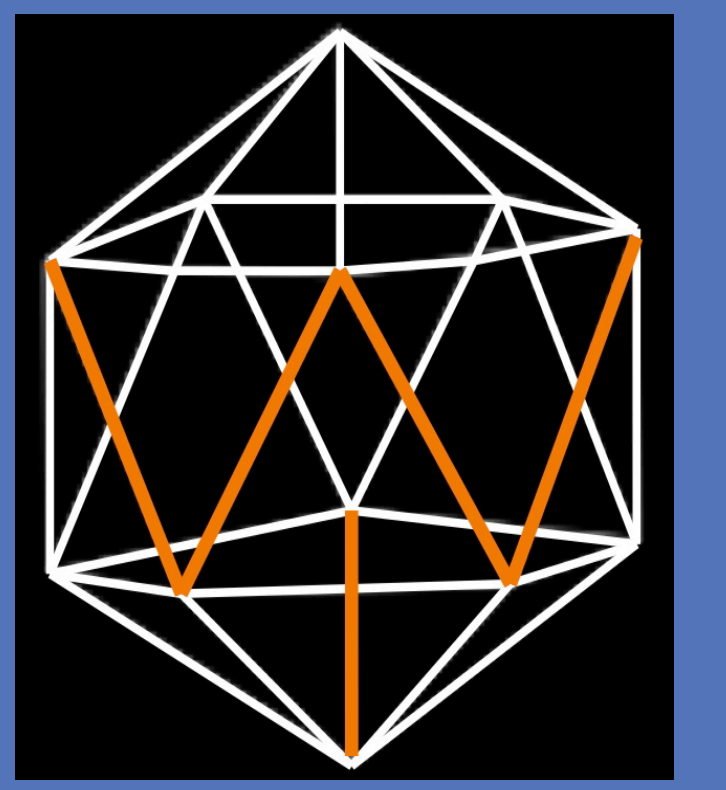


Use of Spatial and Temporal Patterns to Communicate Ocean Science



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INTRODUCTION

The Patterns and Rhythms of Nature are Universally Recognized.

General Observations

- Sharing interdisciplinary perceptions for approaching or representing challenges requires effective communication
- Jargon, mathematics and symbols are seldom compatible with images or sounds recognizable to most laypersons
- Do words, symbols or numbers represent good candidates for a common language—or not?
- Patterns (both spatial and temporal) are reportedly more easily perceived and discerned by humans
- Scientific descriptions often refer to shapes, geometries, distributions, vibrations, frequencies, and cycles

Similar patterns created by different processes...



Ocean Patterns and Rhythms

- Temperature patterns associated with events such as ENSO are rhythmic and linked to terrestrial vegetation patterns
- The tides are rhythmic oscillations of the ocean surface resulting from gravitational and centrifugal forces
- Oceanic circulation patterns occur over a range of scales, as do those of phytoplankton and other marine organisms
- Chemical and geological data can be portrayed as patterns and rhythms in either static or dynamic modes
- Oceanographic engineering can be displayed as designs and operations in terms of repeated patterns and rhythms

EXAMPLES

Similar Patterns are Created by Very Different Physical Processes.

Fractals consist of spatial and temporal patterns that initially appear random, but describe a wide range of oceanic processes, forms, and events.



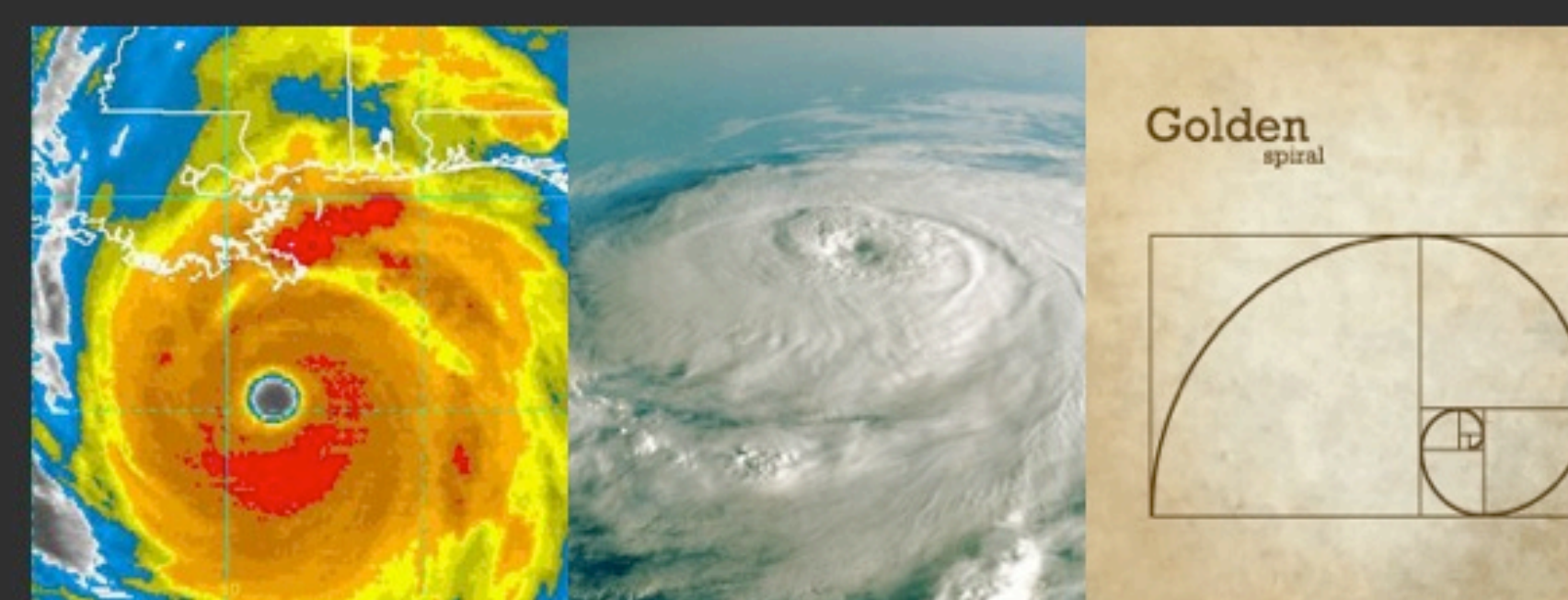
An artistic, rather than geographic, depiction of oceanic and atmospheric phenomena on different scales can be applied to both waves and clouds.

Similar fractal patterns appear in diverse aspects of the ocean on many scales; describing not only appearance, but also growth and transformation.



Complex changes or cause-and-effect relationships in ocean phenomena are difficult to explain, but can be communicated via artistic displays.

Spirals and vortices appear in the atmosphere and ocean over a range of scales and in human designs that transcend both cultures and millennia.

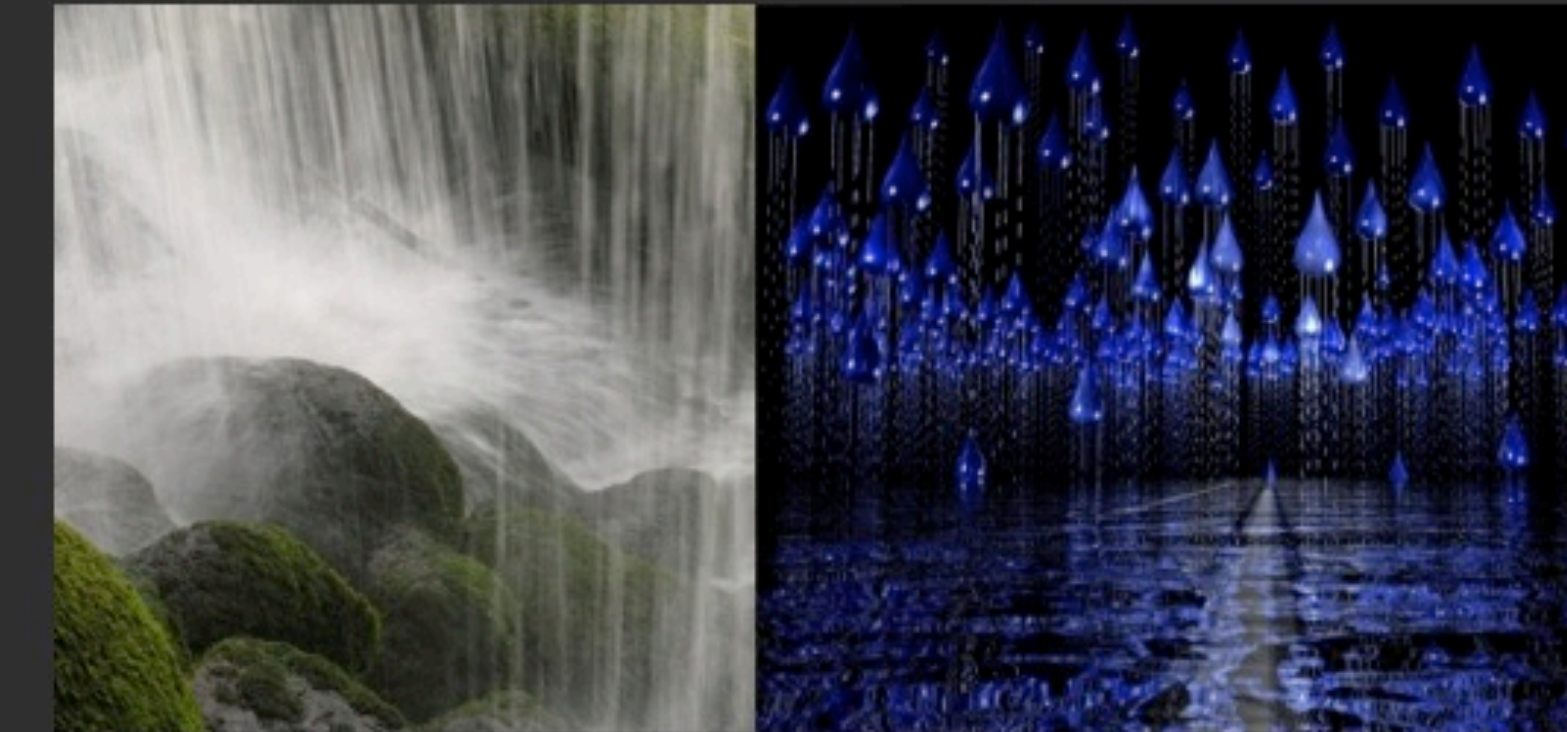


Portraying a hurricane using enhanced imagery and relating it to the spirals found in art, architecture, and other recognizable images of the world.

EXAMPLES (cont.)

Scientific Data Can Be Presented as Patterns to Convey the Information.

Rhythmic patterns appear in diverse aspects of nature on different timescales and in human endeavors such as music, dance, and drumming.



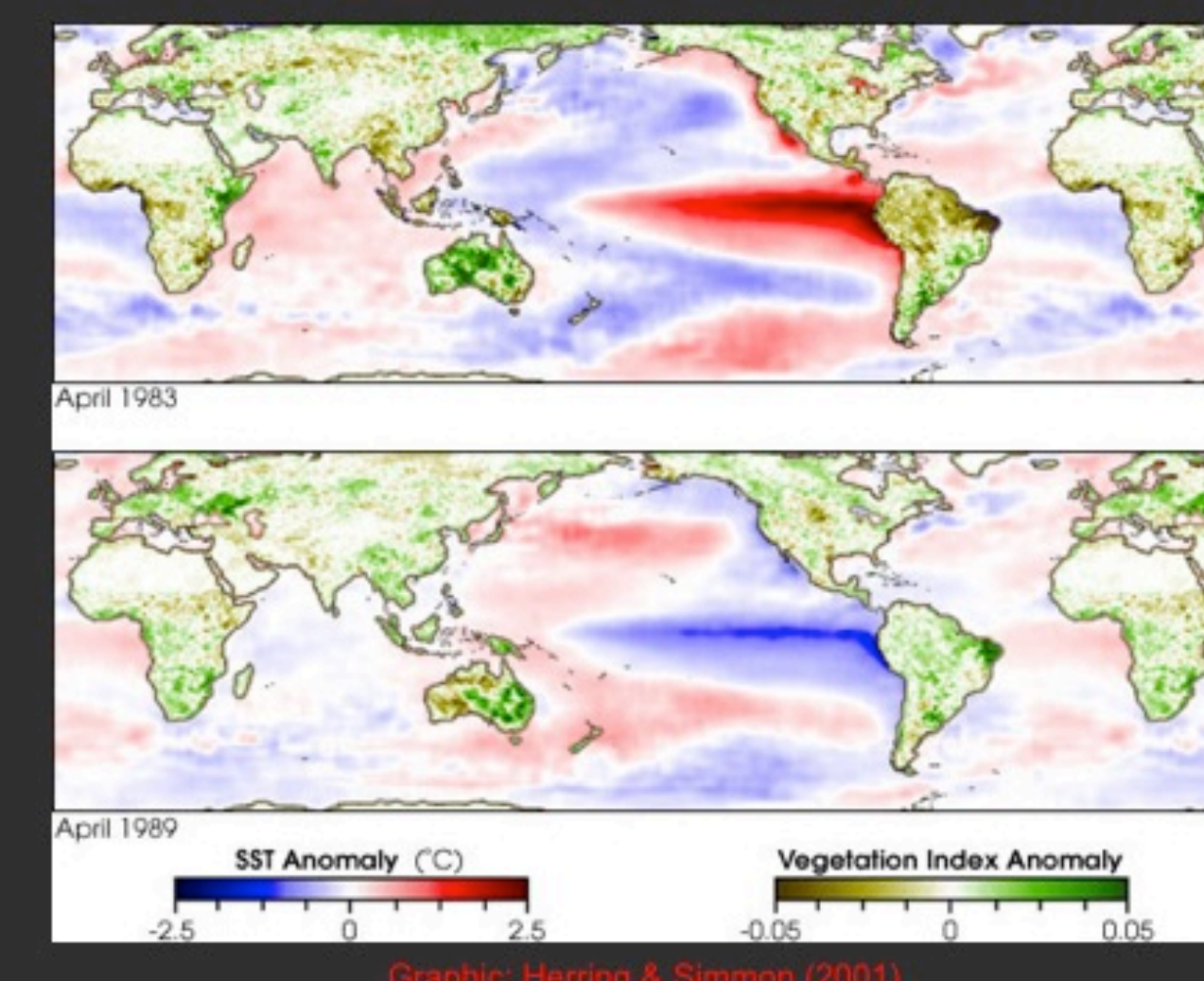
Quantifying the frequency, intensity or volume of rain schematically, instead of statistically, creates patterns to view or rhythms to hear.

At a molecular level, the complex networks of seawater swap connections and geometries that allow it to flow and interact with other substances.



The physics and chemistry of seawater can be portrayed as schematics that present the phenomena as different color schemes or network patterns.

The oceans play a lead role in global climate and myriad planetary processes via their influence on continents, freshwaters, and the biosphere.



Graphic: Herring & Simmon (2001)

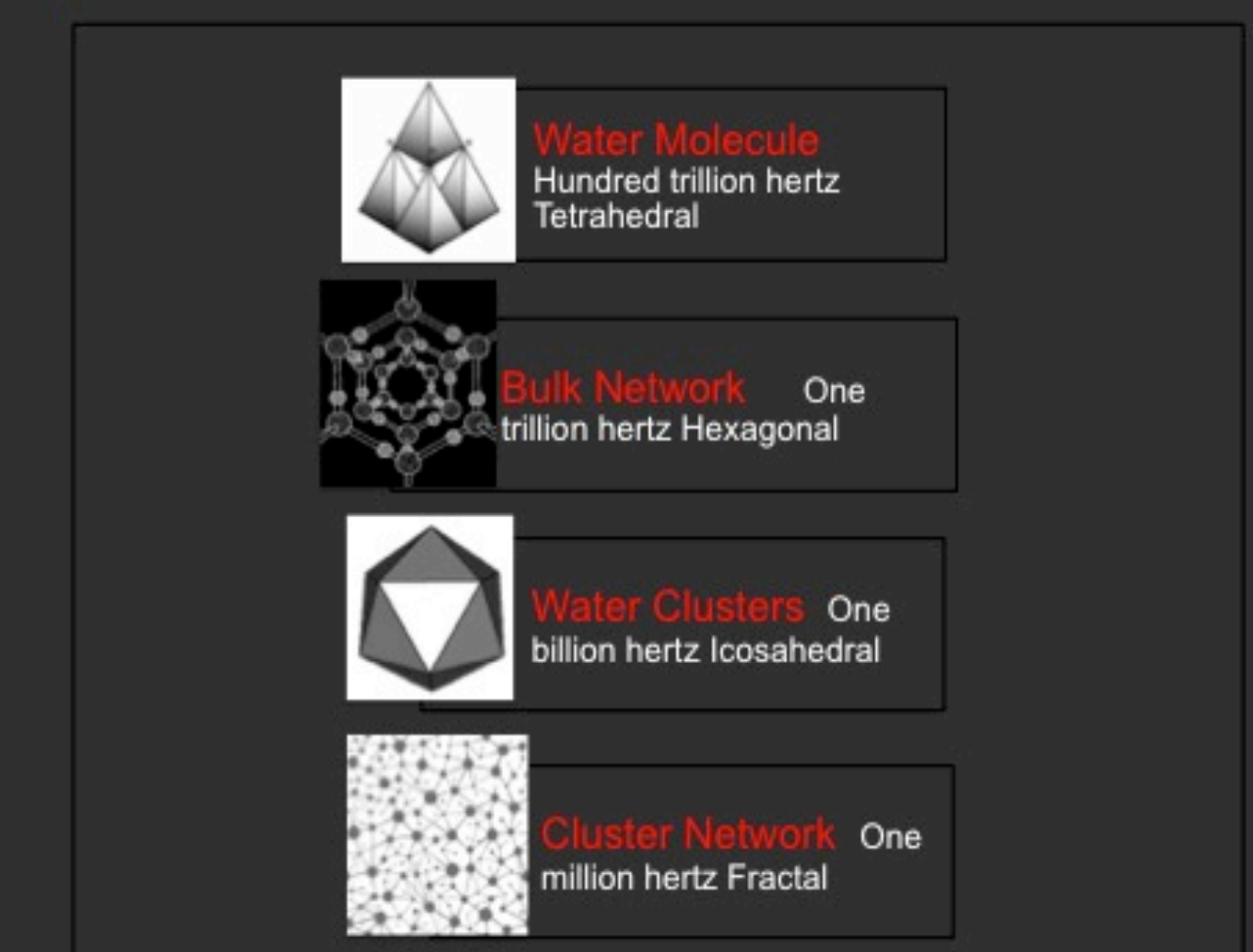
CONCLUSIONS

Many Different Systems Exist for Communicating via Patterns.

Communicating Ocean Science

- Increased recent interest in art-science collaborations that can present concepts and data more effectively
- Both art and science can be expressed in terms of spatial and temporal patterns or as network transformations
- Whereas patterns may not communicate science's subtle intricacies, they can present its essential messages
- Pattern "languages" have been developed for software design, architecture, and other technical applications
- Patterns may be systematically categorized, illustrated, ranked, and exemplified to create a common base that users can apply, modify and refer to when communicating

Rhythmic and Geometric Patterns



Hierarchical diagram for the structure of molecular seawater.

Pattern Identification Methods

- TYPE/SOURCE: natural, ideal, and abstract
- FRACTAL DIMENSION: interior or perimeter (1D to 3D)
- CONNECTIVITY: functional, structural, or informational
- TEMPLATE MATCHING: sum of overlapping regions with a "standard" or "model" pattern
- SPACE CLASSIFYING: assigns different regions of a pattern to distinct measurable classes
- SYNTACTICAL DIVISION: partitions pattern and assesses relationships between sub-patterns