# Software Requirements Specification (SRS)

## 1. Introduction

This document specifies the requirements for the 'Digital Twin for Disaster Response' system. The system integrates open climate datasets (e.g., ERA5) and OpenStreetMap (OSM) data to visualize and analyze flooding events in near real-time using a modular data pipeline and web-based visualization.

## 2. Overall Description

The system enables data ingestion, preprocessing, raster-to-tile conversion, and API-based access for map visualization clients. It supports multiple data types such as precipitation (ERA5), elevation (DEM), and OSM-based infrastructure layers. The design leverages Python-based libraries for geospatial processing and FastAPI for serving map tiles and GeoJSON layers.

## 3. Functional Requirements

FR1: The system shall download and process ERA5 precipitation data (NetCDF format).

FR2: The system shall generate Cloud Optimized GeoTIFFs (COGs) for raster layers.

FR3: The system shall extract OSM data for roads and buildings within a bounding box.

FR4: The system shall expose API endpoints for serving raster tiles and GeoJSON layers.

FR5: The system shall visualize results in a Folium or Jupyter client interface.

## 4. Non-Functional Requirements

NFR1: The system shall be modular and extensible for additional datasets.

NFR2: The system shall ensure compatibility with standard geospatial formats (NetCDF, GeoTIFF, COG).

NFR3: The system shall support scalable processing using Dask.

NFR4: The API shall follow RESTful principles and use FastAPI.

## 5. System Features

• Data Pipeline: Extracts, transforms, and stores datasets like ERA5, DEM, and OSM.

• Data Serving: FastAPI backend exposing raster tiles (WMTS-like) and OSM GeoJSON layers.

• Visualization: Folium-based interactive maps with time sliders for precipitation data.

## 6. External Interfaces

• CDS API (for ERA5 data)

• OpenStreetMap (Overpass API)

• REST API (FastAPI service for client access)