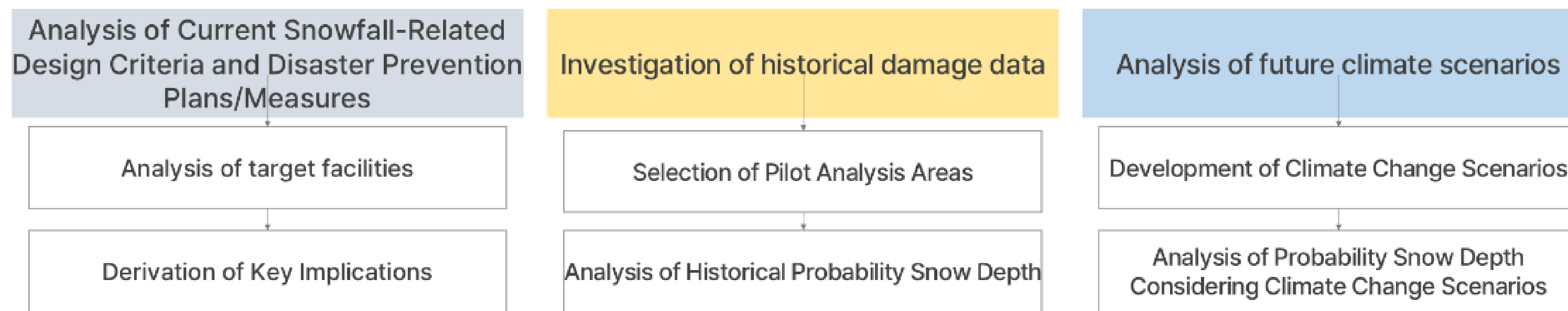


1. Introduction

- Recent climate change has led to an increase in the frequency of natural disasters, while heavy snowfall events have shown a distinct trend toward greater intensity and extremity.
- In South Korea, a record-breaking heavy snowfall event occurred in November 2024 across parts of the Seoul metropolitan area, including Yongin-si, Gyeonggi-do, marking the heaviest snowfall in 117 years. This event caused extensive damage, particularly to horticultural and specialty crop facilities such as plastic greenhouses.
- Currently, South Korea provides snow load-related design criteria through the Korean Building Code, which applies a 100-year return period, and the design criteria for horticultural and specialty crop facilities, which apply a 30-year return period. However, these criteria are primarily based on historical observation data and do not sufficiently account for the effects of climate change.

2. Research Methodology & DB Construction

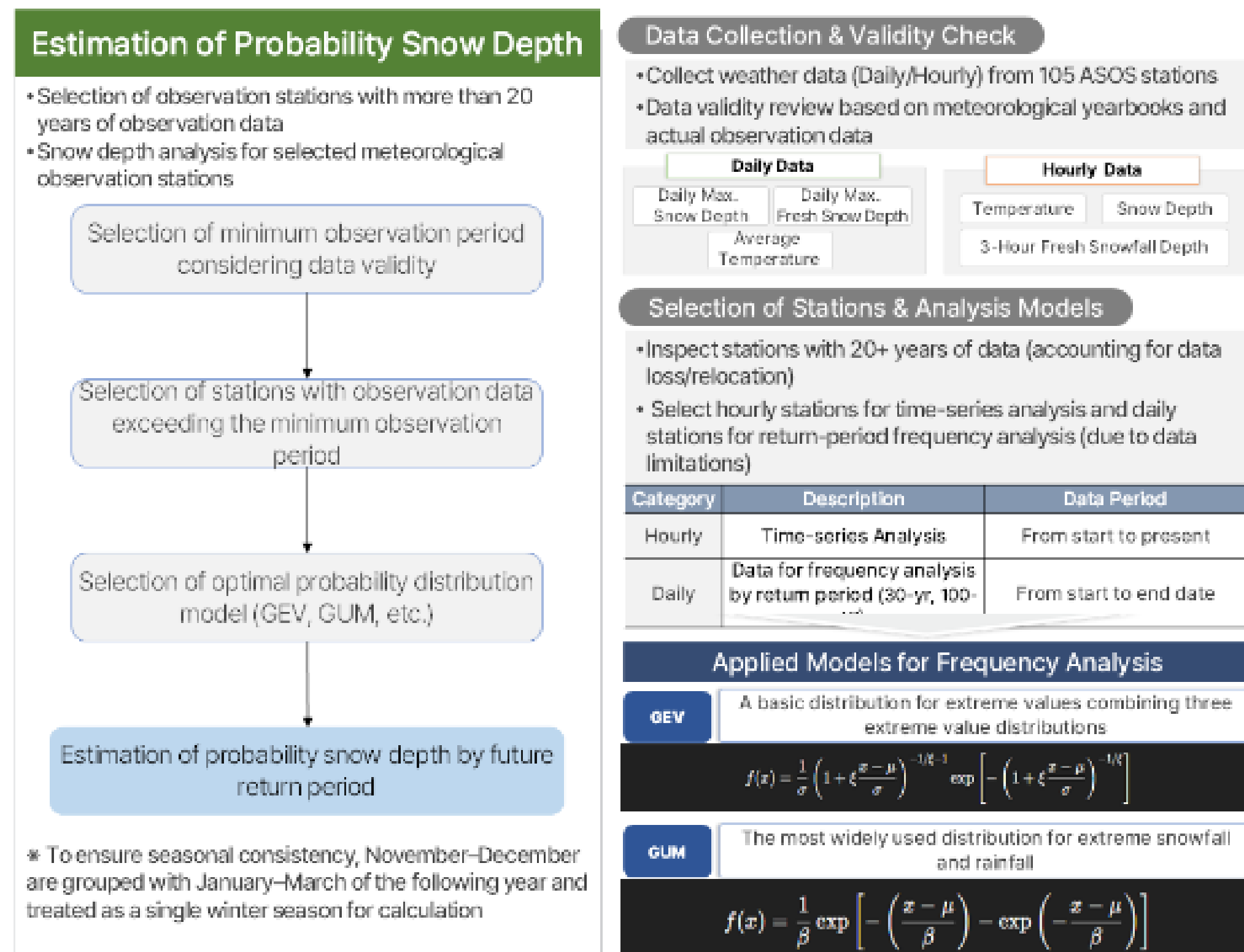
Research Methodology



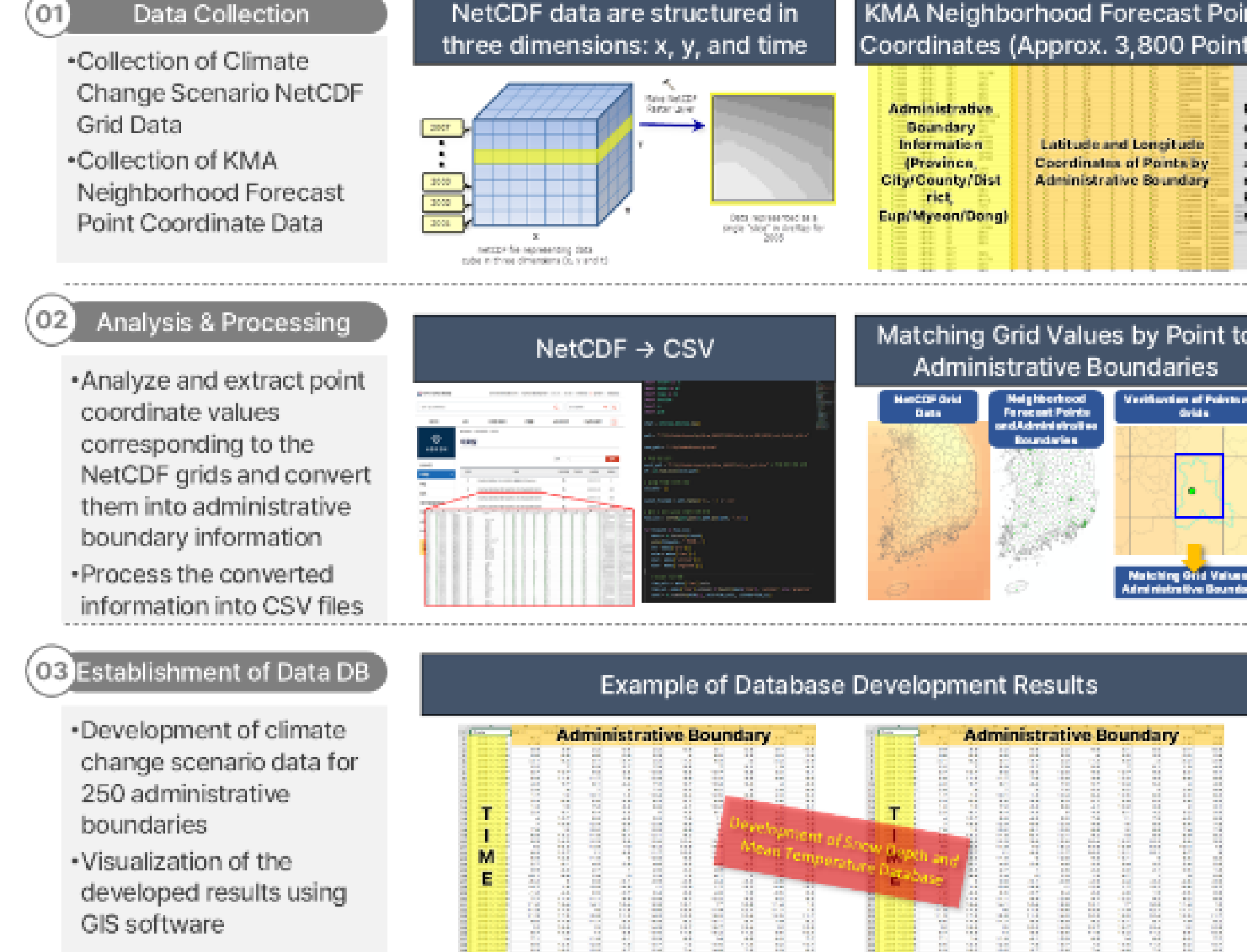
Comparison and Analysis of Current vs. Future Frequency Results

Development of Historical Observation Data DB and Climate Change Scenario DB

Development of Historical Observation Data DB



Development of Climate Change Scenario Data



3. Analysis Results

Derivation of key implications through the investigation and analysis of snowfall-related disaster prevention facility types and design criteria

MOIS Status and Key Insights: Comprehensive Natural Disaster Mitigation Plan

- The Comprehensive Natural Disaster Reduction Plan is the highest-level regional plan in the field of disaster prevention, established pursuant to the Countermeasures Against Natural Disasters Act, and is prepared by each local government every 10 years.
- For heavy snow disasters, candidate heavy snow disaster risk areas are selected in accordance with the risk area selection criteria.

MOIT KDS : Current Status & Implications

- Snow load is calculated by ground snow load depth for a 100-year return period.
- The current snow load calculation, in accordance with the provisions of "KDS 41 00 00 Korean Building Code," presents the minimum roof live load for 18 types of building structures.

MAFRA Status and Implications of Horticultural and Specialty Crop Facilities

- Disaster-resistant design criteria are provided based on regional design snow depth criteria with a 30-year return period.
- Target facilities include plastic greenhouses (56 types), simple mushroom cultivation houses (2 types), and ginseng cultivation facilities (20 types), with corresponding design strength criteria provided.

MOIS Status and Key Insights: Comprehensive Natural Disaster Mitigation Plan

MOIT KDS : Current Status & Implications

MAFRA Status and Implications of Horticultural and Specialty Crop Facilities

Deriving Key Implications

- Regional snow depth criteria (cm) are based on 30-year return-period snow depth.
- Design criteria reflecting regional snow depth under climate change scenarios are needed.

Comparative Analysis of Existing Design Criteria and Current Conditions Based on Probability Snow Depth by Return Period

Selection of pilot areas through the review of snow depth decrease and historical damage cases

Selection of areas with recent damage history: Yongin-si (Gyeonggi), Jangseong-gun (Jeonnam), Samcheok-si (Gangwon)

Estimation and comparison of probability snow depth for pilot areas

- Korean Building Code: Yongin-si and Jangseong-gun showed higher values, while Samcheok-si showed lower values.
- Horticultural and Specialty Crop Facilities: Frequency analysis results were lower in all three regions

Analysis Result (2005-2025): Average temperature increased by 1.5°C, Snowfall decreased by 2.9cm.

Frequency Analysis: Performed for 100-year (KDS) and 30-year (Horticultural & Special Crop Facilities) return periods.

Design Standards (KDS)	Category	Design Standards	Conversion to Unit Weight (unit: kN/m ²)	
			GEV	Gumbel
Design Standards for Horticultural/Special-purpose Facilities	Yongin-si	0.5	▲ 1.0	▲ 1.0
	Samcheok-si	2.0	▼ 1.0	▼ 1.0
	Jangseong-gun	0.5	▲ 1.0	▲ 1.0

Comparison and Analysis of Current with Future Frequency Results under Climate Change Scenarios

Survey of Current Status and Data Collection for Climate Change Scenarios

Subscription to SSP scenario NC files through an official request (SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5)

Extraction of Climate Change Scenarios

Identification of Limitations and Comparative Review

- The review results by climate change scenario indicate that snow depth decreases under all scenarios, while snowfall tends to become concentrated during specific periods.
- The nationwide analysis of current and future conditions shows that snow depth is expected to decrease relatively significantly in Seoul-Gyeonggi, Chungnam, Jeonnam, and Gangwon

Climate Change Scenarios: Nationwide Decrease in Snowfall (↓)

Development of Climate Change Scenario DB for Pilot Areas

Frequency Analysis by Return Period (100-Year, 30-Year)

Comparative Analysis of Current and Future Frequency Results

Frequency analysis by return period was conducted for the pilot areas under each climate change scenario

- (100-year return period) The results were the same across all pilot area
- (30-year return period) The results were lower across all pilot areas

Future Plan: Application to All Cities, Counties, and Districts Nationwide

Return Period	Category	Present(05-25)		Future(27-100)					
		GEV	Gumbel	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5	Unit: kN/m ²	
		GEV	Gumbel	GEV	Gumbel	GEV	Gumbel	GEV	Gumbel
100-yr Return Period	Yongin-si	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Samcheok-si	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Jangseong-gun	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
30-yr Return Period	Yongin-si	10.6	9.5	▼ 0.8	▼ 0.7	▼ 0.6	▼ 0.5	▼ 0.4	▼ 0.4
	Samcheok-si	14.9	15.0	▼ 0.6	▼ 0.6	▼ 0.7	▼ 0.6	▼ 0.5	▼ 0.4
	Jangseong-gun	17.2	17.5	▼ 0.5	▼ 0.5	▼ 0.5	▼ 0.4	▼ 0.4	▼ 0.4

4. Conclusions

- Analysis based on AR6 scenarios (SSP2.6-8.5) was conducted at a level comparable to the current design standards
- Under all climate change scenarios, snow depth decreases overall, but snowfall becomes concentrated during specific periods, with design return periods also showing a downward trend
- As snowfall data are currently available only at the East Asia scale (25.0 km), further spatial downscaling to 12.5 km and 1.0 km will be required for detailed analysis
- Because estimation methods differ across ministries and design standards, an integrated guideline is needed