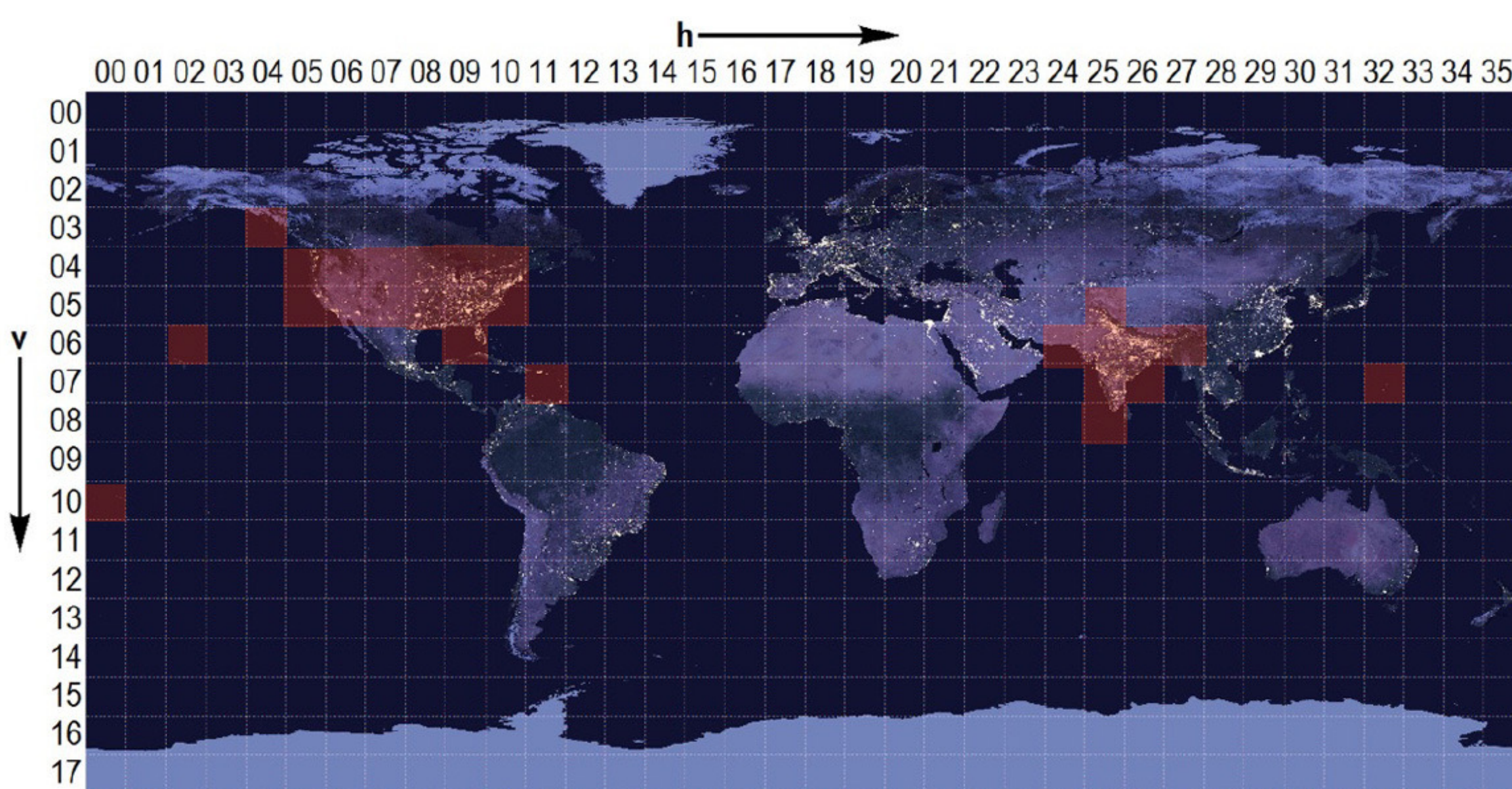


1. Introduction

Our mission: We propose a strategy to leverage big data for commercial alpha. We transform NASA nightlights data into a predictive feature and reveal insights about the economy earlier than large financial firms. Our resulting models forecast stock market activity to reveal hidden investor insights.

Method: We mask major cities in India and the US, encode the images as vectors and combine those with economic indicators to forecast stock market activity.



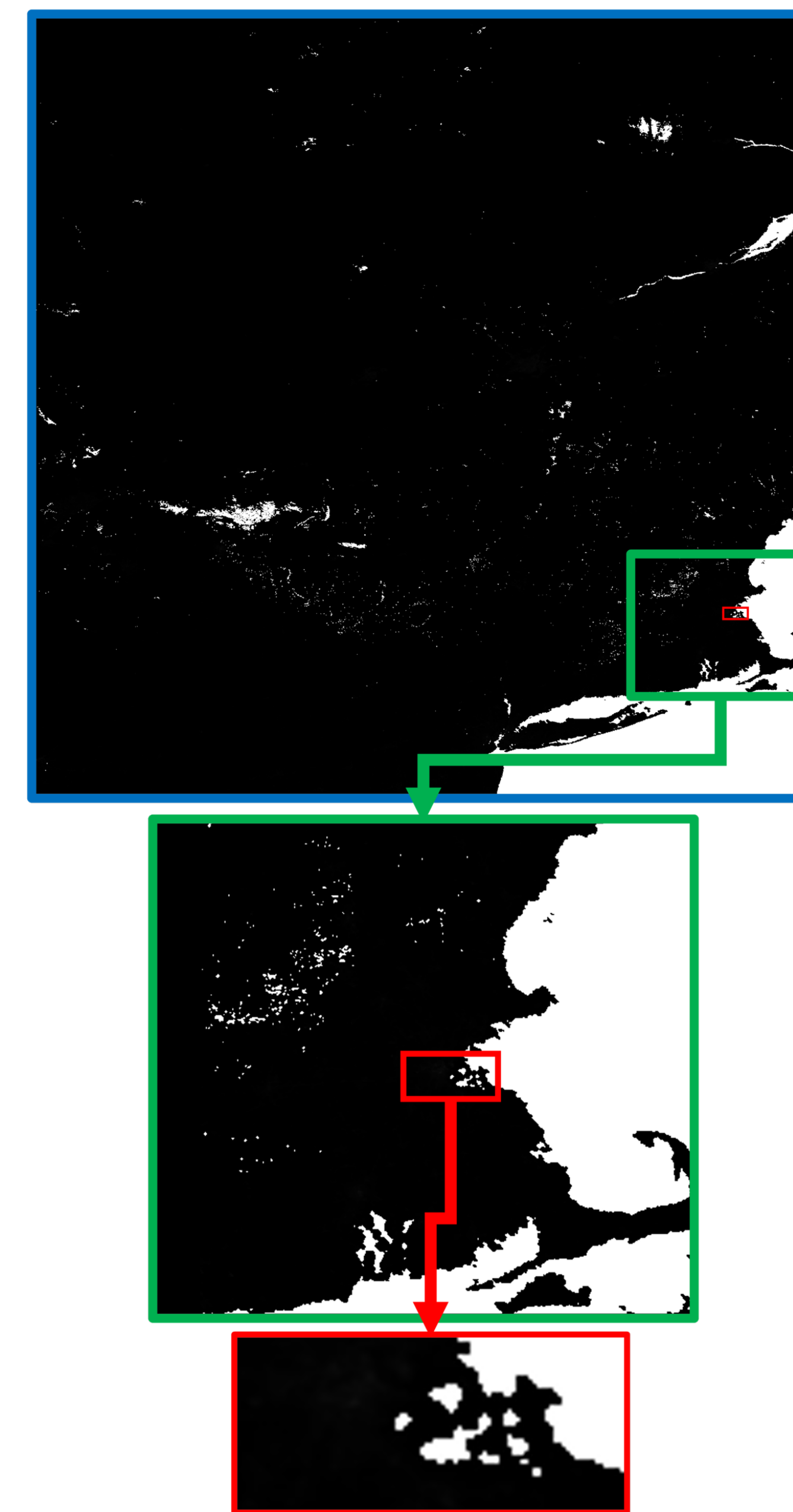
2. Dataset

VNP46A3 - VIIRS/NPP Lunar BRDF-Adjusted Nighttime Lights Monthly L3 Global 15 arc second Linear Lat Lon Grid

Overview	Product Information	Data Availability
Shortname:	VNP46A3	
Platform:	Suomi-NPP	
Instrument:	VIIRS	
Processing Level:	Level-3	
Data Format:	HDF5	
Spatial Resolution:	15 arc-second	
Temporal Resolution:	monthly	
ArchiveSets:	5000	
Collection:	NPP VIIRS collection 1.0 (ArchiveSet 5000)	
PGE Number:	PGE556	
File Naming Convention:	Syntax: ESDT.AYYYYDDDD.hXXVYY.VID.YYYYDDHHMMSS.Format Example: VNP46A3.A2020032.h08v05.001.2021125043819.h5 <ul style="list-style-type: none"> ESDT Earth Science Data Type or Shortname A Stands for Acquisition YYYYDDDD Data acquisition year and Day-of-year per the Julian Calendar hXXVYY Horizontal and Vertical Tile Identifiers VID Version ID of the data collection YYYYDDHHMMSS Processing year, Day-of-year, UTC time (hour, minutes, seconds) Format File format suffix, which in the above case represents HDF5 	
Keywords:	SNPP VIIRS, Lunar BRDF-Adjusted Nighttime Lights, Monthly composite, 15 arc-second, L3 Grid	

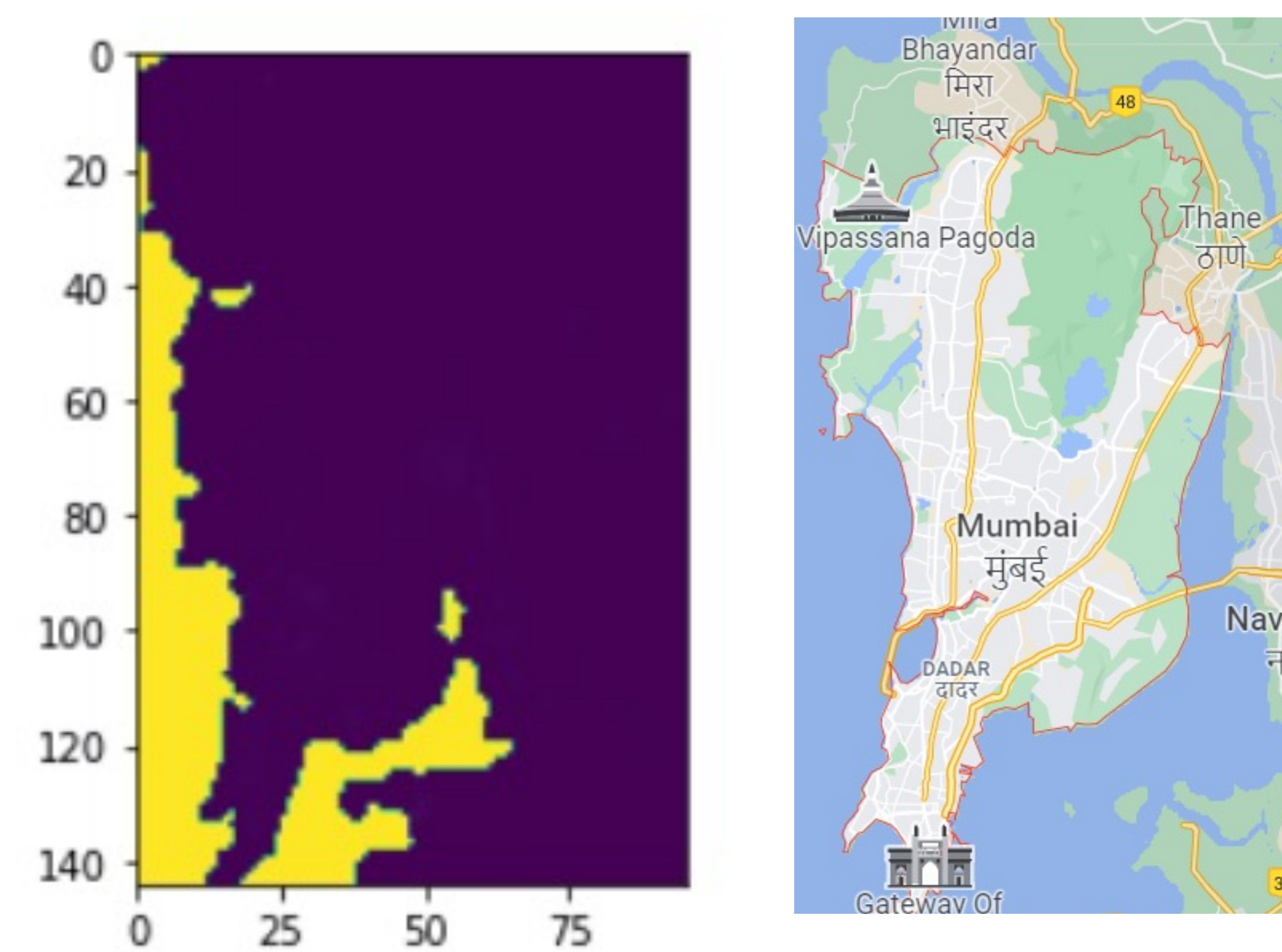
This dataset aggregates satellite images of the nighttime sky over the course of a month and contains over 300 GB of data.

3. Data Masking

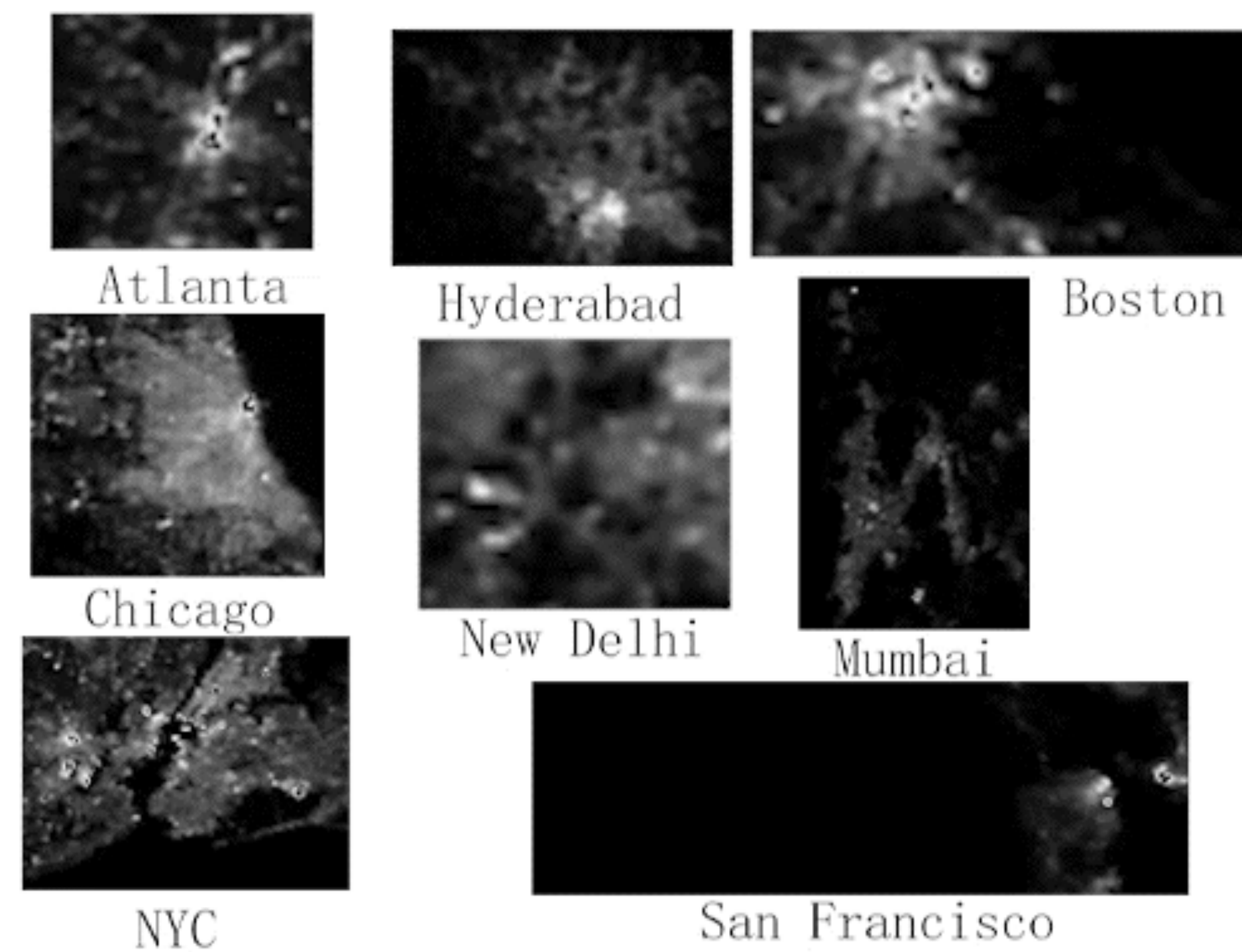


NASA tile H10V04 contains Boston, which is a fraction of the size of the grid square. In the future, we could crop a ragged outline of the city, to more closely capture its nightlights.

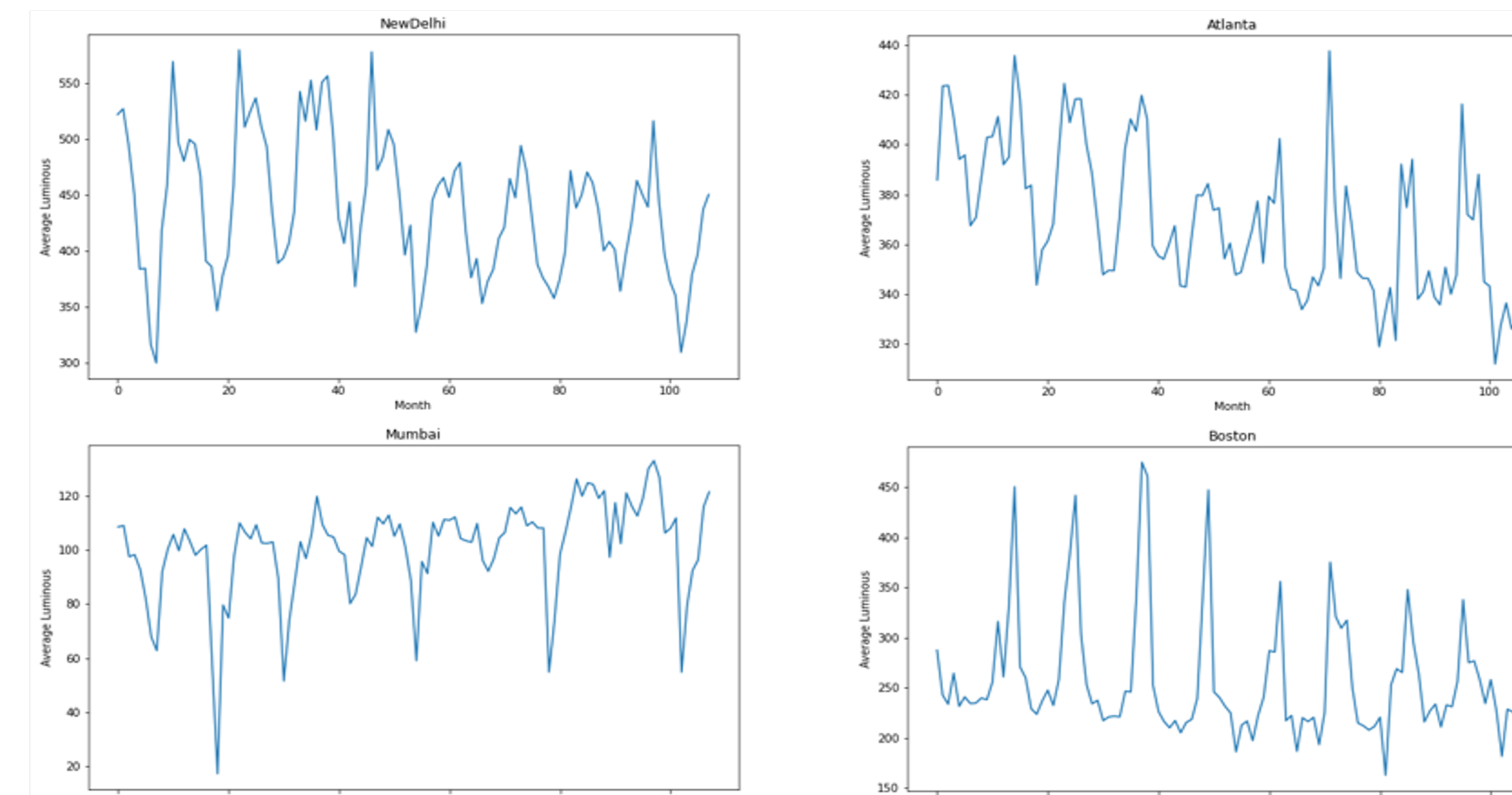
4. Data Transformation



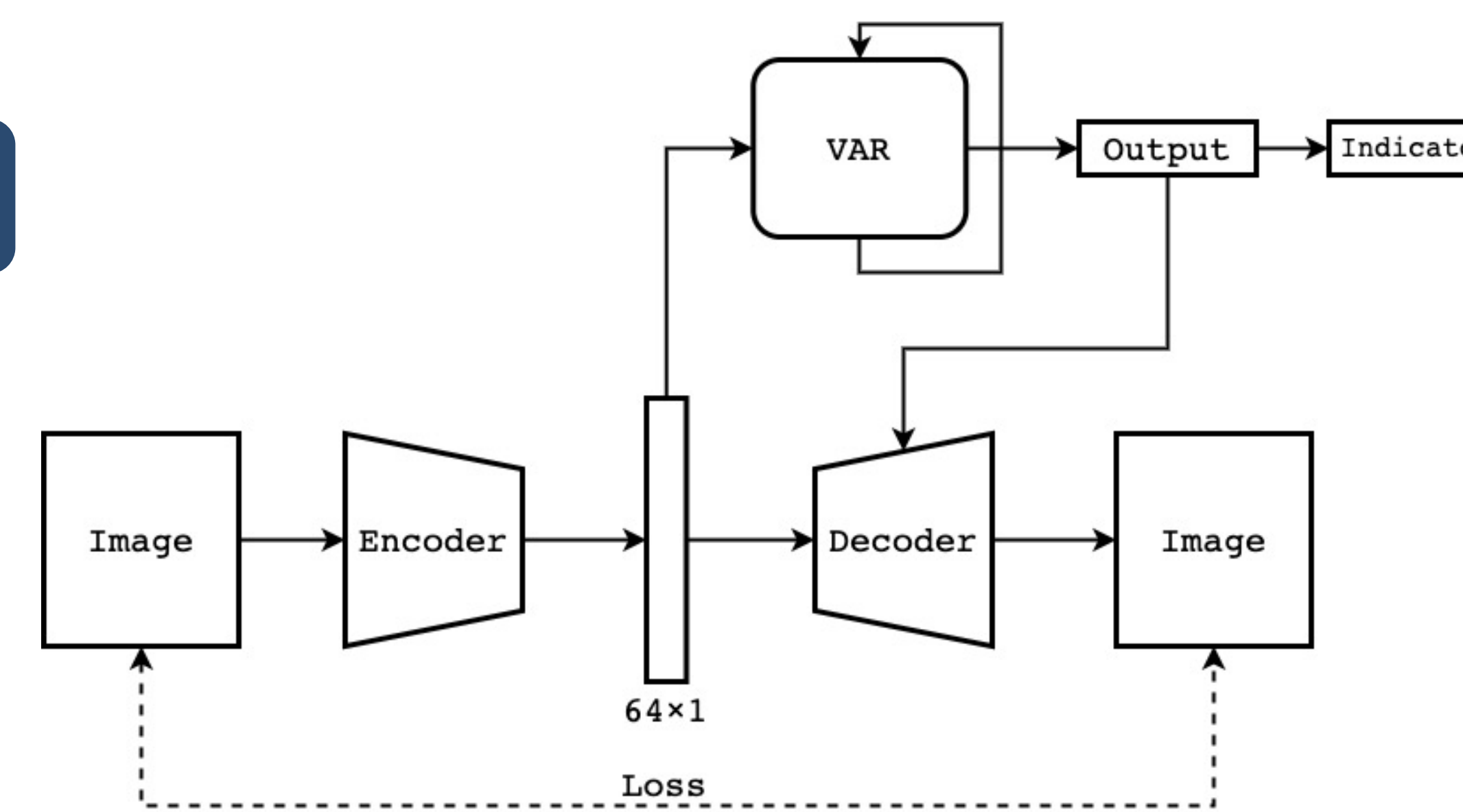
Exploratory data analysis revealed that NASA fills values for bad quality data or if the solar zenith angle $< 108^\circ$. So, we re-scaled the values to reveal luminescence as shown in the following figures.



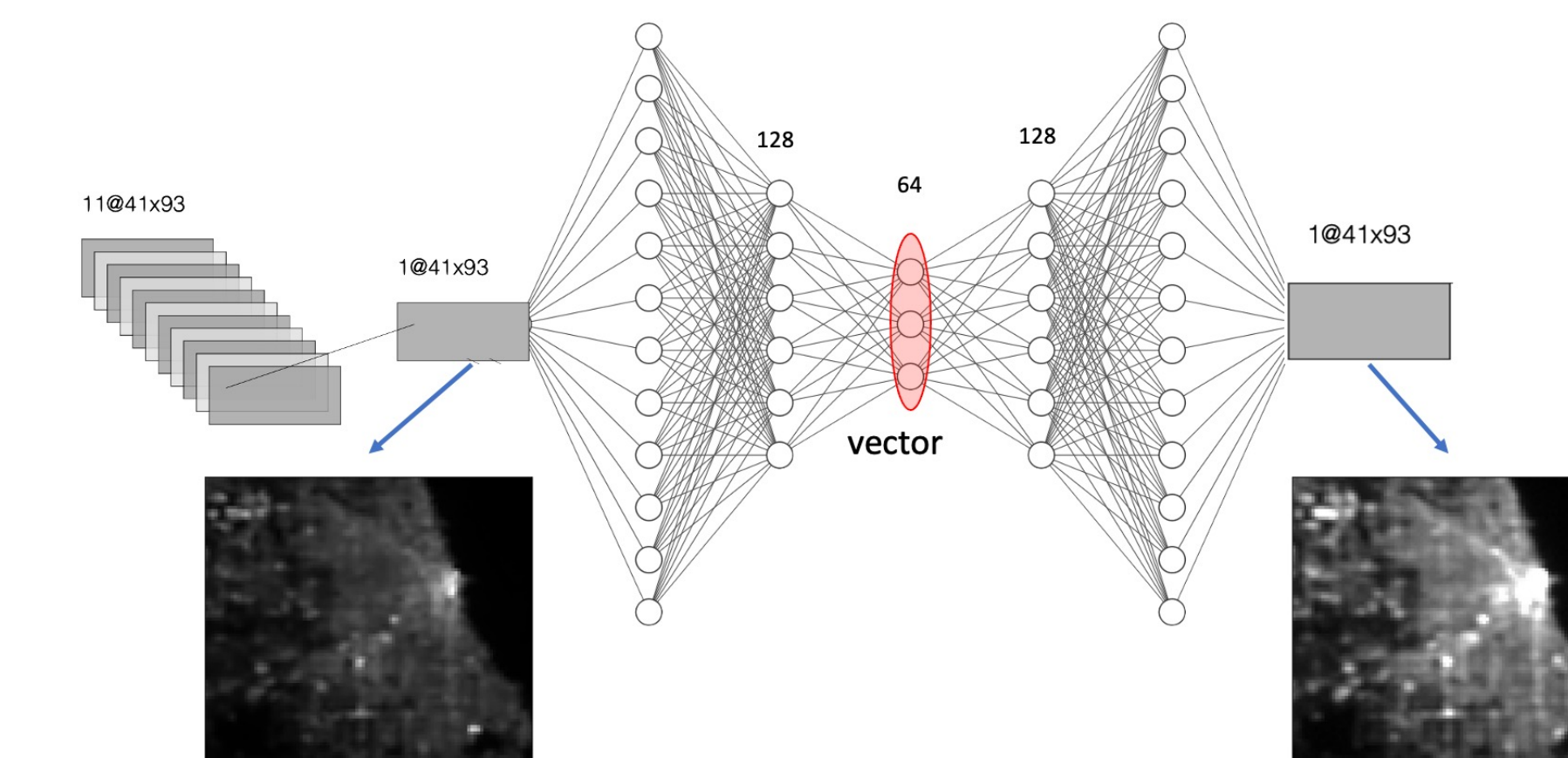
Computing the total luminescence over time for the cities in question reveals the following trends.



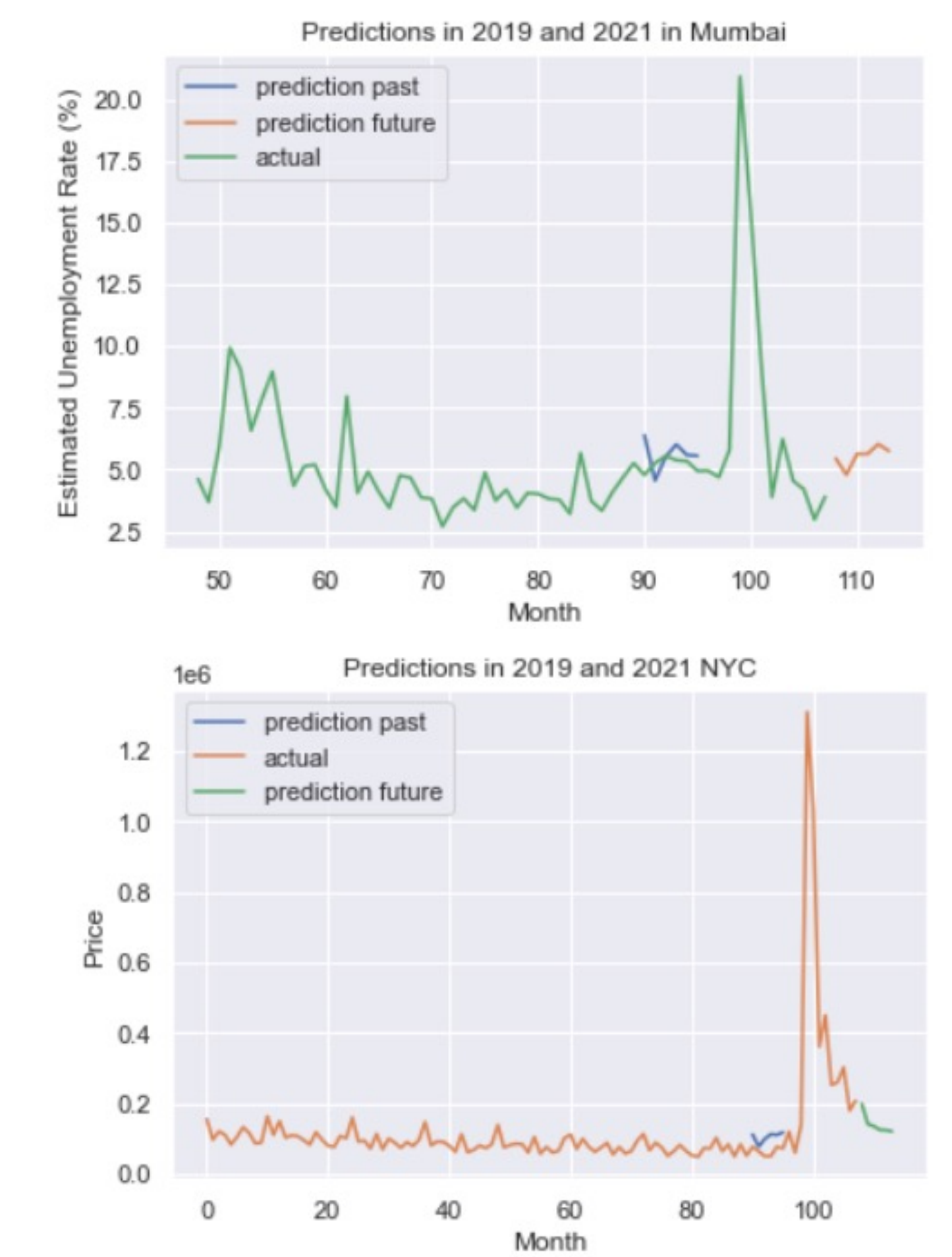
4. Modeling



Our system encodes images as vectors and forecasts those vectors into the future. Then, it combines forecasts with economic indicators to produce predictions and decodes the vectors back into images of future nightlights.



5. Results



Our system succeeds in producing commercial alpha using city nightlights as a feature. Each of these plots shows our 6-months-ahead predictions of cities' economic activity.

7. Acknowledgements

We would like to thank Professors Anand and Caliskan for their continuous support and mentorship, as well as Apurv and Ajinkya at MacroX for their guidance throughout the project.

8. References

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