

YSGF (Yasir Sultan Geodesic Flux): A Rotational Geodesic Flux Framework for Maps and Globes

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Abstract

This paper introduces the Yasir Sultan Geodesic Flux (YSGF) framework, a generalized spatial representation methodology based on dynamic pole transformation and rotational normalization of spherical coordinates. The framework reinterprets geographic space by allowing any location on Earth to become a temporary pole, generating a new geodesic structure centered on that point.

Within this representation, longitudinal structures become geodesic flux trajectories converging toward the selected pole, while latitudinal structures represent equal-distance contours relative to the selected pole. The approach is independent from specific cartographic projections and may operate directly on the sphere or as an overlay layer applied to conventional map systems such as the Mercator projection.

The concept of Flux forms the central structural and interpretive component of the framework. Rather than treating coordinate systems as static Earth-fixed constructs, YSGF models geographic orientation as a dynamically normalized rotational field. This enables intuitive reinterpretation of navigation, distance relations, spatial flow analysis, and geodesic organization.

The framework focuses primarily on intuitive visualization, geodesic interpretation, and adaptive spatial orientation while remaining fully compatible with existing mathematical geography and cartographic systems.

1. Introduction

Traditional geographic coordinate systems define the Earth using fixed polar references. While mathematically effective, these systems impose a rigid orientation that does not adapt to arbitrary spatial focal points.

The YSGF framework proposes an alternative interpretation in which any selected geographic location may be transformed into a rotational pole through a process called Pole Transformation. After transformation, the coordinate structure reorganizes itself around

the chosen location.

This creates a new geodesic field in which:

- The transformed longitudinal lines become the principal geodesic trajectories.
- The transformed latitudinal lines become equal-distance contours.
- Spatial organization becomes locally centered and rotationally normalized.

The framework introduces the concept of Geodesic Flux, where directional geodesic structures behave as continuous spatial flow trajectories across the Earth's surface.

2. Core Concepts

2.1 Flux

The term Flux is fundamental within YSGF.

In this context, Flux refers to the organized directional propagation of geodesic structures across a spherical surface after rotational normalization. Flux lines represent coherent spatial trajectories converging toward or diverging from the transformed pole.

Unlike traditional longitude systems tied permanently to the geographic poles, Flux structures are dynamically generated relative to any selected point on Earth.

2.2 Pole Transformation

Pole Transformation is the operation that redefines an arbitrary geographic location as a temporary pole of the coordinate system.

If a city such as London is selected as the transformed pole, then:

- The new longitudinal system becomes composed of geodesic trajectories converging at London.
- The new latitudinal system becomes composed of equal-distance contours relative to London.
- All spatial directions become normalized around the transformed coordinate orientation.

This transformation may be applied mathematically on:

- The physical sphere,
- A virtual globe,
- Or any projected mapping system.



[Figure 1]

Pole Transformation and Rotational Normalization centered on London.
The transformed longitude system forms geodesic flux trajectories converging at the selected pole, while transformed latitudes represent equal-distance contours.

2.3 Rotational Normalization

Rotational Normalization is the process of rotating the coordinate framework so that the selected reference point becomes the effective pole.

The transformation preserves spherical continuity while redefining directional geometry.

Conceptually:

- Standard Earth coordinates remain mathematically valid.
- The interpretive orientation changes.
- Geodesic behavior becomes centered around the selected location.

This normalization creates a locally intuitive spatial topology without requiring reconstruction of the underlying map projection.

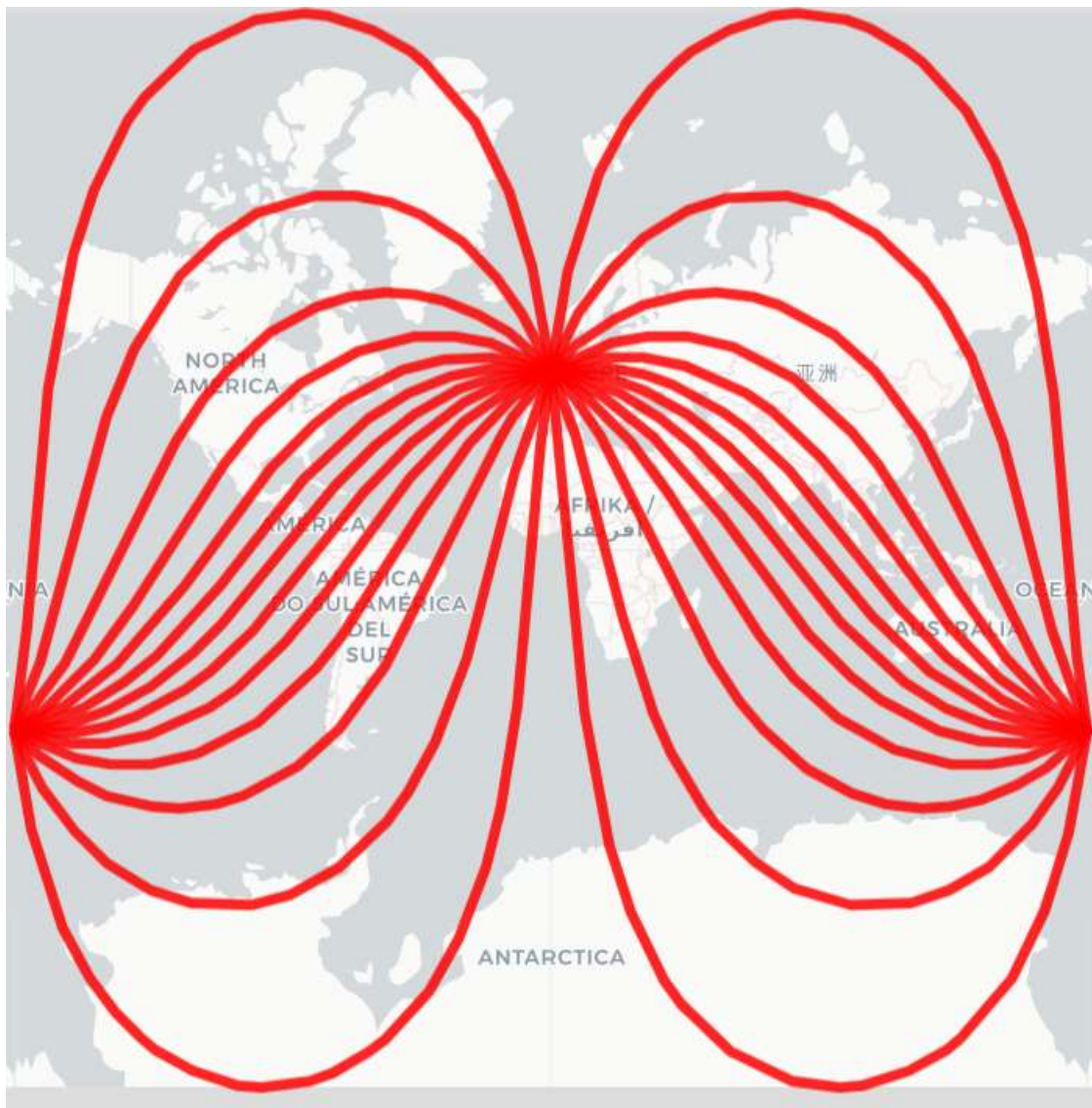
3. Geodesic Flux Structure

When a pole transformation occurs:

- The newly generated longitude lines become geodesic flux trajectories.
- The newly generated latitude lines become equal-distance structures.

On the sphere:

- Flux trajectories correspond to great-circle geodesics passing through the transformed pole.



[Figure 2]

Geodesic flux trajectories for London on a Mercator map representation after rotational normalization.

On projected maps:

- The same transformed geodesic system may be rendered as an overlay layer independent of the underlying projection.

Thus, YSGF does not replace existing projections such as the Mercator projection. Instead, it introduces a higher-level geometric layer capable of operating on top of them.

4. Geodesic Path Construction

Within the YSGF framework, a geodesic path between two locations may be constructed through dynamic pole transformation.

Given two geographic points:

- Point A (origin)
- Point B (destination)

The procedure is defined as follows:

1. Point A is transformed into the temporary rotational pole using rotational normalization.
2. The coordinate system is rotated such that Point A becomes the effective pole of the transformed representation.
3. In the transformed system:
 - The longitude passing through Point B represents the geodesic trajectory connecting A and B.
 - The latitude of Point B represents the distance from Point A.

As a result, geodesic routing may be interpreted through the transformed longitudinal flux structure.

This interpretation applies consistently on:

- Physical spherical models,
- Virtual globes,
- Mercator projections,
- And arbitrary cartographic projections.

The framework therefore provides an intuitive geodesic routing interpretation independent of projection format.

5. Projection Independence

A central property of YSGF is projection independence.

The framework operates consistently across:

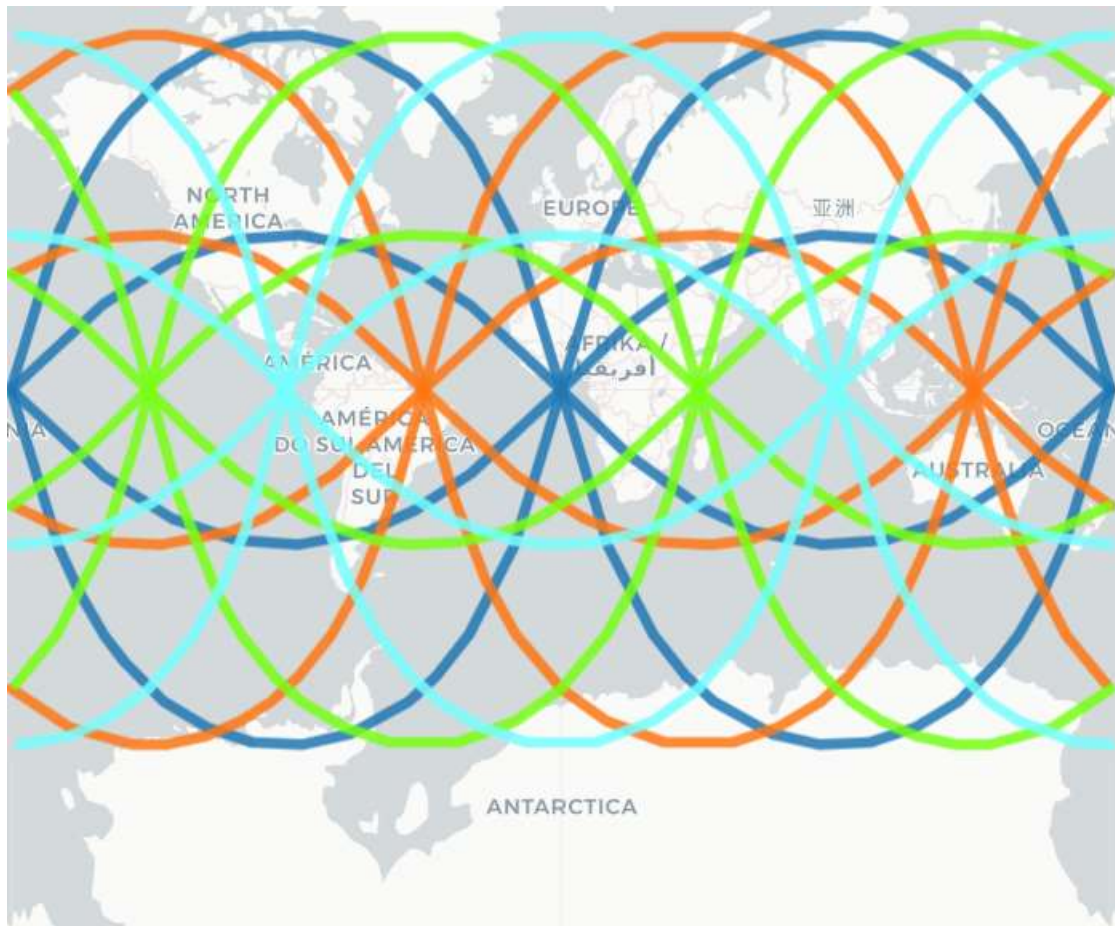
- Spherical representations,

- Globe renderings,
- Mercator projections,
- Cylindrical projections,
- Arbitrary map transformations.

The geodesic flux layer behaves as an abstract coordinate topology independent of visualization format.

Therefore:

- A Mercator map may preserve its original geometry,
- While YSGF overlays transformed flux trajectories and equal-distance contours dynamically.



[Figure 3]

YSGF flux overlay applied on a Mercator world map projection.

The flux layer remains independent from the underlying cartographic projection.

This separation between projection and flux structure allows compatibility with existing geographic systems.

6. Conceptual Interpretation and Applications

The YSGF framework may be interpreted as a dynamic reorientation methodology for spatial cognition and geodesic analysis.

Potential conceptual applications include:

- Navigation systems
- GIS systems
- Spatial analytics
- Dynamic routing
- Geodesic visualization
- Educational geographic systems
- Scientific modeling
- Dynamic aviation routing
- Maritime navigation
- Spatial AI systems
- Geodesic optimization
- Adaptive GIS visualization
- Large-scale Earth interaction systems

6.1 Educational Applications:

YSGF may provide strong educational value for both school and university-level geographic education. By transforming arbitrary locations into temporary poles, students may intuitively understand:

- Great-circle routes
- Distance relationships
- Geodesic structures
- Coordinate transformations
- Earth curvature behavior
- Rotational coordinate systems

The framework may simplify conceptual understanding of spherical geometry and global navigation compared to static Earth-fixed coordinate systems.

6.2 Aviation and Airport Applications:

The framework is particularly compatible with aviation visualization systems. Airports or cities may become temporary poles, allowing:

- Intuitive visualization of global flight paths
- Real-time route interpretation
- Air traffic spatial organization
- Long-distance geodesic routing analysis
- Airline network visualization

For example, a selected airport may become the transformed pole, causing all outgoing flight trajectories to appear as organized geodesic flux structures centered on that airport.

6.3 Offline Regional Processing:

The framework may also operate in partially offline or localized computational environments.

Instead of processing the entire Earth simultaneously, systems may precompute or dynamically compute rotational coordinate structures for:

- Specific cities
- Airports
- Geographic regions
- Military sectors
- Maritime corridors
- Educational local datasets

For example:

- A navigation system may locally compute the rotated coordinate structure for a selected airport only.
- A geographic education platform may generate the transformed geodesic field around a specific city without requiring global real-time processing.

This localized computation model enables lightweight implementations suitable for:

- Embedded systems
- Offline educational software
- Aircraft systems
- Mobile geographic applications
- Interactive visualization platforms

The framework is especially suited for applications requiring intuitive understanding of geodesic relationships centered around arbitrary locations.

7. Mathematical Interpretation

The transformation process may be interpreted as a rotational mapping operation on the sphere:

$$D_{l,a} = R_{l,a} * S$$

Where:

- **S** represents the coordinate vector in the standard static geographic system.

- $\mathbf{R}_{l,a}$ denotes the rotation matrix constructed based on the coordinates of the selected pole (Longitude l and Latitude a).
- $\mathbf{D}_{l,a}$ represents the resulting coordinates within the YSGF dynamic system.

The selected point becomes the transformed pole after applying the rotational operator.

The resulting coordinate family produces:

- Geodesic flux trajectories,
- Equal-distance contour families,
- Rotationally normalized directional fields.

7.1 Mathematical Transformation Framework

To enable the transition from static geographic coordinates to the YSGF dynamic framework, a rotational transformation is applied. The relationship between the standard Earth-fixed coordinates and the dynamic system is defined by the following operator:

$$\mathbf{D}_{l,a} = \mathbf{R}_{l,a} * \mathbf{S}$$

Where:

- \mathbf{S} represents the coordinate vector in the standard static geographic system.
- $\mathbf{R}_{l,a}$ denotes the rotation matrix constructed based on the coordinates of the selected pole (Longitude l and Latitude a).
- $\mathbf{D}_{l,a}$ represents the resulting coordinates within the YSGF dynamic system.

This mathematical representation allows for mutual and bidirectional conversion between the two systems, ensuring that spatial data integrity is maintained while shifting between traditional cartographic views and the geodesic flux representation.

7.2 Geodesic Path Construction Algorithm

The YSGF framework simplifies the generation of a complete geodesic path (the shortest route) between an origin Point A and a destination Point B through a structured three-step process:

- 1. Coordinate Transformation:** The coordinates of Point B are recalculated within the YSGF system, where Point A is established as the temporary dynamic pole through rotational normalization.
- 2. Geodesic Alignment:** In this transformed state, the complexity of spherical geometry is reduced; the entire geodesic trajectory between the two points aligns perfectly with the

longitudinal flux line passing through Point B. This means all intermediate points of the shortest path share the same longitudinal value in the YSGF system.

3. Point Generation and Reverse Mapping:

- A series of intermediate points are generated along the specific longitude between A and B within the dynamic system.
- These points are then transformed back into the standard Earth-fixed coordinate system using the inverse of the rotation matrix.

This methodology results in a mathematically precise geodesic path that can be rendered accurately over any conventional map projection or 3D globe.

8. Compatibility With Existing Mapping Systems

YSGF is designed as an additive framework rather than a replacement cartographic standard.

The flux layer may coexist with:

- GPS systems,
- Existing geographic databases,
- Conventional map tiles,
- Mercator navigation environments,
- Alternative geometric projections including Conic, Azimuthal, and Equal-Area systems,
- Scientific Earth visualization systems.

This allows deployment without requiring abandonment of existing infrastructure.

9. Licensing and Attribution

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Recommended attribution format:

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10. Conclusion

The Yasir Sultan Geodesic Flux (YSGF) framework introduces a rotationally normalized interpretation of geographic space based on dynamic pole transformation and geodesic flux organization.

By allowing arbitrary locations to function as poles, the framework generates new geodesic structures and equal-distance fields while remaining compatible with existing projections and mapping systems.

The central concept of Flux provides a generalized spatial interpretation layer capable of operating independently from visualization format, potentially enabling new forms of geodesic analysis, navigation, and spatial cognition.

11. Implementation Demonstration

A functional implementation of the YSGF framework has been developed using Three.js and WebGL technologies.

The implementation dynamically generates geodesic flux structures for arbitrary geographic locations on both:

- 3D spherical Earth representations,
- and Mercator-based world maps.

The system supports real-time pole transformation and dynamic multi-origin flux visualization.

12. Clarification of Scope

YSGF does not claim discovery of new mathematical laws.

The framework is instead positioned as:

- A new visualization methodology
- A new interpretive spatial framework
- A rotationally normalized geographic representation system
- An intuitive map/globe interaction model

The primary contribution of YSGF is the creation of an intuitive visualization layer capable of reorganizing geodesic understanding around arbitrary spatial reference points while preserving compatibility with classical spherical geometry and existing geographic infrastructure.

Its novelty lies primarily in:

- Dynamic pole-centered visualization
- Rotationally normalized geodesic interpretation
- Intuitive spatial cognition enhancement
- Projection-independent geodesic flux rendering
- Real-time adaptive geographic orientation

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