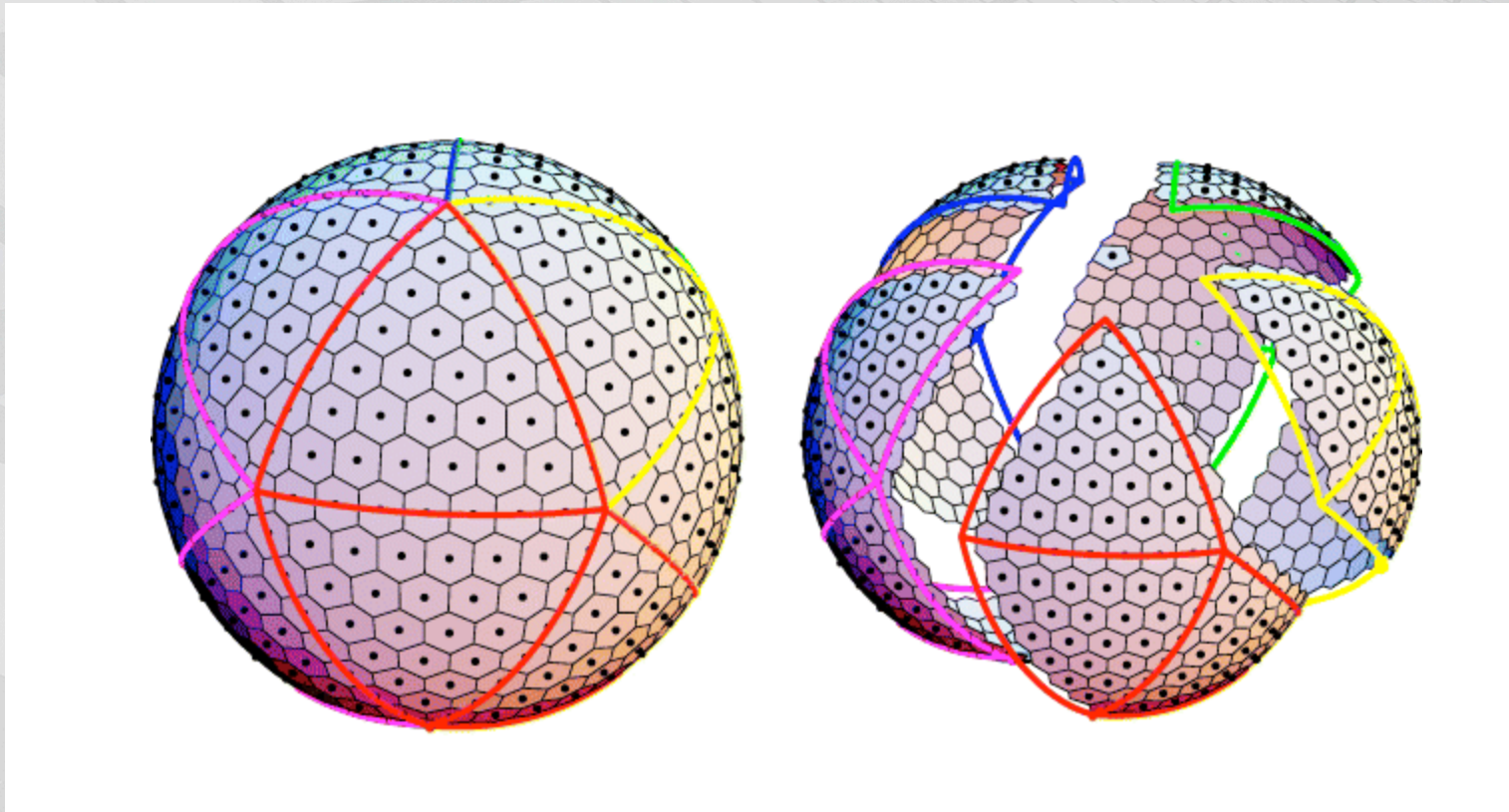


# IO Requirements for a Global Cloud Resolving Model

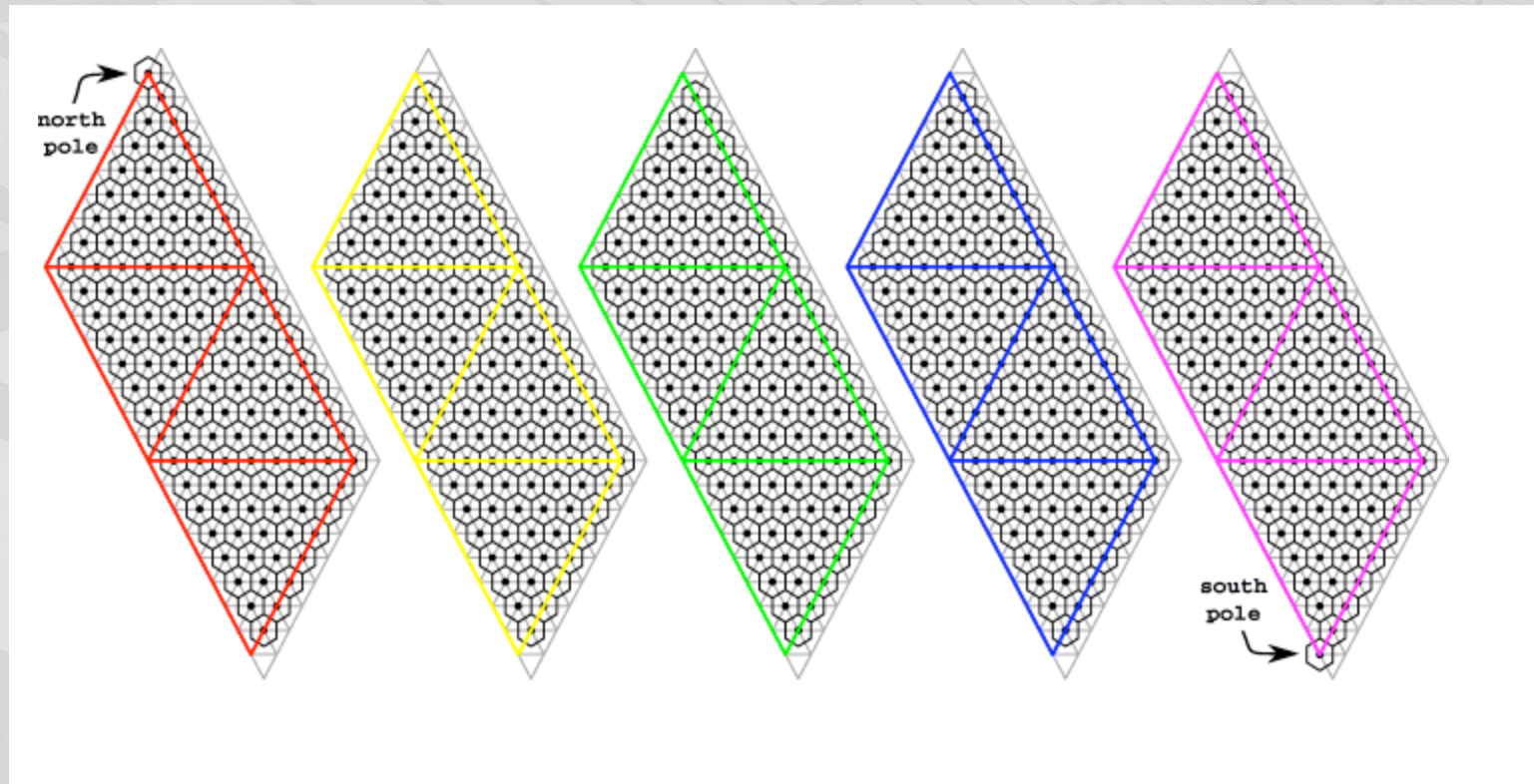
Bruce Palmer  
Annette Koontz  
Karen Schuchardt

# Geodesic Grid

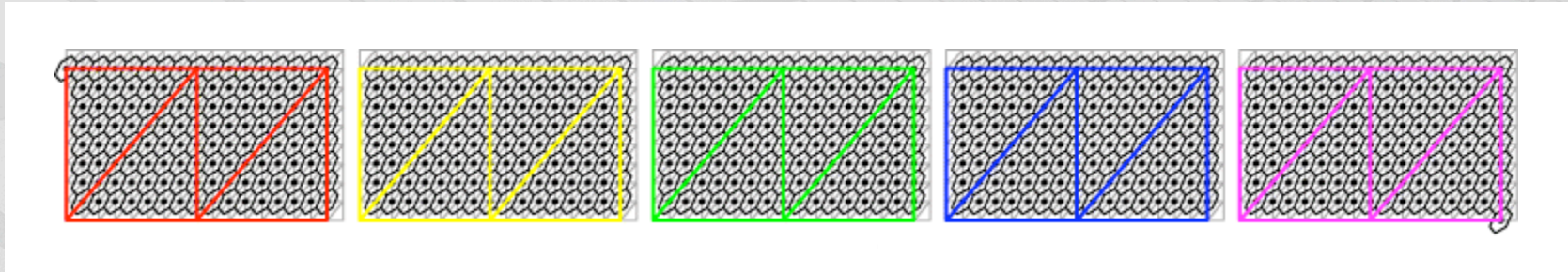


**Geodesic grids can be decomposed into  
5 2x1 panels with the north and south  
poles left over**

# Geodesic Grid Panels



# Geodesic Grid Data Layout

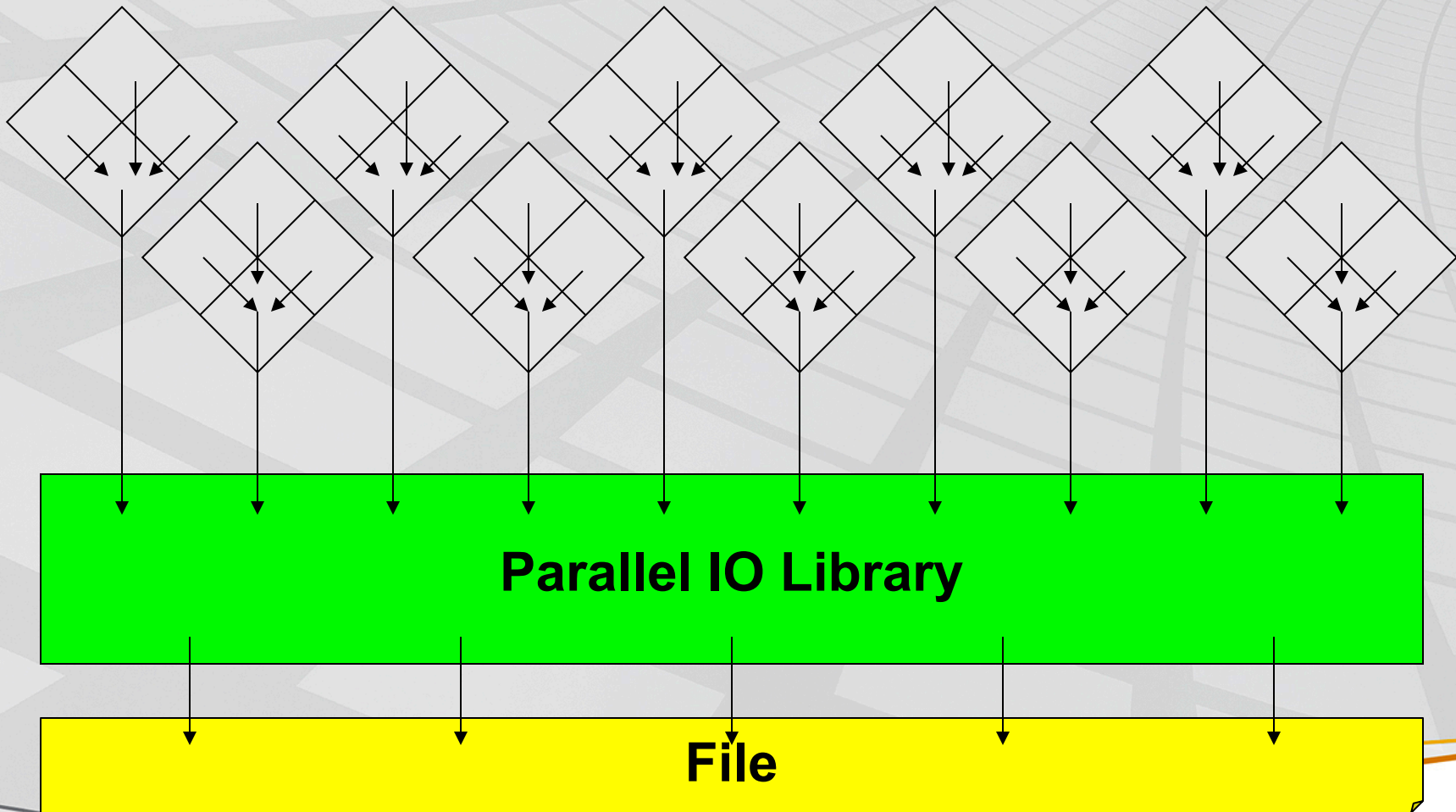


**5 2x1 panels of data or 10 square panels plus the north and south poles. The square panels are dimensioned by an integral power of 2. The total number of grid cells is given by**

$$N = 10 * 2^{2R} + 2$$

**where R is an exponent that characterizes the resolution of the grid. 4km resolution corresponds to a value of R = 11.**

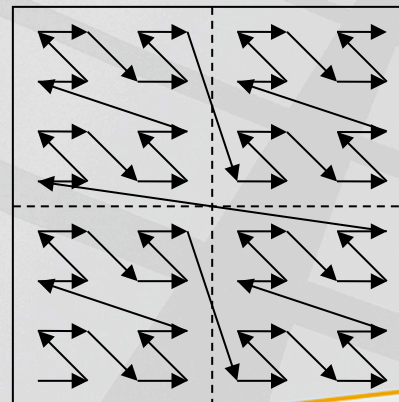
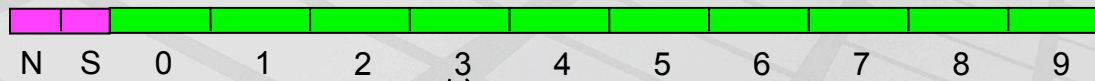
# IO Model for the GCRM



# File Layout

Poles

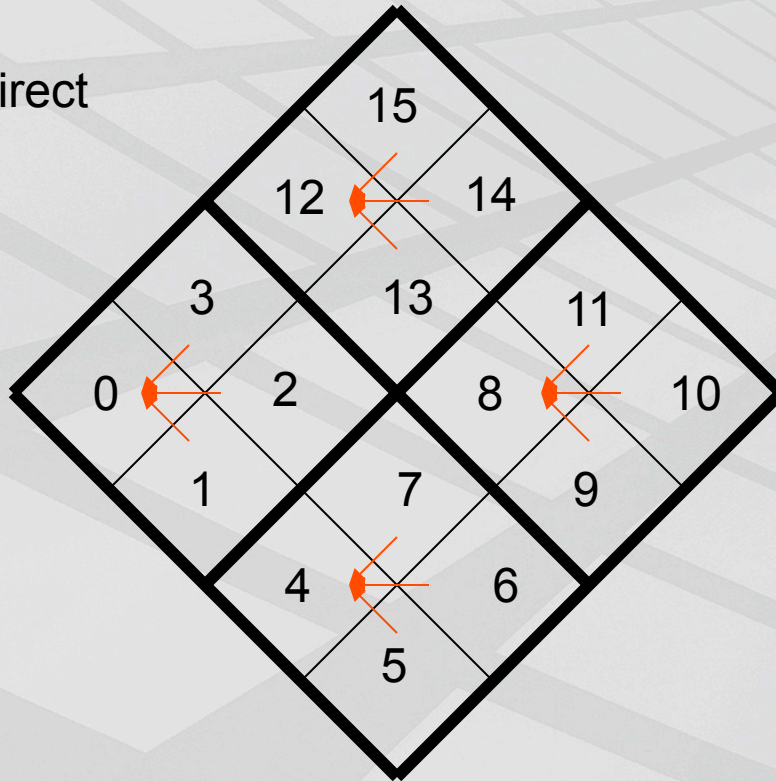
Panels



Morton-ordering  
within panels

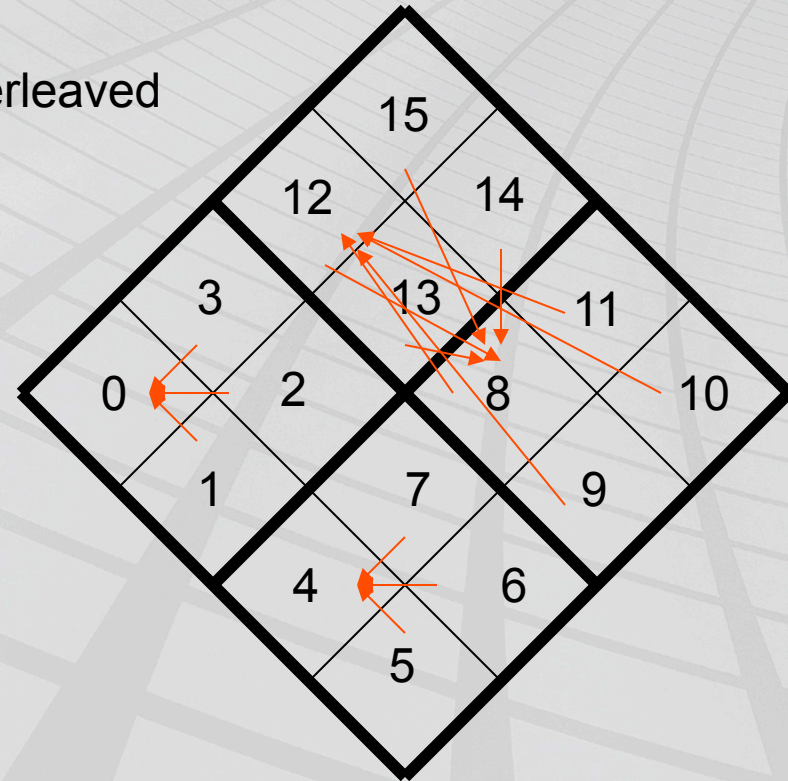
# Direct vs Interleaved Messaging

Direct



```
Process 0: 0 1 2 3
Process 4: 4 5 6 7
Process 8: 12 13 14 15
Process 12: 8 9 10 11
```

Interleaved



```
Process 0: 0 1 2 3
Process 4: 4 5 6 7
Process 8: 8 9 10 11
Process 12: 12 13 14 15
```

# GCRM Targets

- ▶ Run GCRM at 4km resolution or less
- ▶ 16 GBytes of data per cell-centered variable per snapshot.
  - Corner centered data is an extra factor of 2 larger, edge centered data is 3 times as big
- ▶ Produce snapshots every simulated hour
- ▶ Write out ~20 variables per snapshot
- ▶ Simulate model for 1 year
- ▶ Produce ~1-10 Petabytes of simulation data



# IO Targets for GCRM

- ▶ Add less than 10% overhead to cost of running GCRM model
- ▶ Produce files that are easy to access for subsequent analysis and processing (i.e. files that are in standard formats etc.)

# IO Targets for GCRM (cont.)

R	Cell width (km)	Number of Cells	Number of Corners	Number of Edges
10	8	10485762	20971524	31457266
11	4	41943042	83886084	125829126
12	2	167772162	335544324	503316486
13	1	671088642	1342177284	2013265926