

ReliefOps.ph: A Decision Support System for the Prepositioning and Allocation of Supplies for Disaster Relief

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Context: Extreme Weather Events in the Philippines

- An average of 20 typhoons enter the Philippine Area of Responsibility every year
- The Philippines is one of the countries most susceptible to climate change -> stronger, more destructive typhoons

Typhoon Frequency

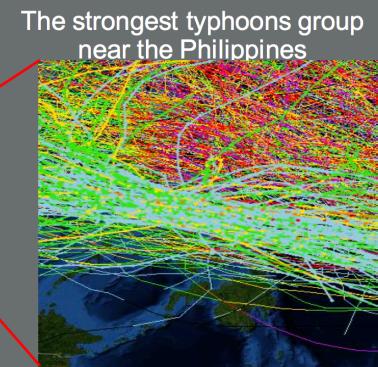
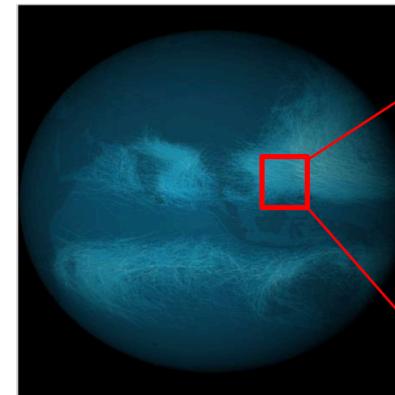


Image courtesy of NOAA

Extreme Weather Events

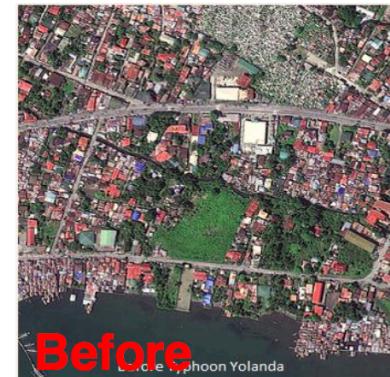


Image courtesy of DigitalGlobe

Context: Disaster Response Framework

- PH adopts the UN cluster approach in coordinating disaster response
- National Disaster Risk Reduction Management Council (NDRRMC) coordinates cross-regional disaster operations
- Cluster that manages food and non-food items in relief operations is led by the Department of Social Welfare and Development (DSWD)

Context: Disaster Response Framework

- In preparation for an incoming typhoon, NDRRMC utilizes Pre-Disaster Risk Assessment (PDRA)
- ReliefOps.ph was developed to serve as a decision support system that can be used during PDRA

Pre-disaster

Meeting by cluster leaders

Projected affected regions and provinces are determined

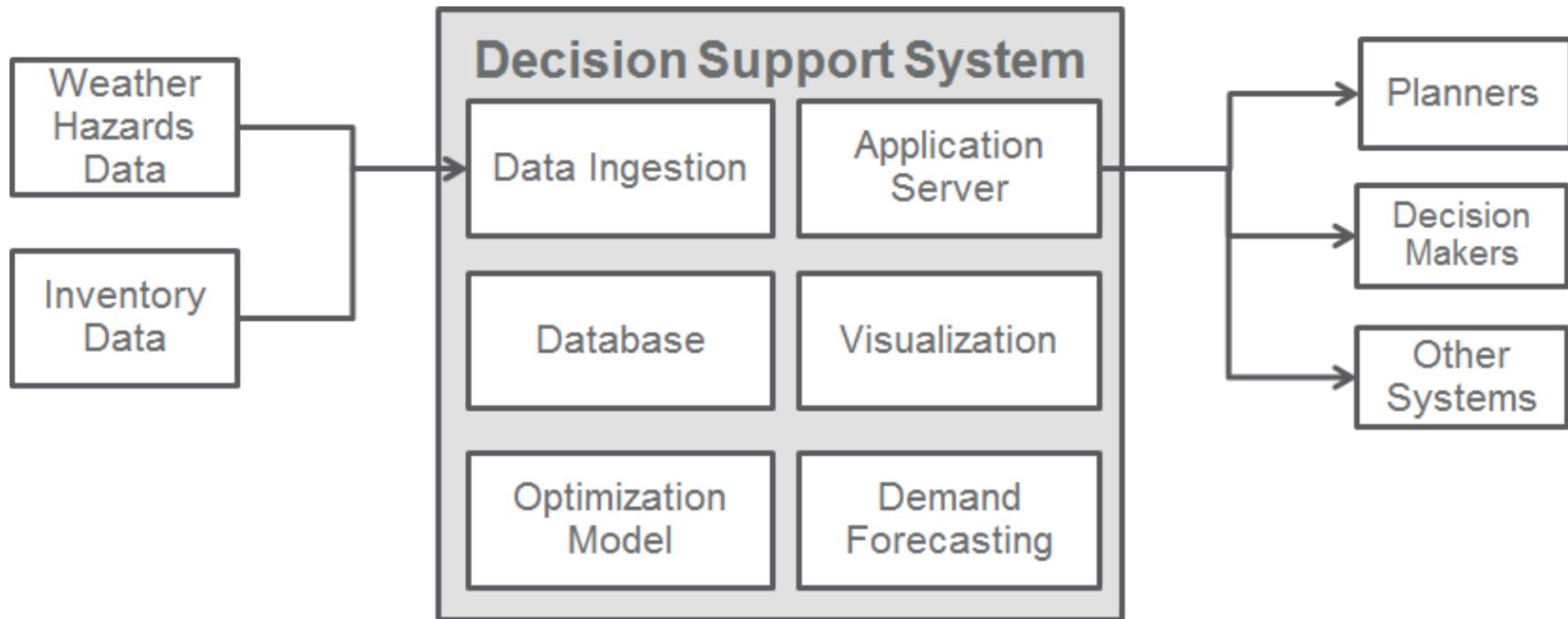
Information conveyed to local government units

Regional governments pre-position family food packs (autonomously)

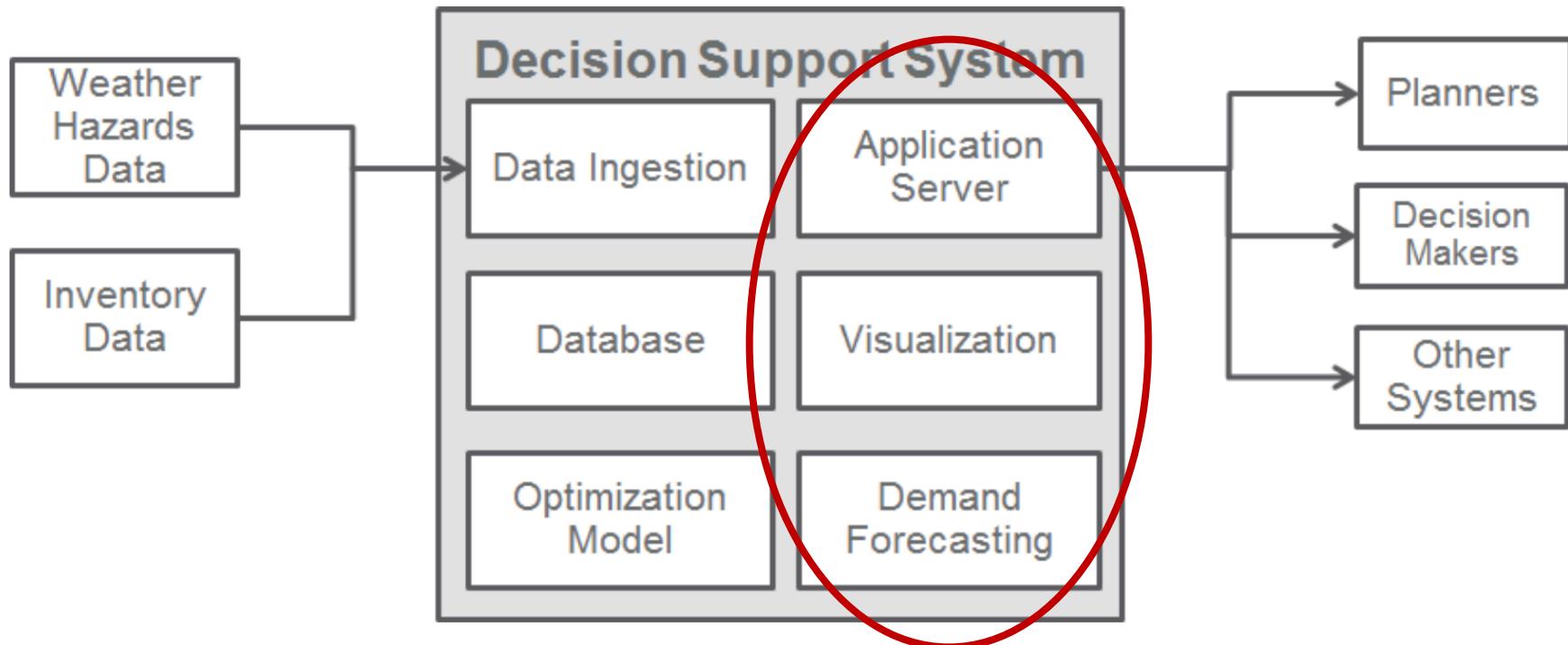
System Overview

The screenshot displays the ReliefOps.PH website interface. At the top, there's a navigation bar with links for HOME, FEATURES, TEAM, WORKSHOP, and FORECAST. Below the navigation is a large banner featuring a black and white photograph of people in relief operations gear. The banner text reads "DECISION-SUPPORT TOOL FOR HUMANITARIAN LOGISTICS" and "MAXIMIZE COVERAGE. MINIMIZE BACKLOG." A "LOGIN" button is visible. In the center, a monitor shows a detailed map of the Philippines and surrounding regions, with a specific area highlighted in red. A sidebar on the left of the monitor screen is titled "INCIDENT MANAGER" and includes options like "MAP", "INCIDENT", "New Incident", "Load Incident", "List of Incidents", and "Export". Below the monitor, four cards describe system features: SCENARIO PLANNING (Consider multiple possible disaster scenarios), DEMAND FORECAST (Predict affected population and demand for relief supplies), PRE-POSITIONING (Recommend optimal prepositioning or relief supplies), and DISTRIBUTION (Recommend optimal distribution of supplies).

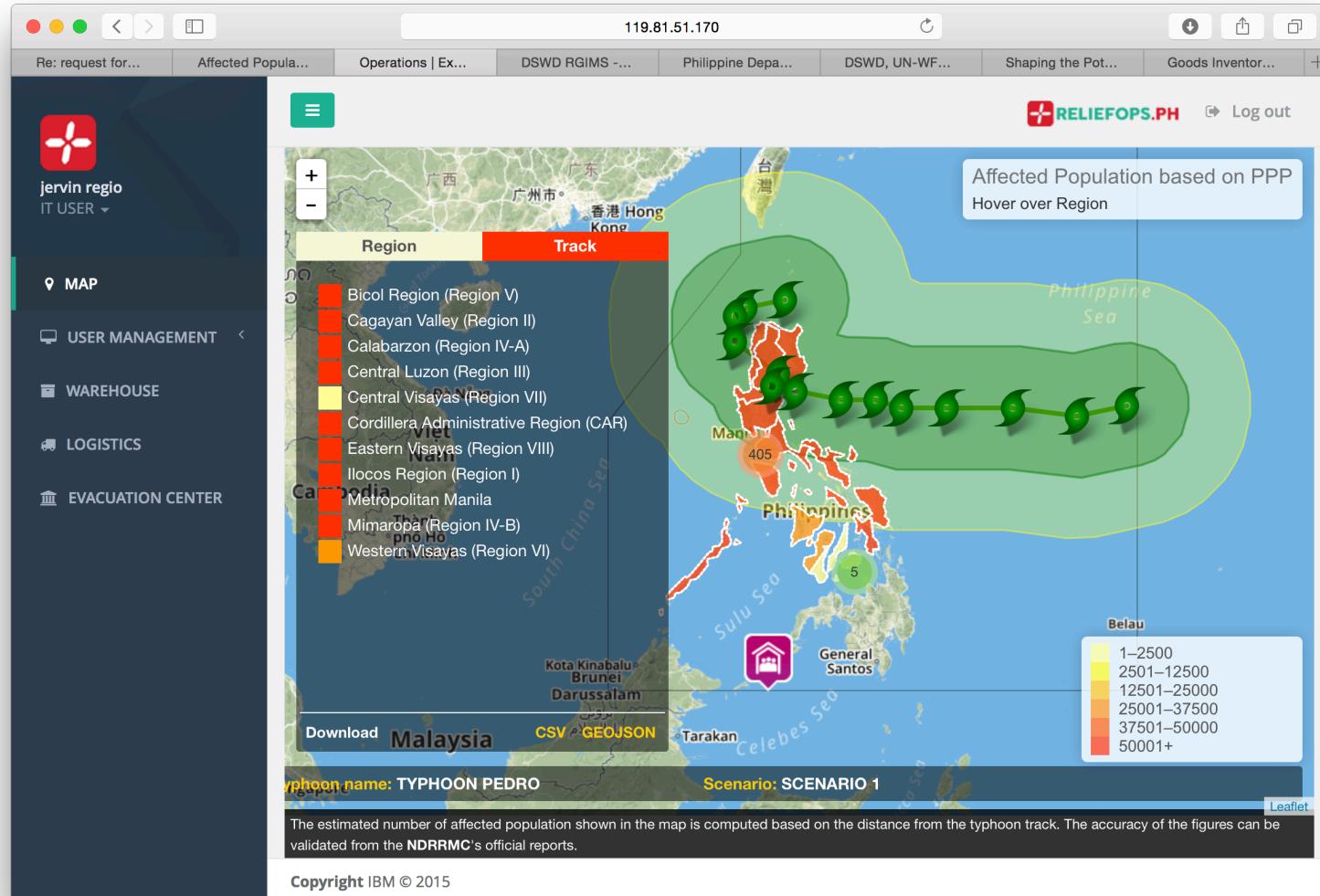
System Overview



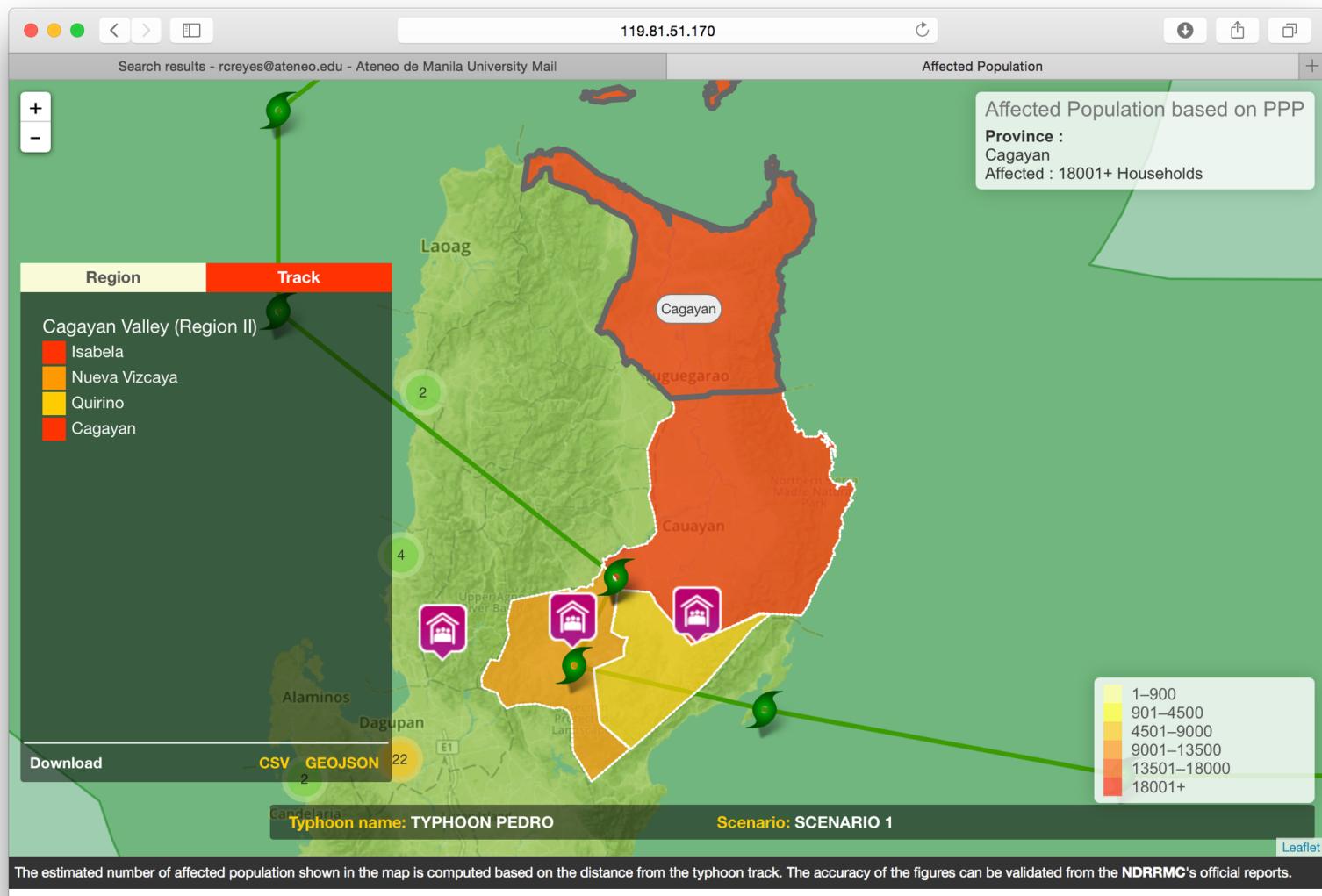
System Overview



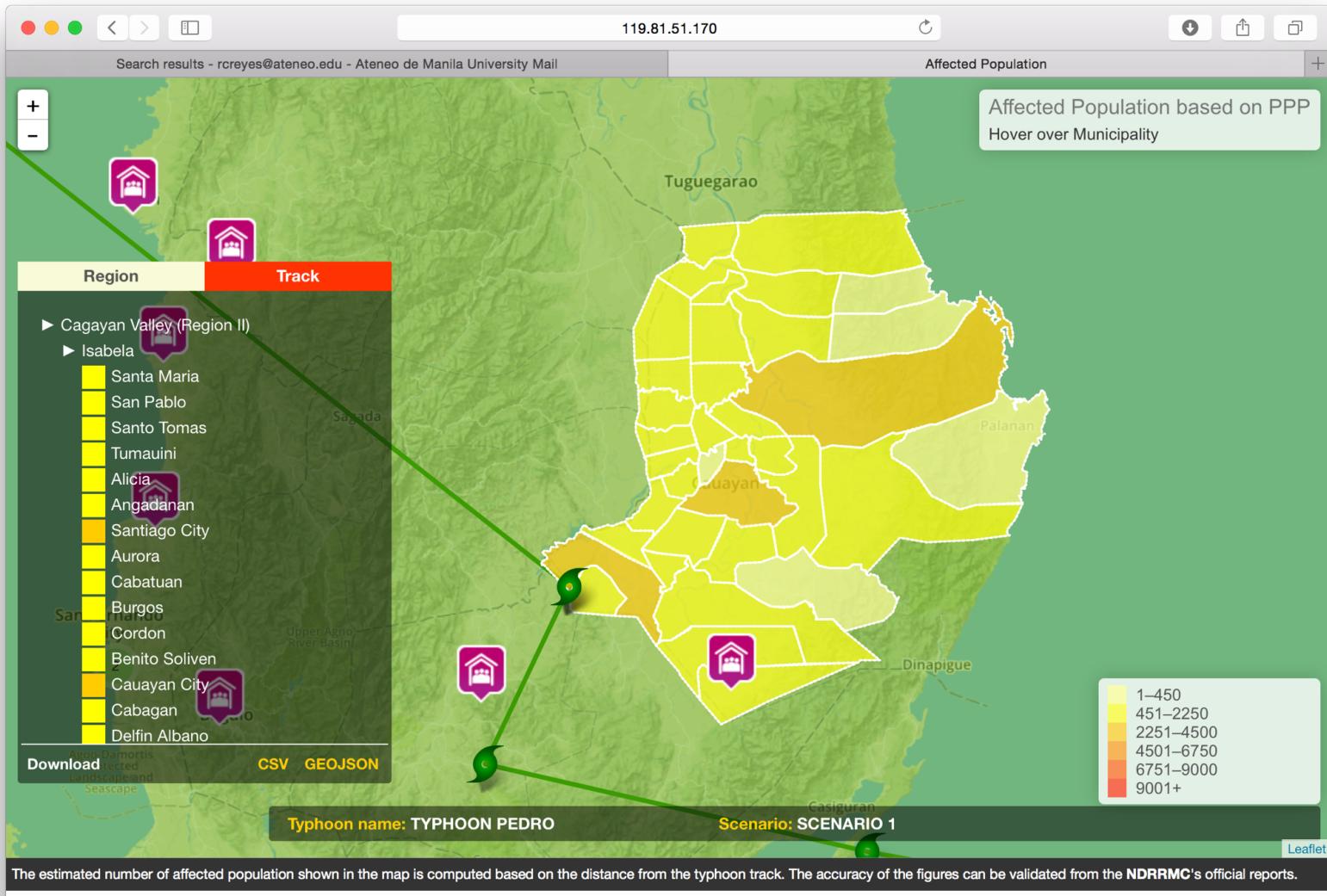
Demand Forecasting



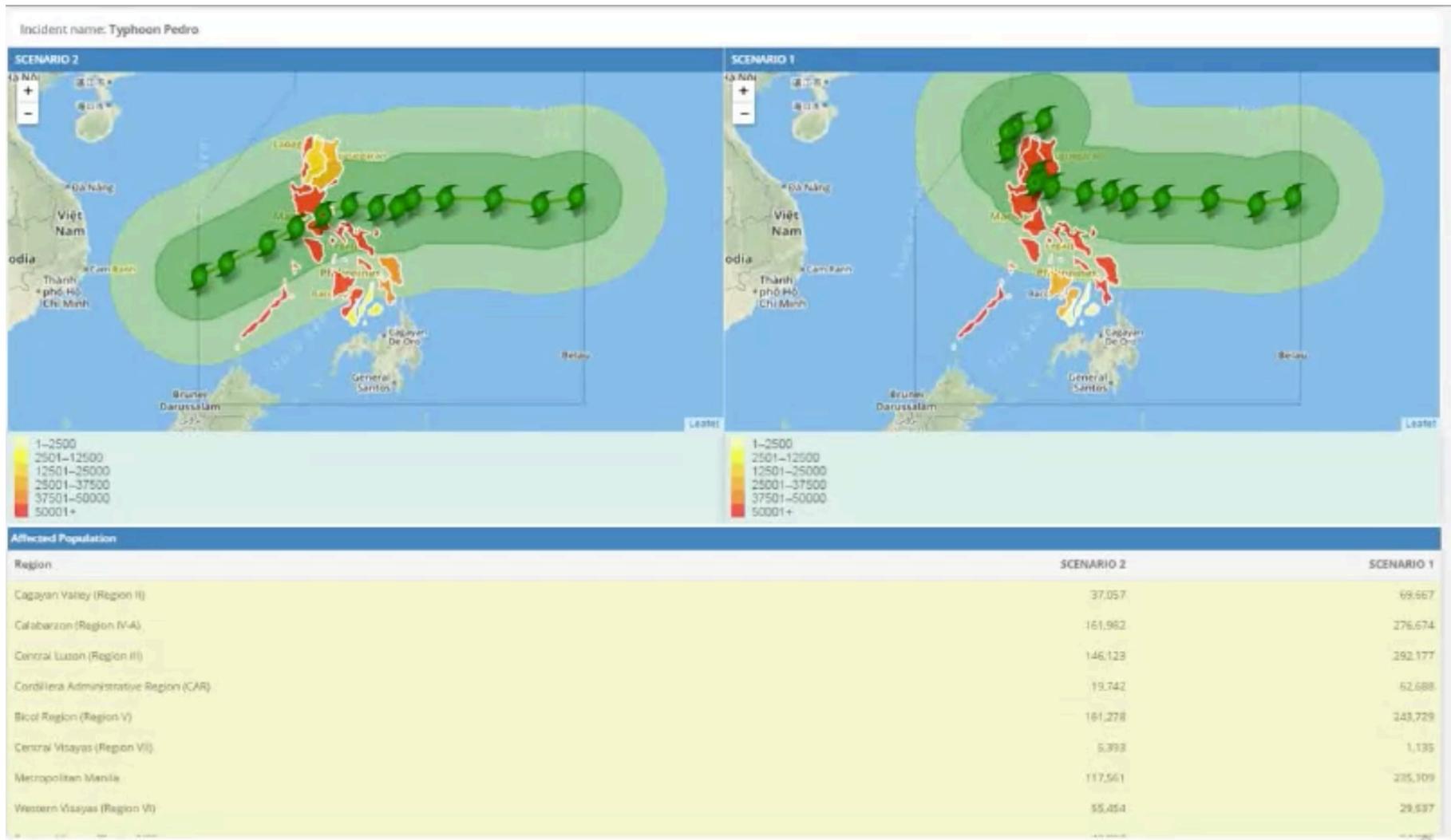
Demand Forecasting



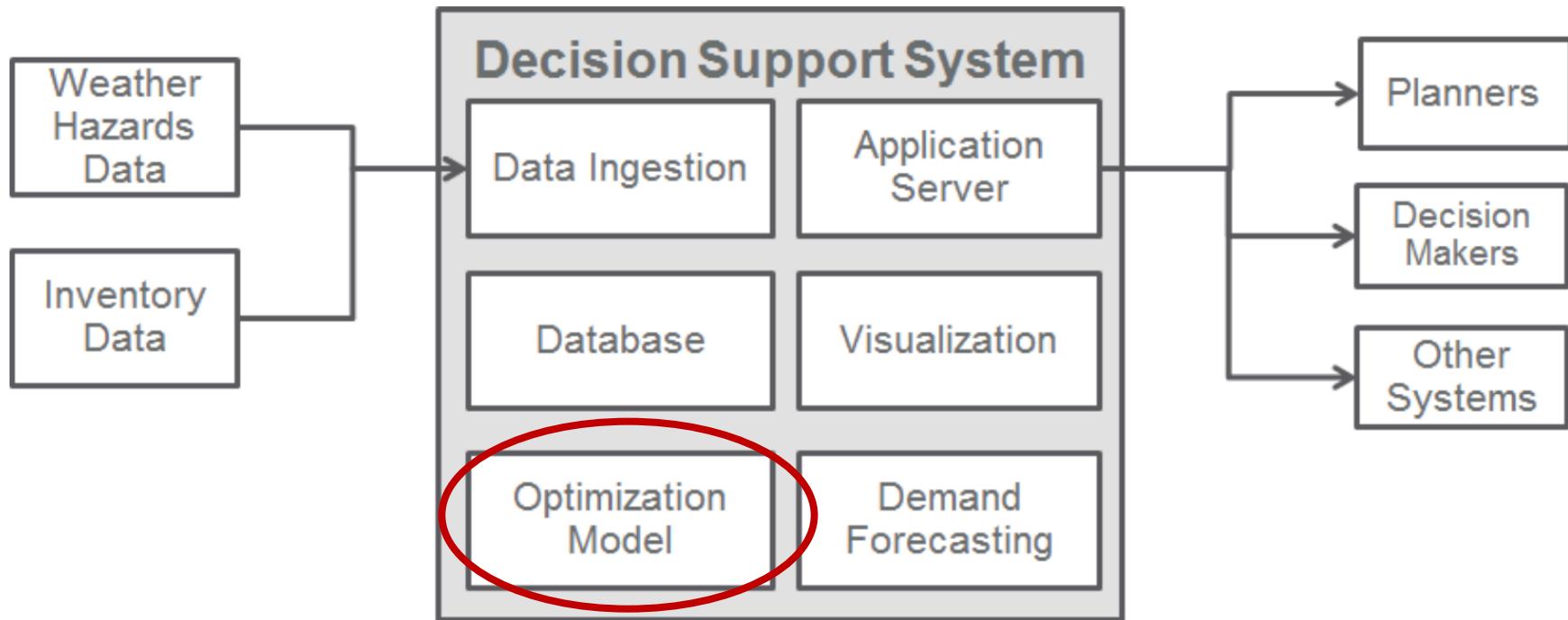
Demand Forecasting



Demand Forecasting - Scenario Analysis

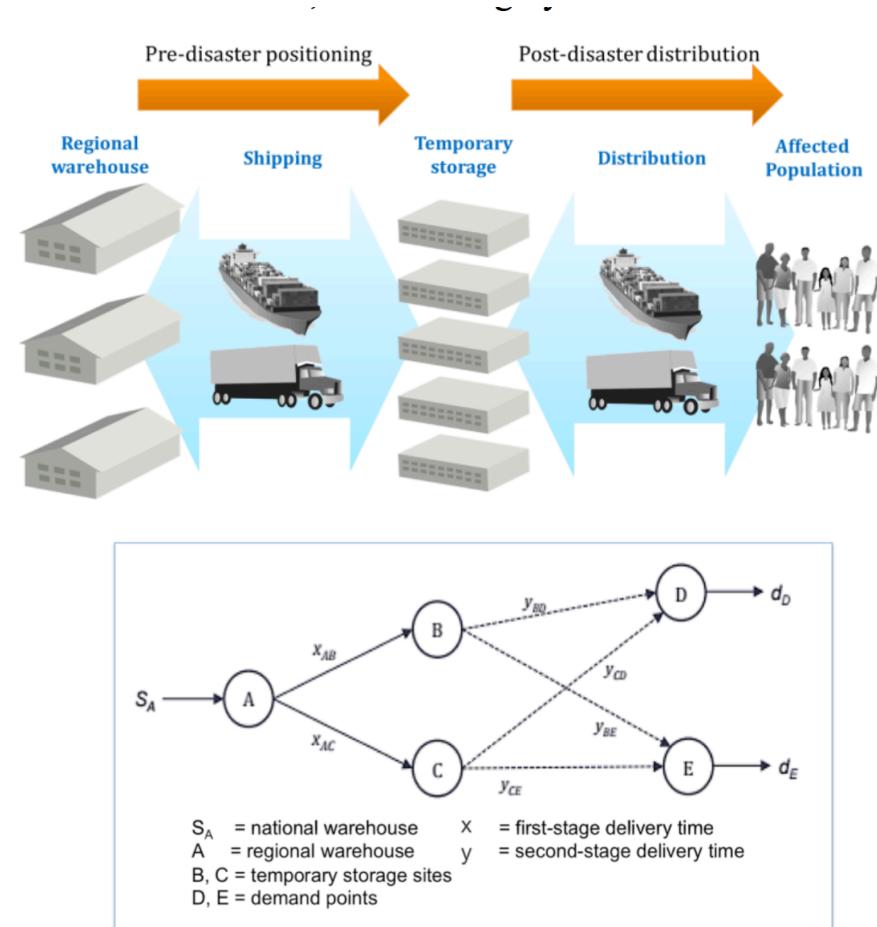


System Overview

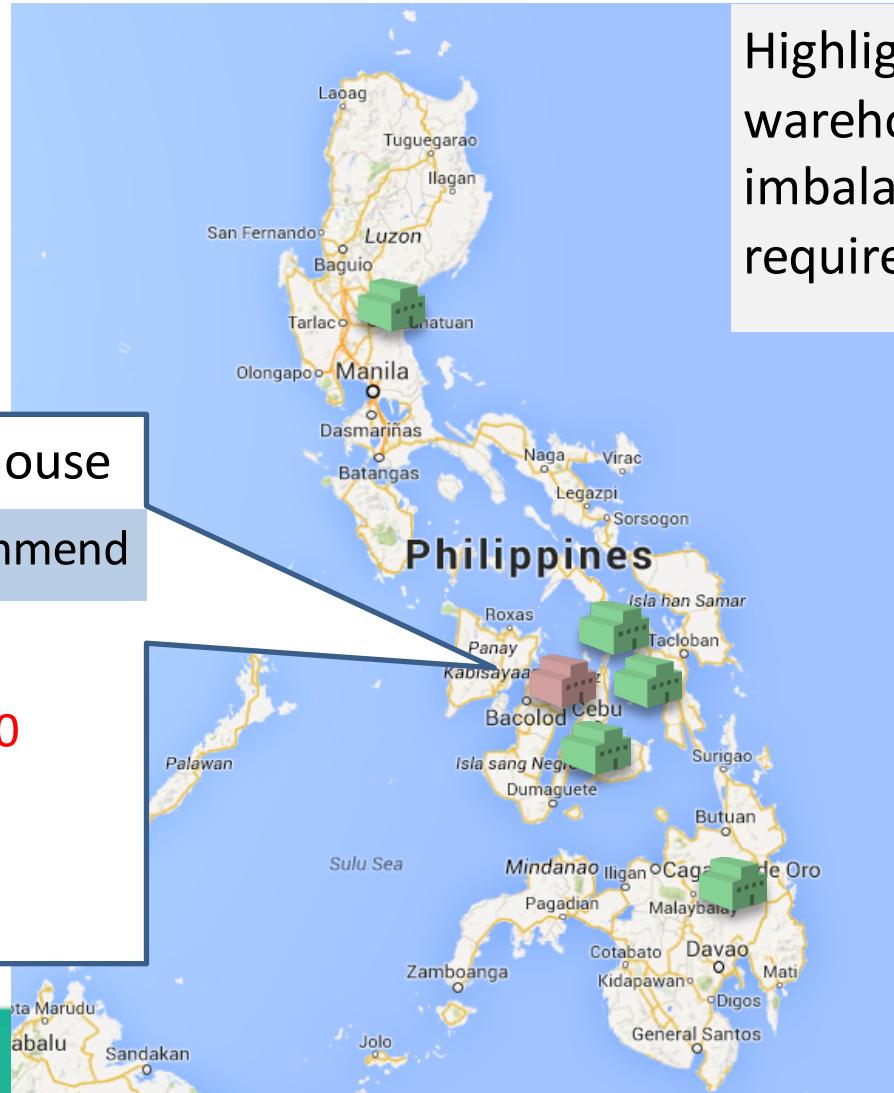


Optimization for Pre-positioning of Relief Goods

- Two-stage robust model for pre-positioning under uncertain typhoon path developed by collaborator Dr. Joline Uichanco (Univ. of Michigan)
- Robust optimization algorithm currently implemented in CPLEX with Python wrapper (using CPLEX Python API)



Optimization for Pre-positioning of Relief Goods

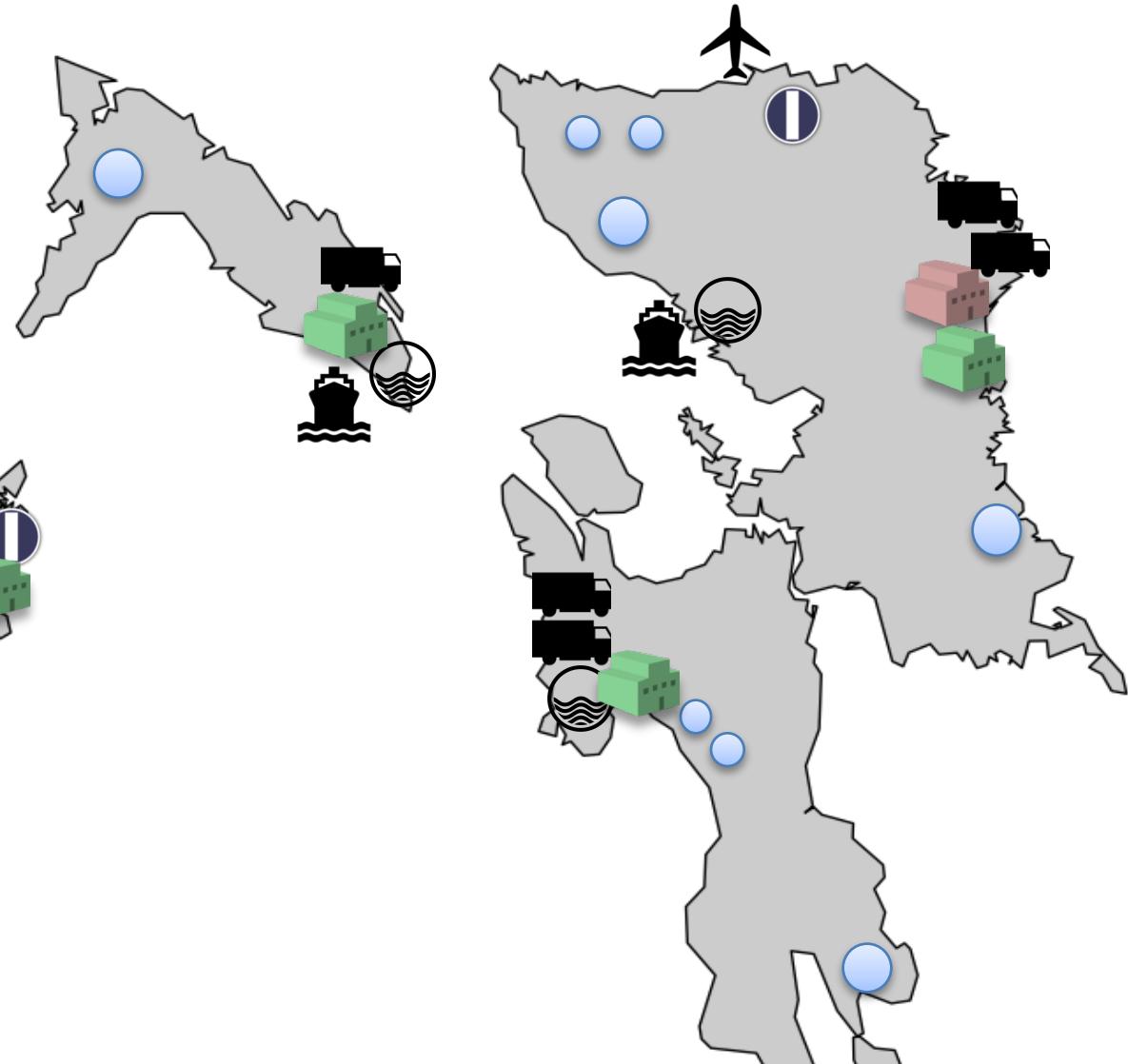
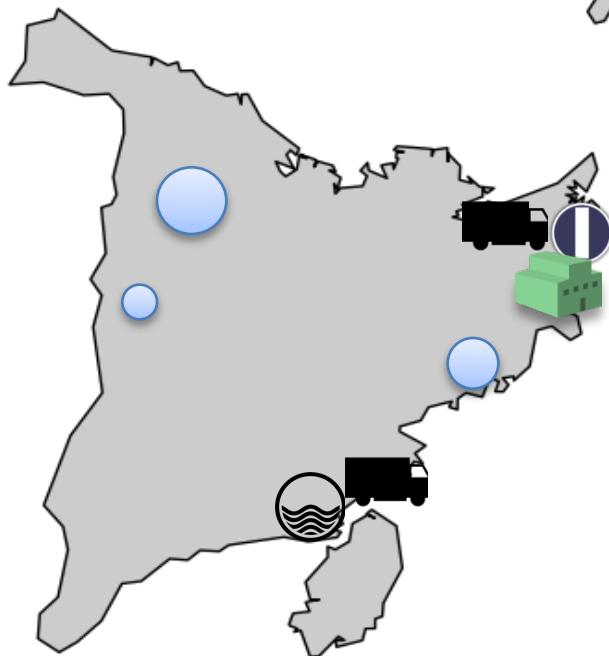


Highlights which warehouses have imbalanced items and require action.

Summary and Outlook

- ReliefOps.ph is a web-based decision support system designed to aid in the pre-disaster planning of typhoon relief operations in the Philippines
- R&D efforts needed to improve the predictive and prescriptive models used (e.g. for demand forecasting: incorporate historical data, hazard maps)
- Stakeholder engagement needed to improve usability and potential for integration within existing protocol

Allocation Scheme



Data Ingestion: Affected Population Statistics

The image displays two overlapping windows. The foreground window is a web application interface titled 'Reports' under 'Juan Dela Cruz INCIDENT MANAGER'. It shows fields for 'Incident Name', 'Report Date', 'Report Number', and 'Configuration'. Below these is a large 'Upload File' section with a 'Drop files here' placeholder and a 'Submit' button. A blue arrow points from this section towards the background window. The background window is an Excel spreadsheet titled 'FO1 TY Lando 17 Oct 2015 0835pm e'. The spreadsheet contains data about evacuation centers, specifically for Ilocos Sur, including columns for 'NAME OF EVACUATION CENTERS', 'FAMILIES', 'PERSONS', and 'PLACE OF ORIGIN'. The 'Report No. 4' tab is selected.

STATUS OF EVACUATION CENTERS			
		Report No. 4	
		As of October 17, 2015	
		STATUS OF E.C.s	
TYPE OF DISASTER: Tropical Storm "Lando"			
DATE OF OCCURRENCE: August 18, 2015			
PLACE OF EVACUATION CENTER	NUMBER OF E.C.s	SERVED	PLACE OF ORIGIN
PROVINCE/CITYES	CUM NOW	NAME OF EVACUATION CENTERS	FAMILIES PERSONS
MUNICIPALITIES		CUM NOW	CUM NOW
Ilocos Sur			
Burgos	1 1	Bessang Elementary School, Burgos, Ilocos Sur	66 66 280 280
Total Ilocos Sur	1 1		66 66 280 280
GRAND TOTAL	1 1		66 66 280 280