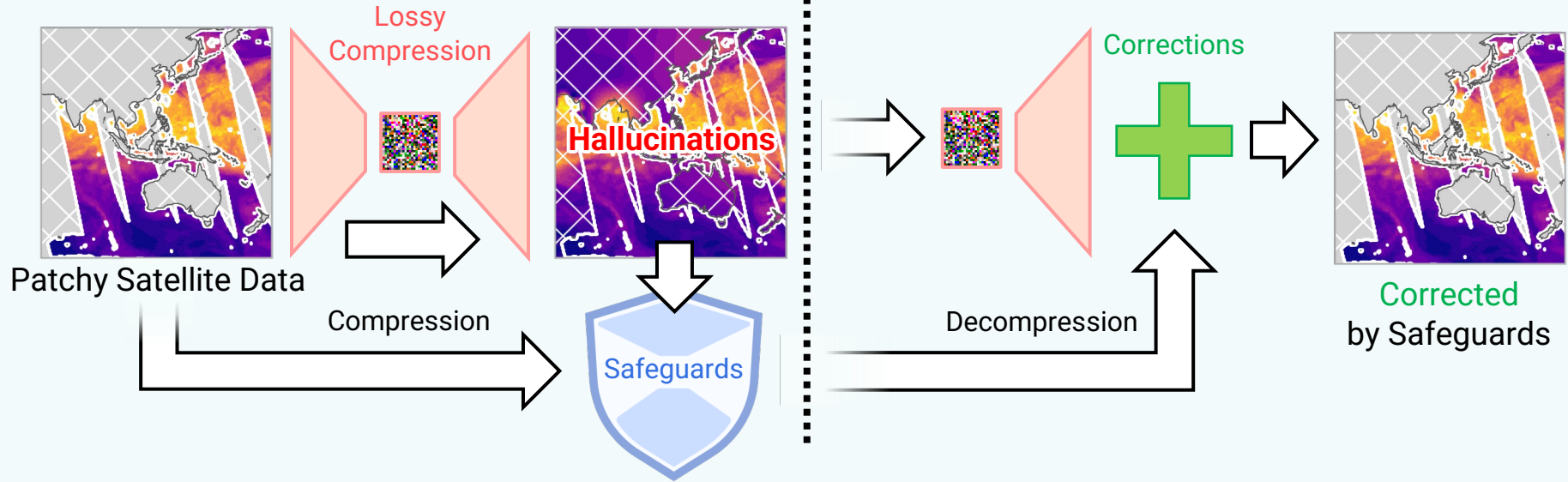


Distortions from Lossy Compression can be **Scary**



**Compression Safeguards provide
Guaranteed Declarative Safety**

Any
Compressor

Any
Combination

Error Bounds

Regions of Interest

NaNs

Quantities
of Interest

Boundary
Conditions

Chunked
Data

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Compression Safeguards Cheat Sheet – Installation:

```
pip install compression-safeguards
pip install numcodecs-safeguards xarray-safeguards
```

Usage with numcodecs and an all-in-one meta-compressor:

```
sg = numcodecs_safeguards.SafeguardedCodec(
    codec=codec, # any numcodecs codec
    # list all safeguards to uphold, e.g. abs error bound
    safeguards=[{"kind": "eb", "type": "abs", "eb": 0.1}, ...],
    # auxiliary constant late-bound data, e.g. coordinates
    fixed_constants={"a": 42, "eb": numpy.array([...])},
)
x_enc = sg.encode(x) # compress x with safeguards
x_dec = sg.decode(x_enc) # decompress with corrections
```

Usage with (chunked) xarray data arrays:

```
da_corr = xarray_safeguards.produce_data_array_correction(
    da, da_dec, safeguards=[...], late_bound={"aux": da2},
)
da_sg = xarray_safeguards.apply_data_array_correction(
    da_dec, da_corr,
)
```

Low-Level Sans-Compression API:

```
sg = compression_safeguards.Safeguards(safeguards=[...])
x_corr = sg.compute_correction(x, x_dec, late_bound={...})
x_sg = sg.apply_correction(x_dec, x_corr)
assert sg.check(x, x_corr, late_bound={...})
```

Pointwise Error Bounds: absolute, relative, ratio

$|x - \hat{x}| \leq \epsilon_{abs}$: {"kind": "eb", "type": "abs", "eb": 0.1}
 $|x - \hat{x}| \leq |x| \cdot \epsilon_{rel}$: {"kind": "eb", "type": "rel", "eb": 0.1}
 $\hat{x} \in [x/\epsilon_{ratio}, x \cdot \epsilon_{ratio}]$: {"kind": "eb", "type": "ratio", "eb": 1.1}

Missing Values:

NaN: automatically preserved by error-bounding safeguards

Non-NaN: {"kind": "same", "value": 9999, "exclusive": True}

Isosurfaces: {"kind": "sign", "offset": 42}

Quantities of Interest $f(x)$:

Pointwise: {"kind": "qoi_eb_pw", "qoi": "log10(x)",
"eb": 0.1, "type": "rel", "eb": 0.1}
Stencil: {"kind": "qoi_eb_stencil", "qoi": "sum(X)/size(X)",
"neighbourhood": [{"axis": 0, "before": 2,
"after": 2, "boundary": "wrap"}],
"type": "ratio", "eb": 1.1}

Regions of Interest:

Select: {"kind": "select", "selector": "\$i", "safeguards": [...]}
Continuous: e.g. {"kind": "eb", "type": "abs", "eb": "\$eb"}

Find our More:

<https://compression-safeguards.rtfd.io/>

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