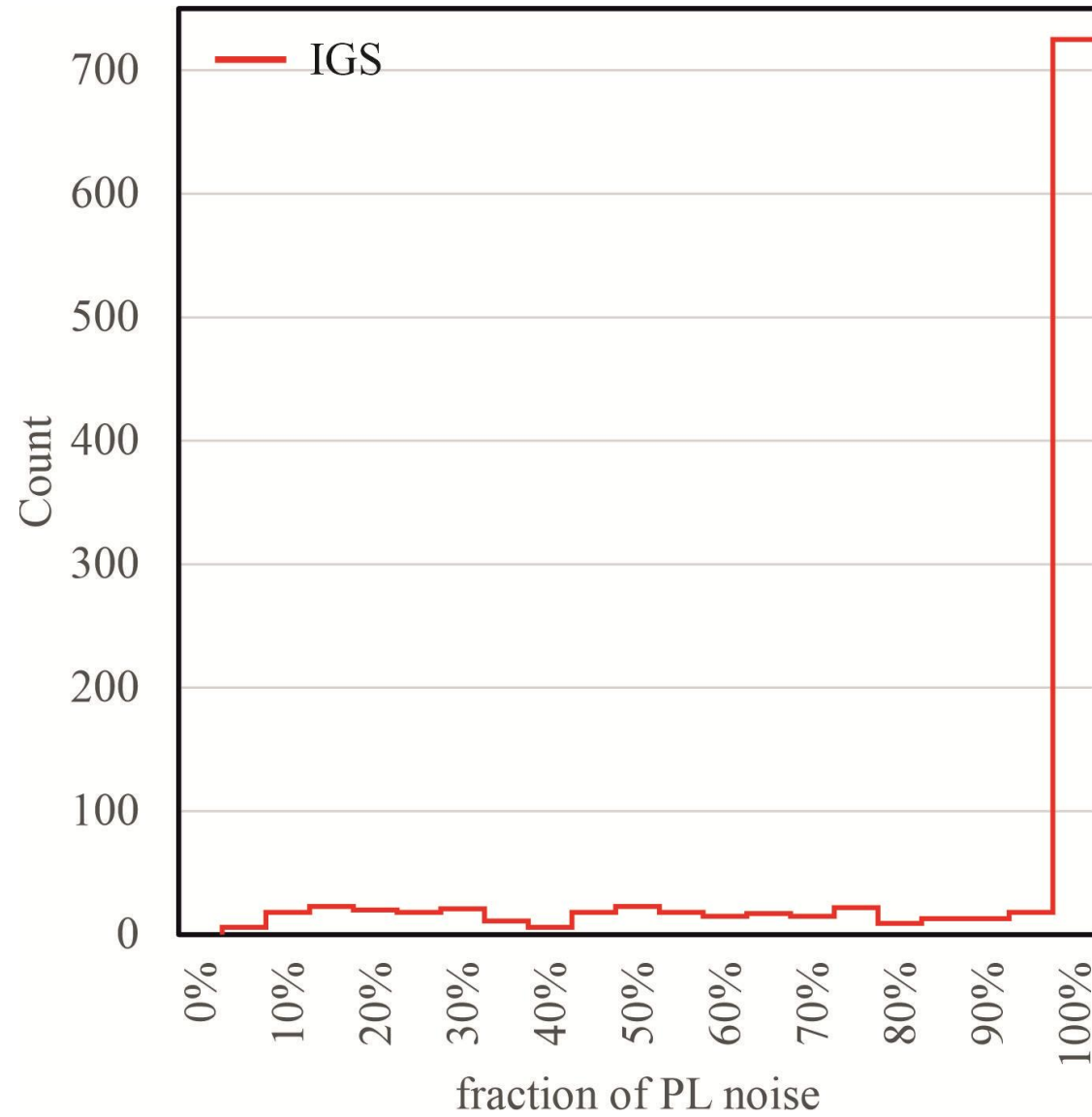


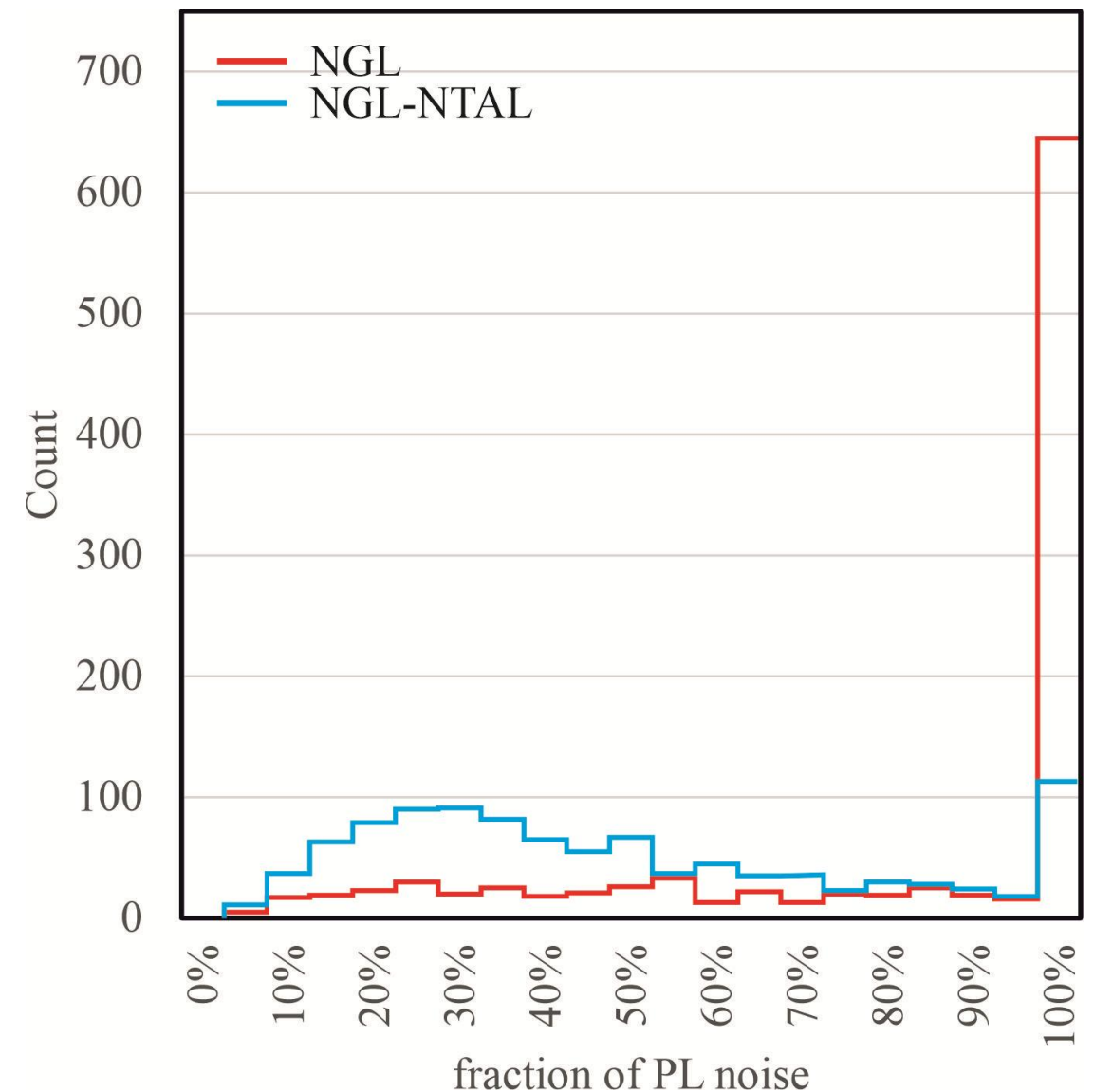
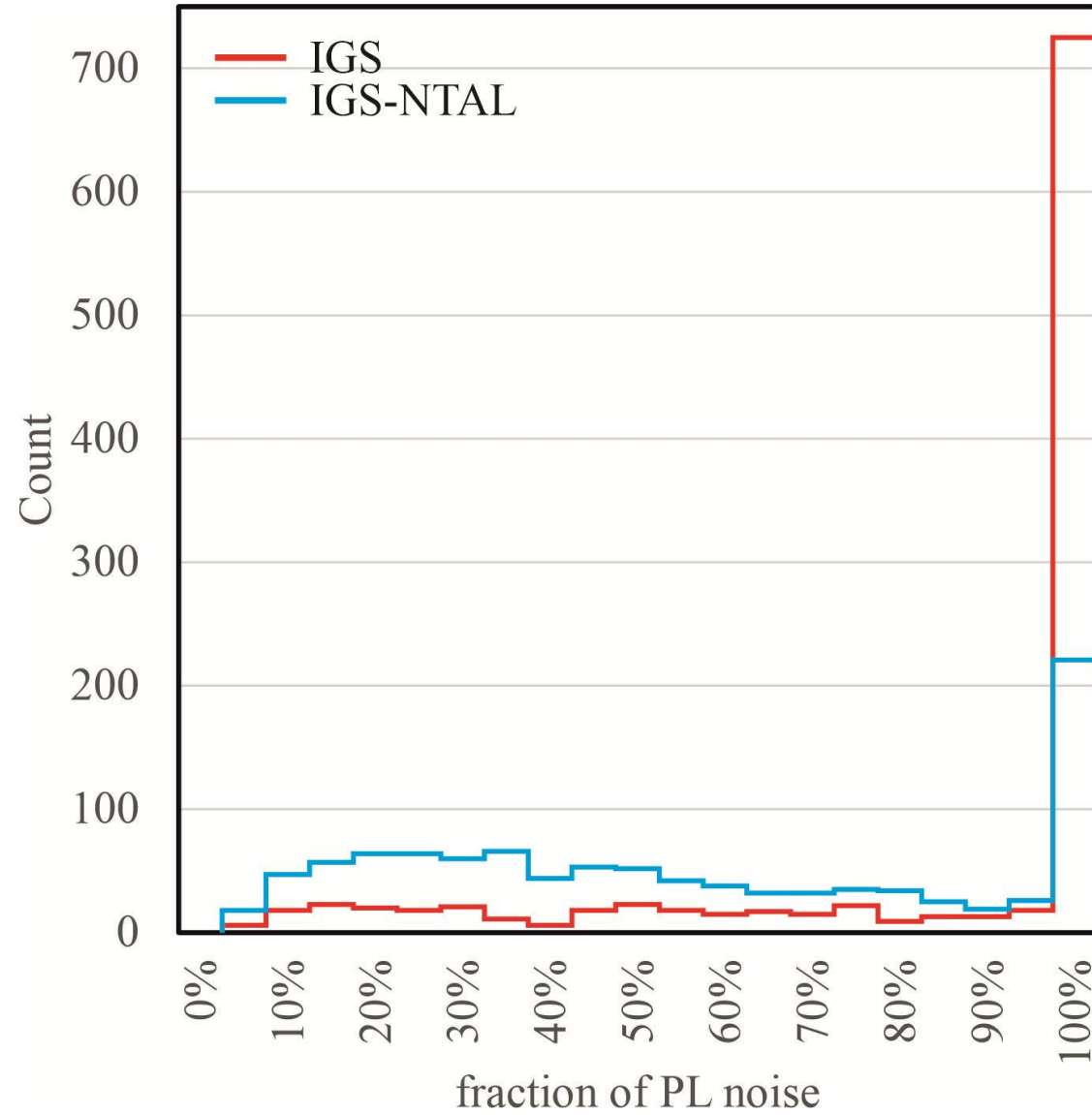


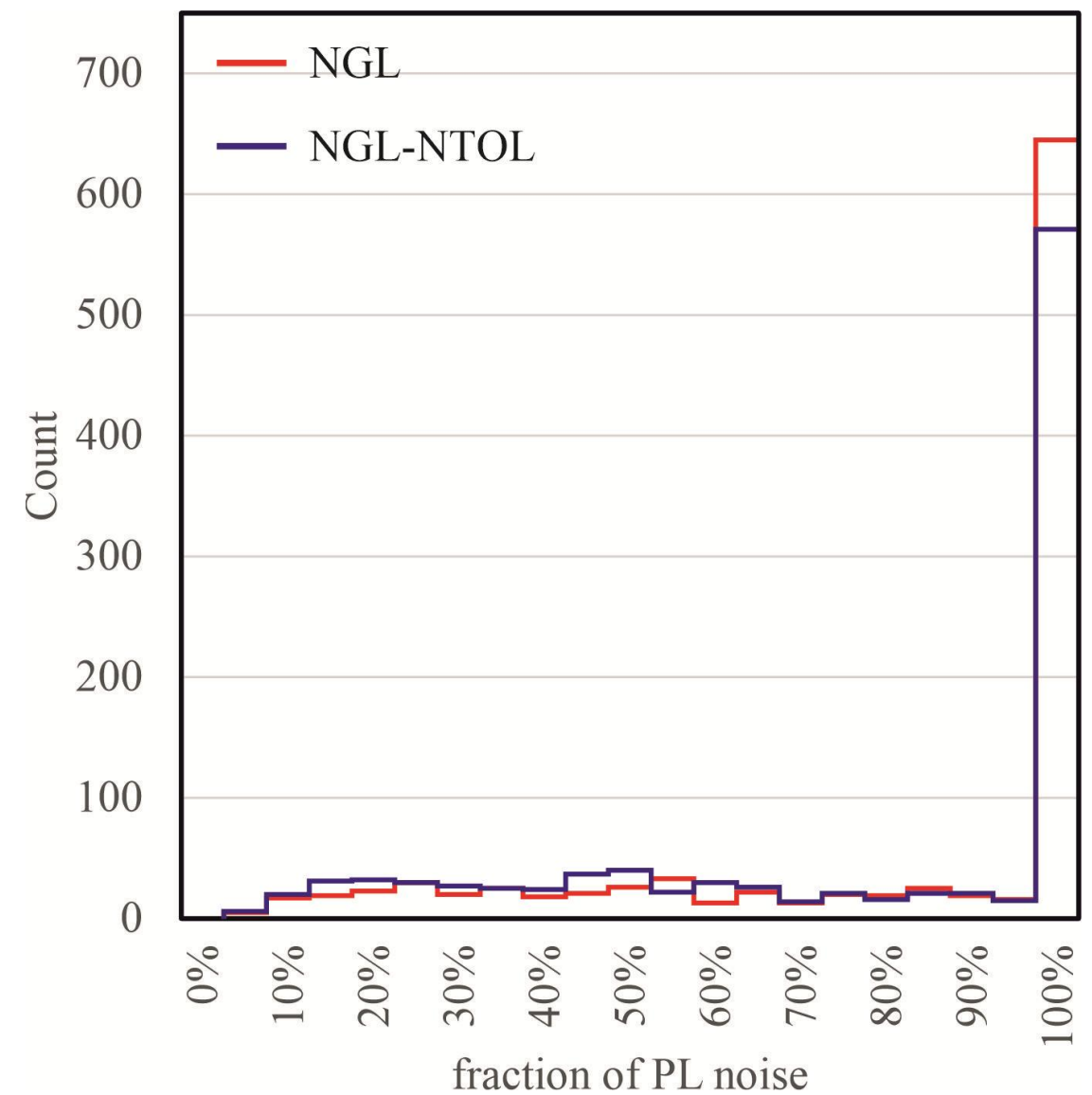
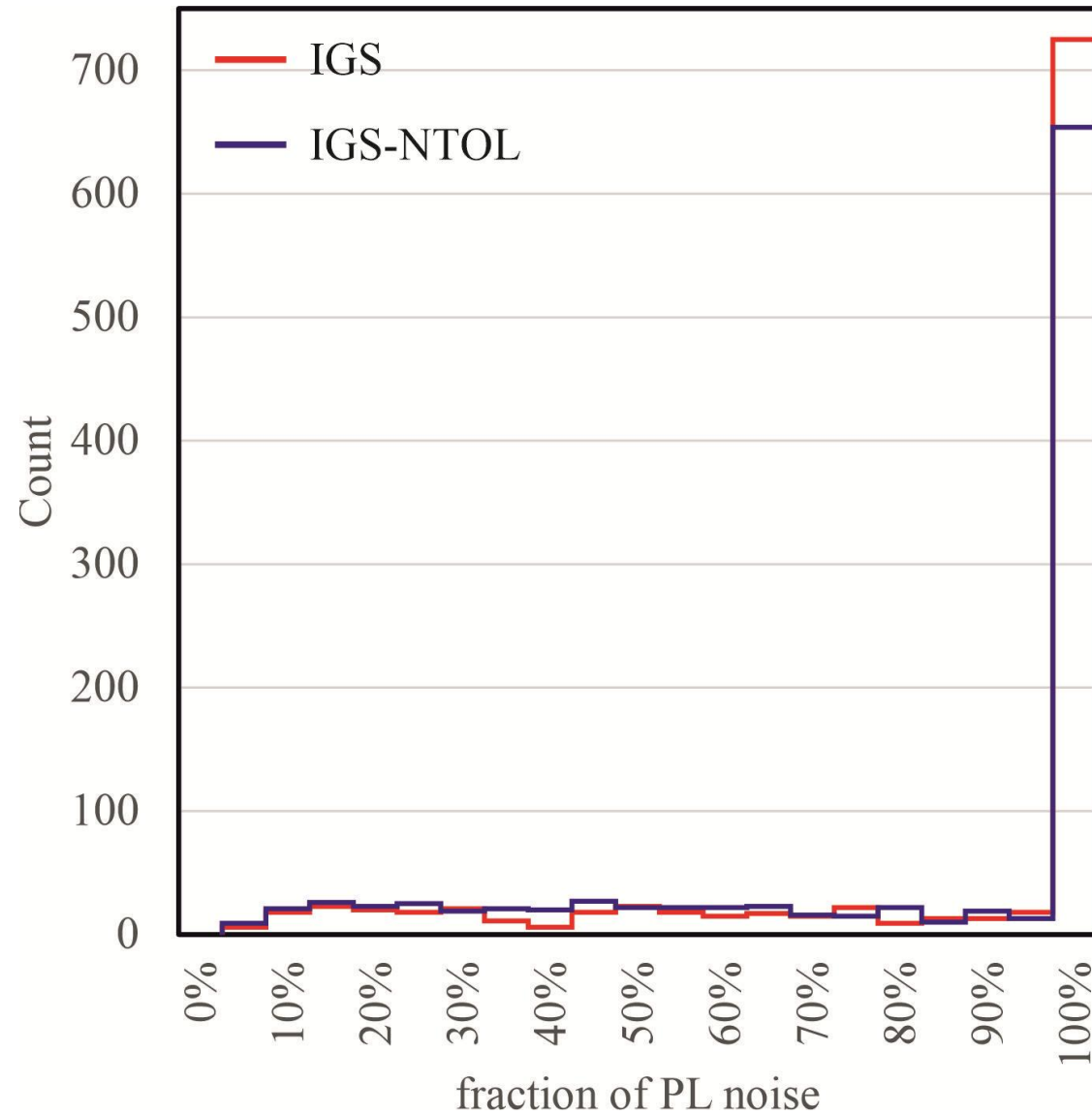


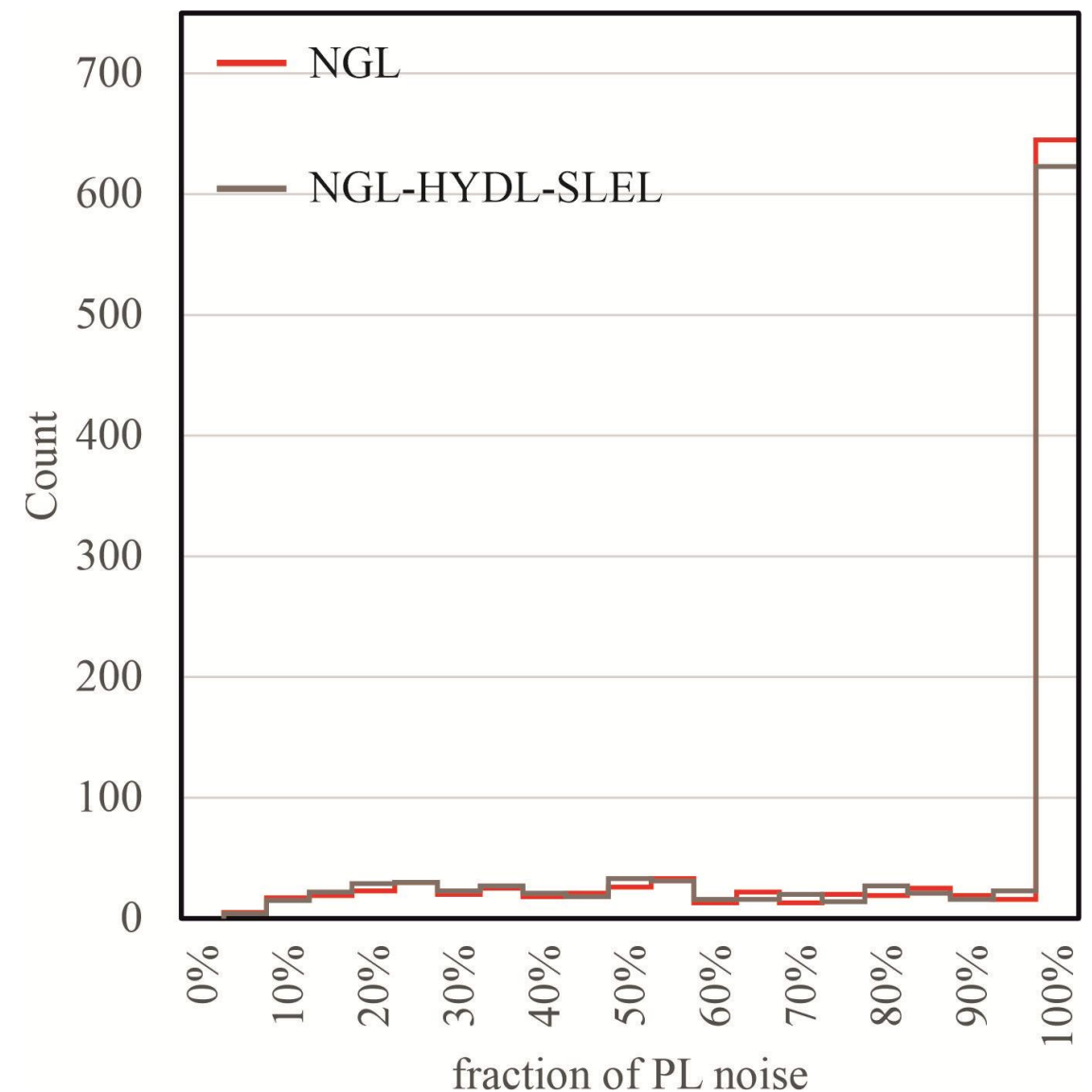
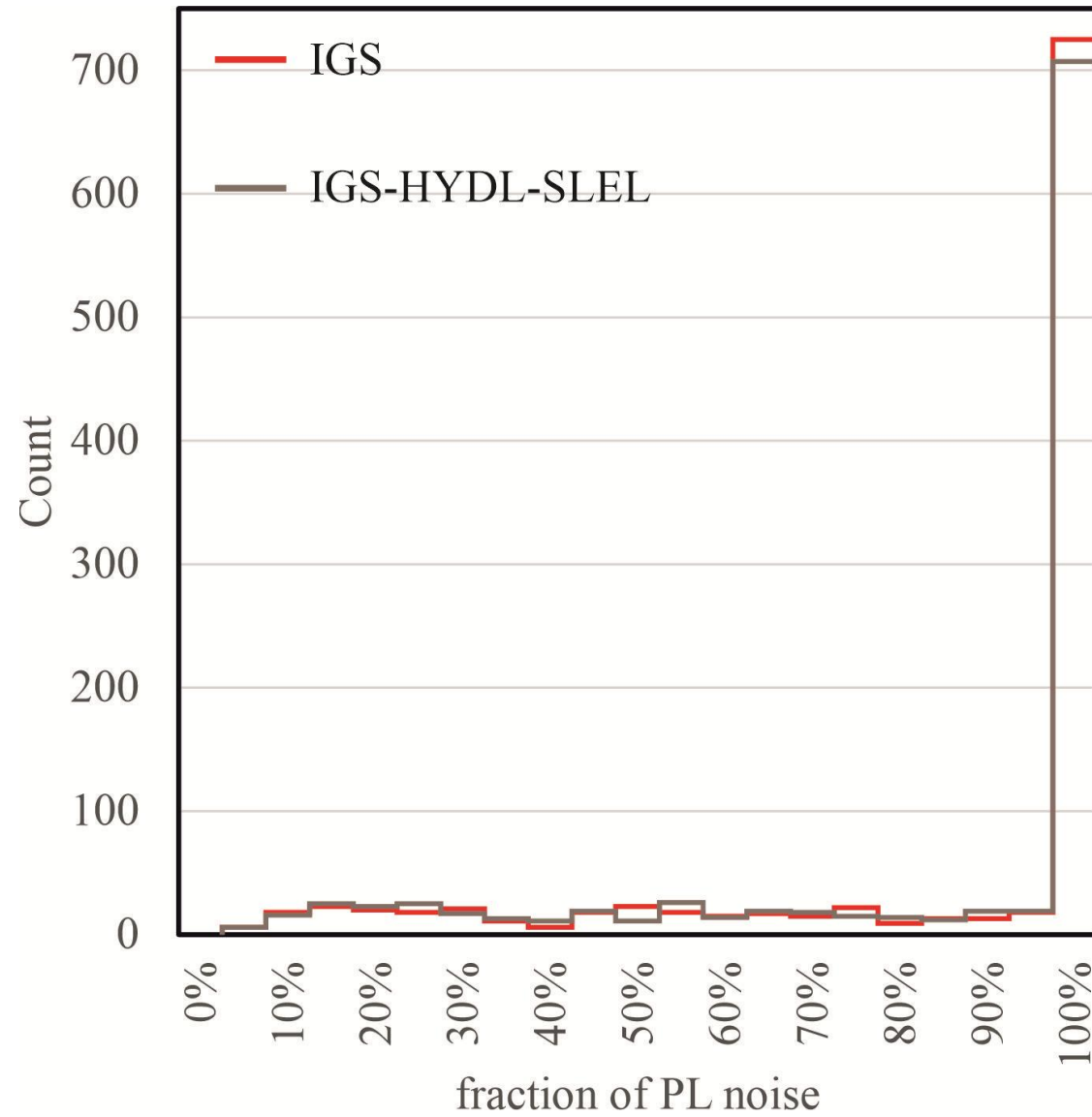




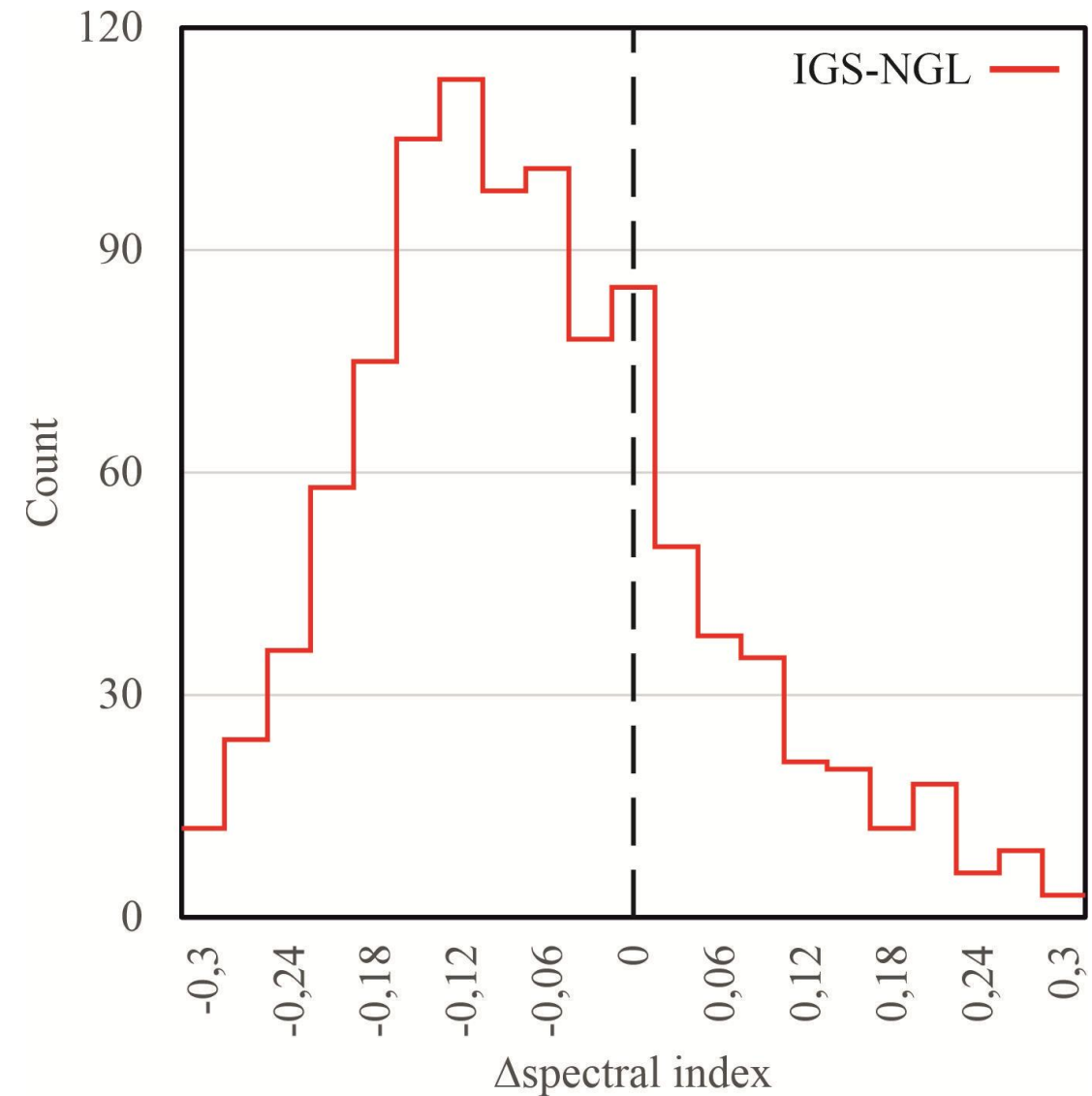
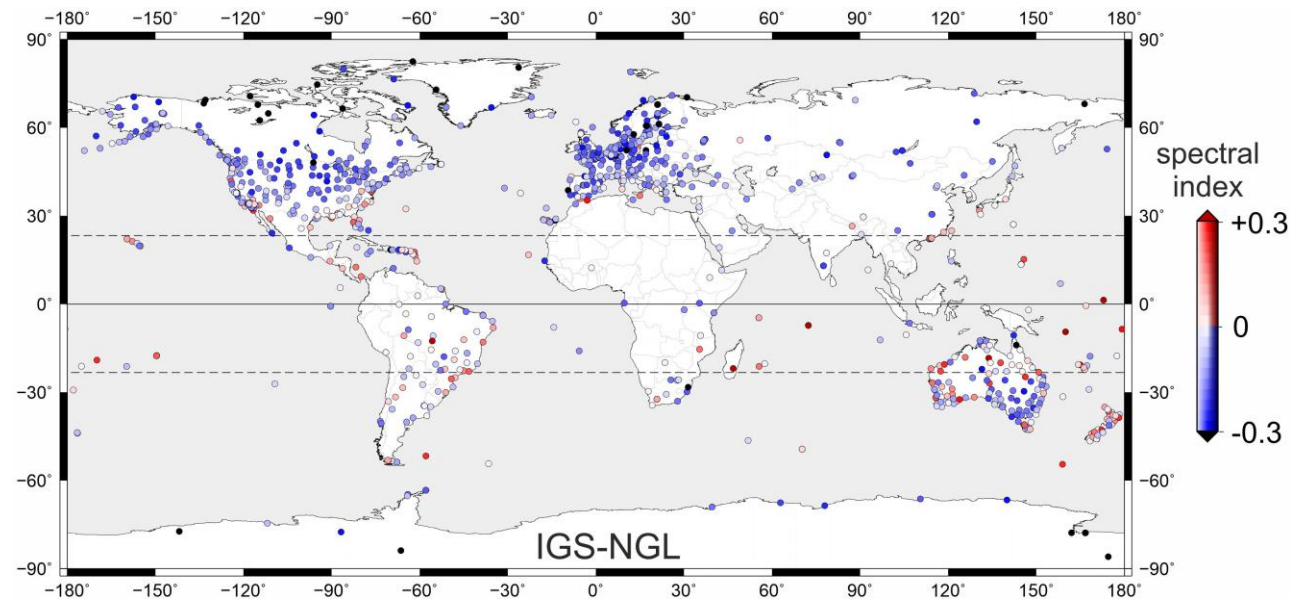




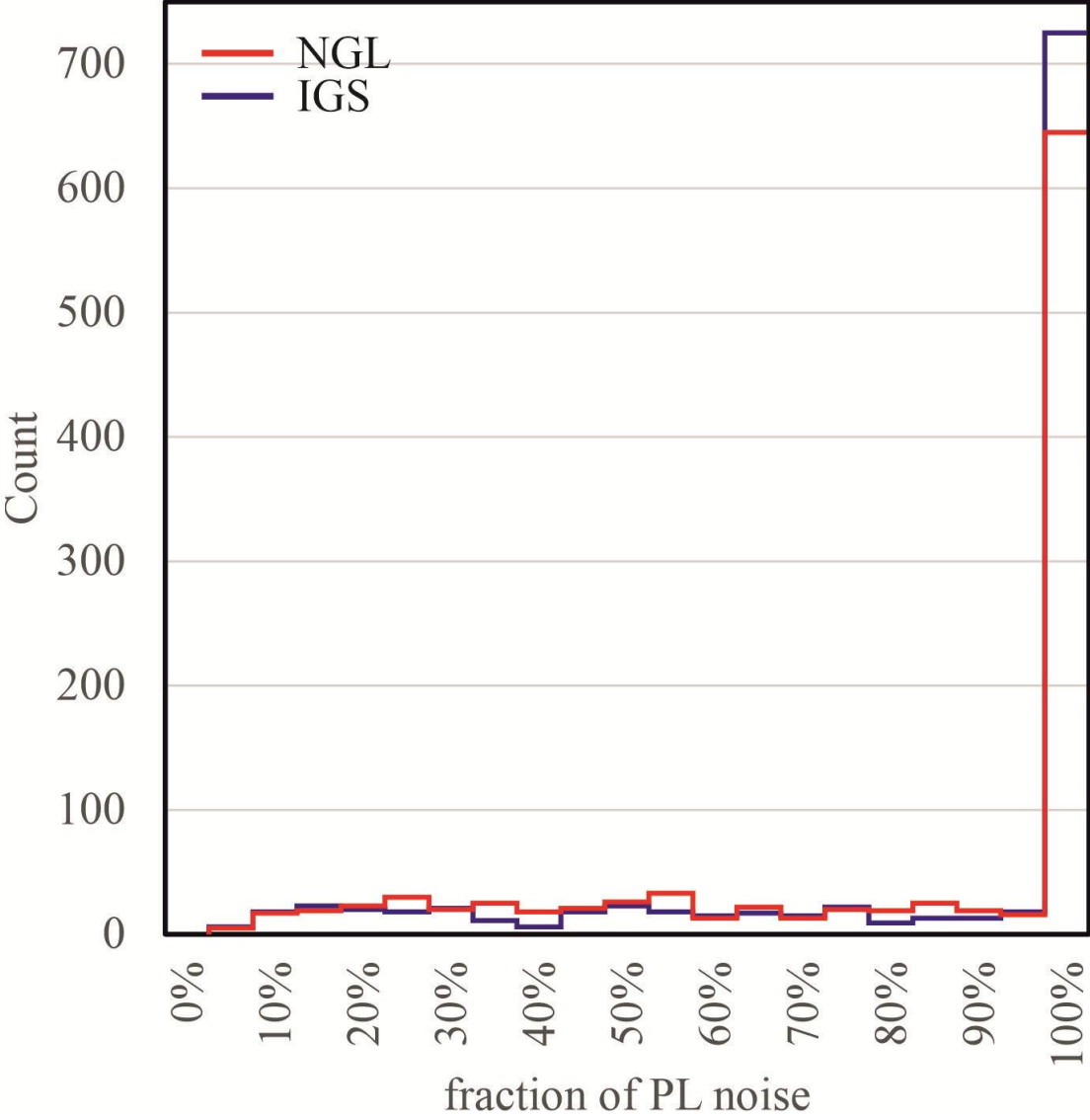
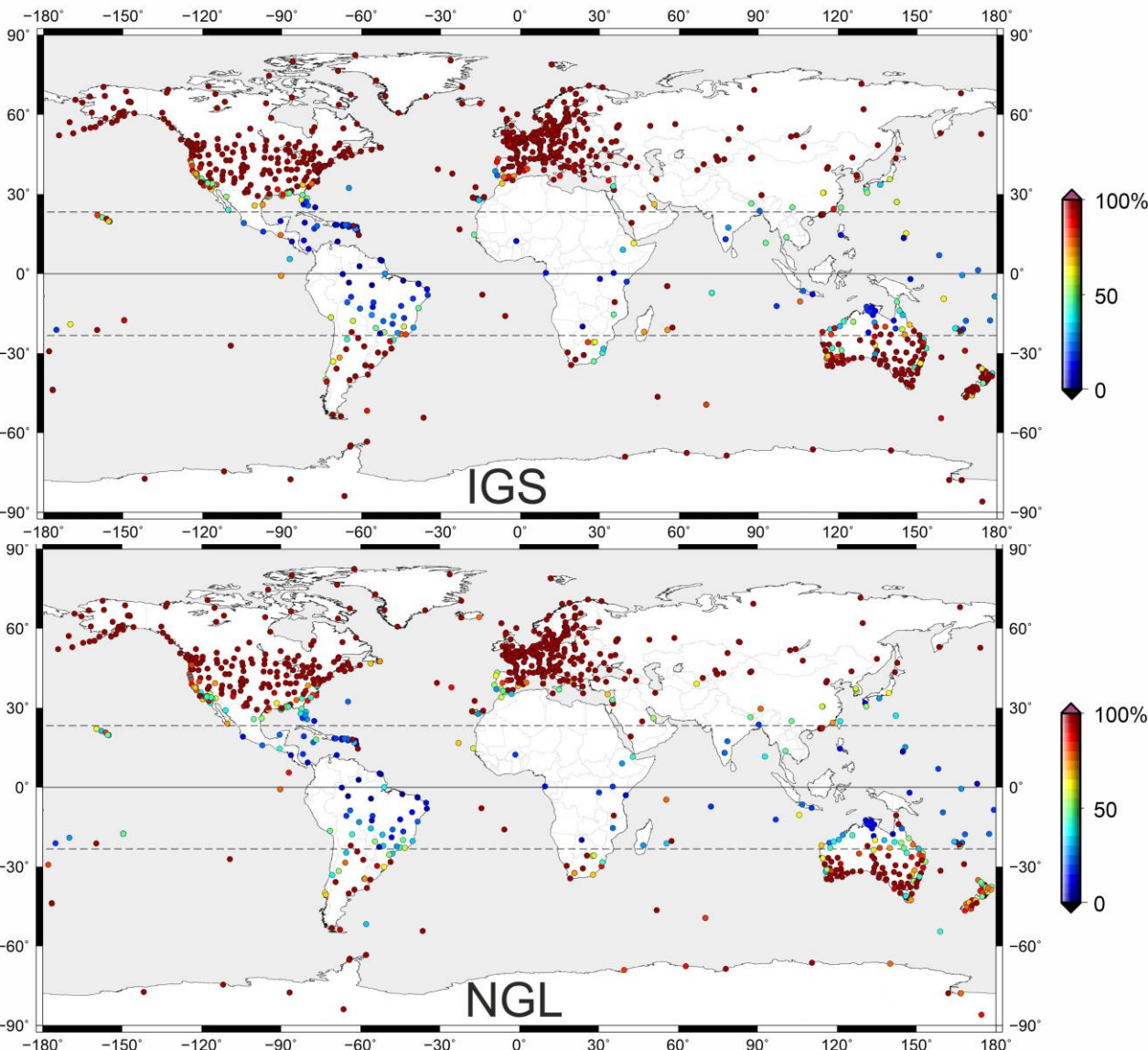




Spectral indices:



Fraction of power-law noise:



Environmental loadings:

