Spherical Function Representations: a Practical Survey
Supplemental 2/2: Images and Results

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Abstract

This supplemental document contains a preview of the LDR and the HDR data set as well as some chosen examples for all models. The examples show artifacts of the different representations for one example of each data set and are manly for cross-model comparison.

1. Low-Dynamic-Range Image Test Data

Our first set of data is a list of environment maps from Emil Persson (aka Humus) [**?**]. All cube maps have a resolution of $6 \cdot 2048^2$. The following previews are downsampled to $6 \cdot 256^2$. The unusual view of the cube map requires less vertical space allows us to place three instead of two images per page.

Brudslojan Emil Persson

Fishermans Bastion Emil Persson

Heros Square Emil Persson

Langholmen Emil Persson

Maskonaive Emil Persson

Nissi Beach Emil Persson

Palm Trees Emil Persson

Perea Beach Emil Persson

Ryfjallet Emil Persson

Stairs Emil Persson

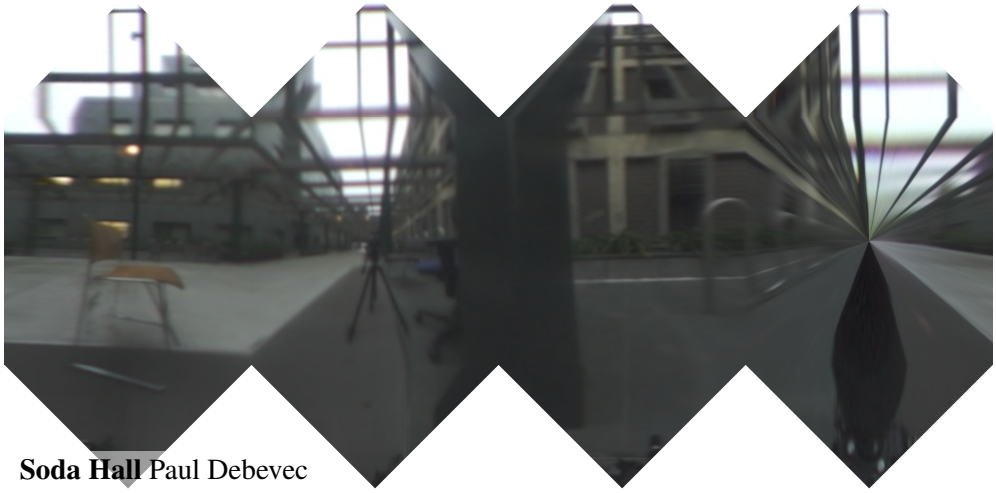
Tantolunden Emil Persson

Tantolunden 2 Emil Persson

2. High-Dynamic-Range Image Test Data

The high dynamic test data consists of 8 HDR maps from Paul Debevec [**?**] ($6 \cdot 256^2$ resolution) and 4 maps from Greg Zaal [**?**] ($6 \cdot 1024^2$ resolution). All of the following images are tone mapped (and downsampled if greater than 256^2).

Funston Beach Paul Debevec

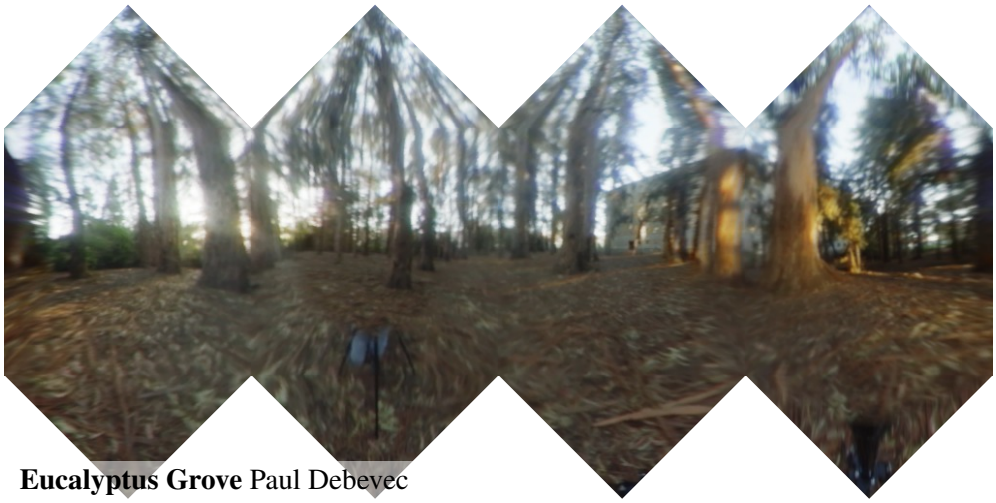


Soda Hall Paul Debevec

Galileo's Tomb Paul Debevec

Grace Cathedral Paul Debevec

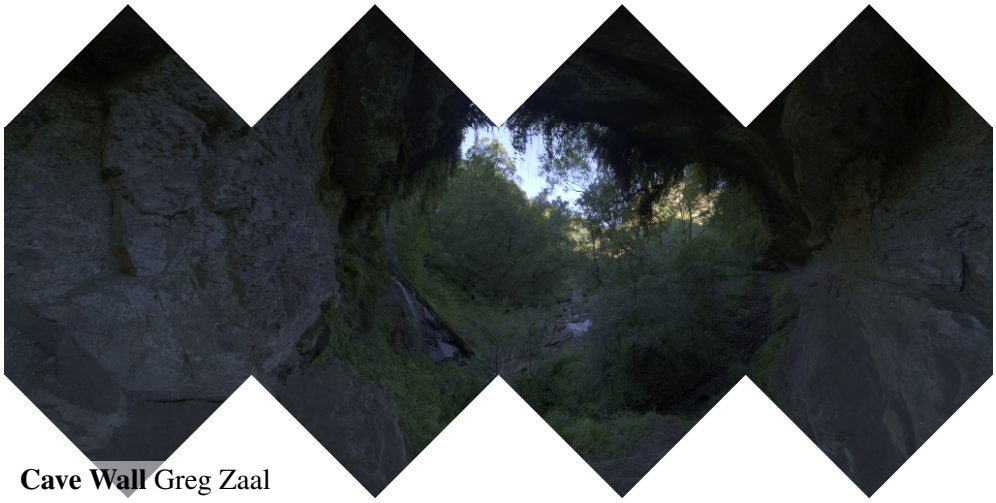
Kitchen Paul Debevec



Eucalyptus Grove Paul Debevec

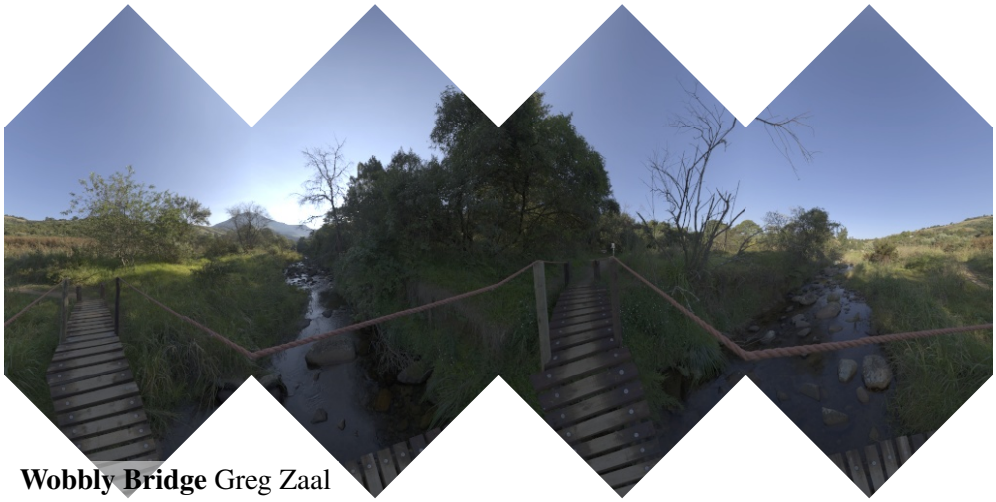
St. Peter's Basilica Paul Debevec

Uffizi Gallery Paul Debevec



Cave Wall Greg Zaal

Preller Drive Greg Zaal



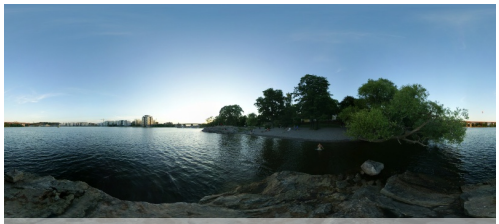
Wobbly Bridge Greg Zaal

Woods Greg Zaal

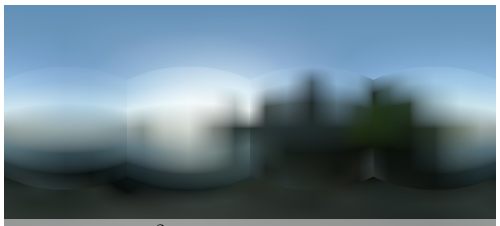
3. Result Images

This section shows a visual comparison of all spherical models. Each model is fitted using approximating 1KB space for the parameters per color channel. While this is not truly meaningful, because adaptive models may chose different parametrizations per channel, it still gives a good impression at roughly the same level of compression.

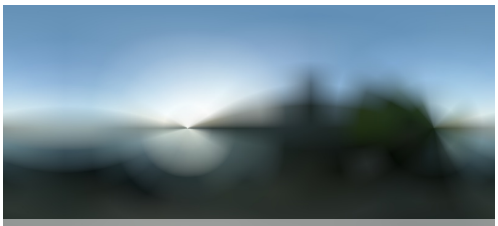
Further, we show examples for one of the LDR maps only, because the artifacts are the same regardless of the data. We would need to tonemap the other models anyway and therefore images would not differ dramatically.



Original



Cube Map 6×7^2 pixels, RMSE: 0.0967



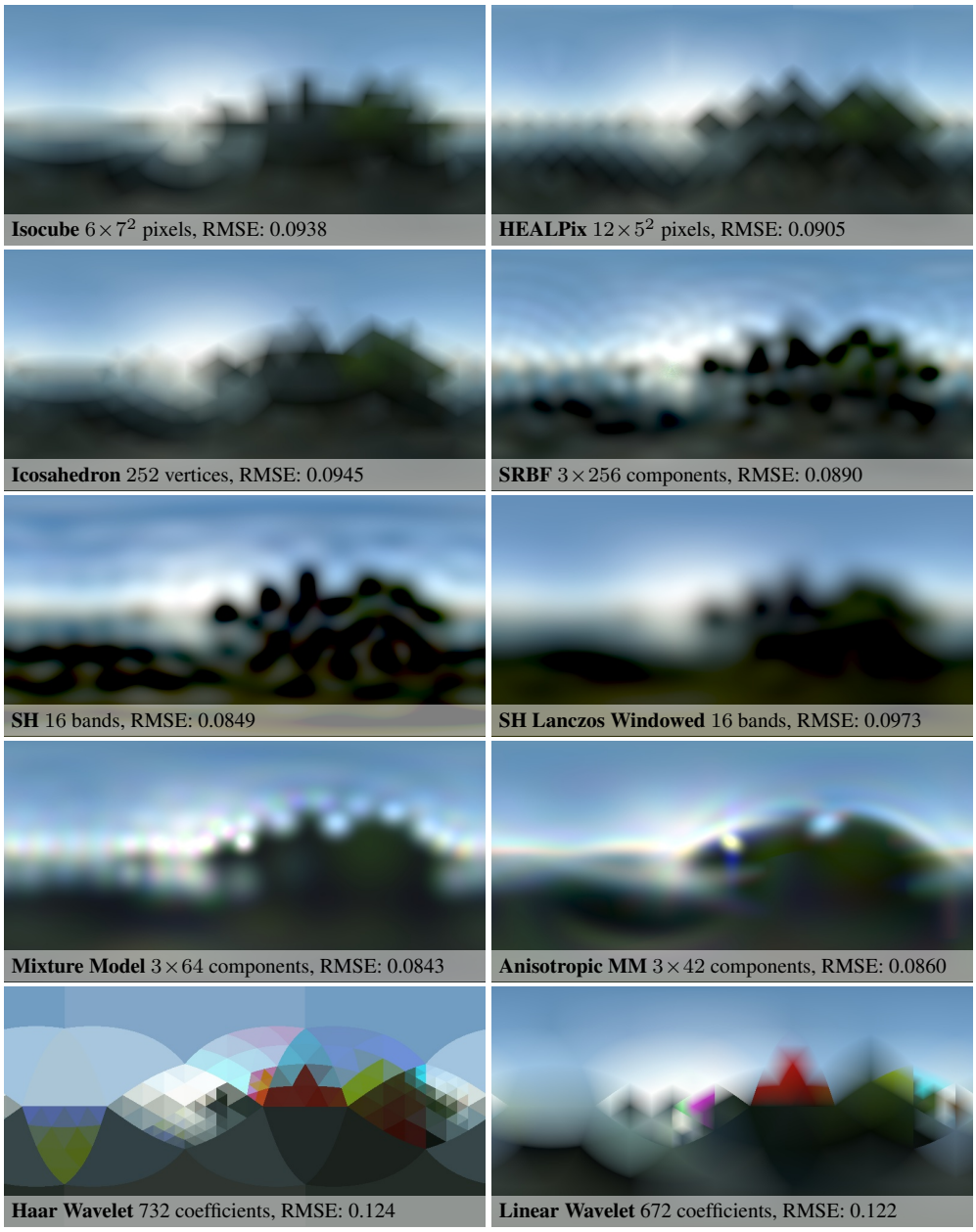
Polar Map 11×22 pixels, RMSE: 0.0972

Elliptical EA Projection 11×11 pixels, RMSE: 0.101

Projection 11×11 pixels, RMSE: 0.0960

Shirley EA Projection 11×11 pixels, RMSE: 0.096

Octahedron 16×16 pixels, RMSE: 0.0935



Isocube 6×7^2 pixels, RMSE: 0.0938

HEALPix 12×5^2 pixels, RMSE: 0.0905

Icosahedron 252 vertices, RMSE: 0.0945

SRBF 3×256 components, RMSE: 0.0890

SH 16 bands, RMSE: 0.0849

SH Lanczos Windowed 16 bands, RMSE: 0.0973

Mixture Model 3×64 components, RMSE: 0.0843

Anisotropic MM 3×42 components, RMSE: 0.0860

Haar Wavelet 732 coefficients, RMSE: 0.124

Linear Wavelet 672 coefficients, RMSE: 0.122

First you will notice discontinuous in some of the mapping based visualizations. This happens if no interpolation between faces is performed and can be fixed with more complicated samplers. Note that Isocube, HEALPix and Icosahedron are implemented with correct interpolation.

In some cases alignment with the data plays an important rule. The examples visualize the worst case where the north axis of the model points into z+ direction in the image. This results in the visible singularity of the polar map and patterns in most other maps.

The Haar wavelet transformation, with informations stored on faces, does not do any interpolation at all. The linear wavelet uses linear interpolation between vertices, but shows discontinuities along T-junctions of different tessellated faces.

On the other hand we have the polynomial and mixture models which show ringing to different degrees. Negative values in SRBF and SH models are clamped to zero. In case of SH, windowing helps a lot to reduce the ringing at the price of information loss which results in a higher error. Finally, the mixture models have the lowest error and are visually more pleasing than most other models.

References

DEBEVEC, P. Light Probe Image Gallery. Accessed: 2015-02-05. URL: http://www.pauldebevec.com/Probes/.

PERSSON, E. Humus' Cube Map Collection. Accessed: 2015-02-05, License: CC BY 3.0. URL: http://www.humus.name/index.php?page=Textures.

ZAAL, G. HDRI Haven. Accessed: 2017-04-07, License: CC BY 4.0. URL: http://hdrihaven.com.