Development of the the GIS-Based Population Data Conversion Program, POPCON

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Introduction

❖ The development of a GIS-based population data processing program is necessary for more efficient automatic computation of sector-specific demographics for offsite consequence analysis in probabilistic safety assessment (PSA).

❖ In the paper, , the GIS-based population data conversion program (POPCON; POPulation data CONverter) was developed to generate sector-specific demographics efficiently, using GIS-based grid population data that were recently started to provide by the National Geographic Information Institute (NGII).

❖ POPCON program has made it possible to calculate sector-wise population data by more accurately and quickly pointwise counting method rather than by relatively inaccurate area ratio method in KOSCA-POP preprocessors for creating MACCS2 input data for offsite consequence analysis.

Overview and Problem of the Population Data Processing Program

❖ KOSCA-MACCS2 code package was developed to enable site-specific consequence analysis for Korean nuclear power plant, which largely consists of three parts; 1) pre-processing modules, 2) MACCS2 execution, and 3) post-processing module.

❖ As shown in figure, KOSCA-POP program is a useful pre-processor to automatically convert site-specific sector population and land fraction into MACCS2 input in KOSCA-MACCS2, given the polar-coordinate spatial grid specified by user.
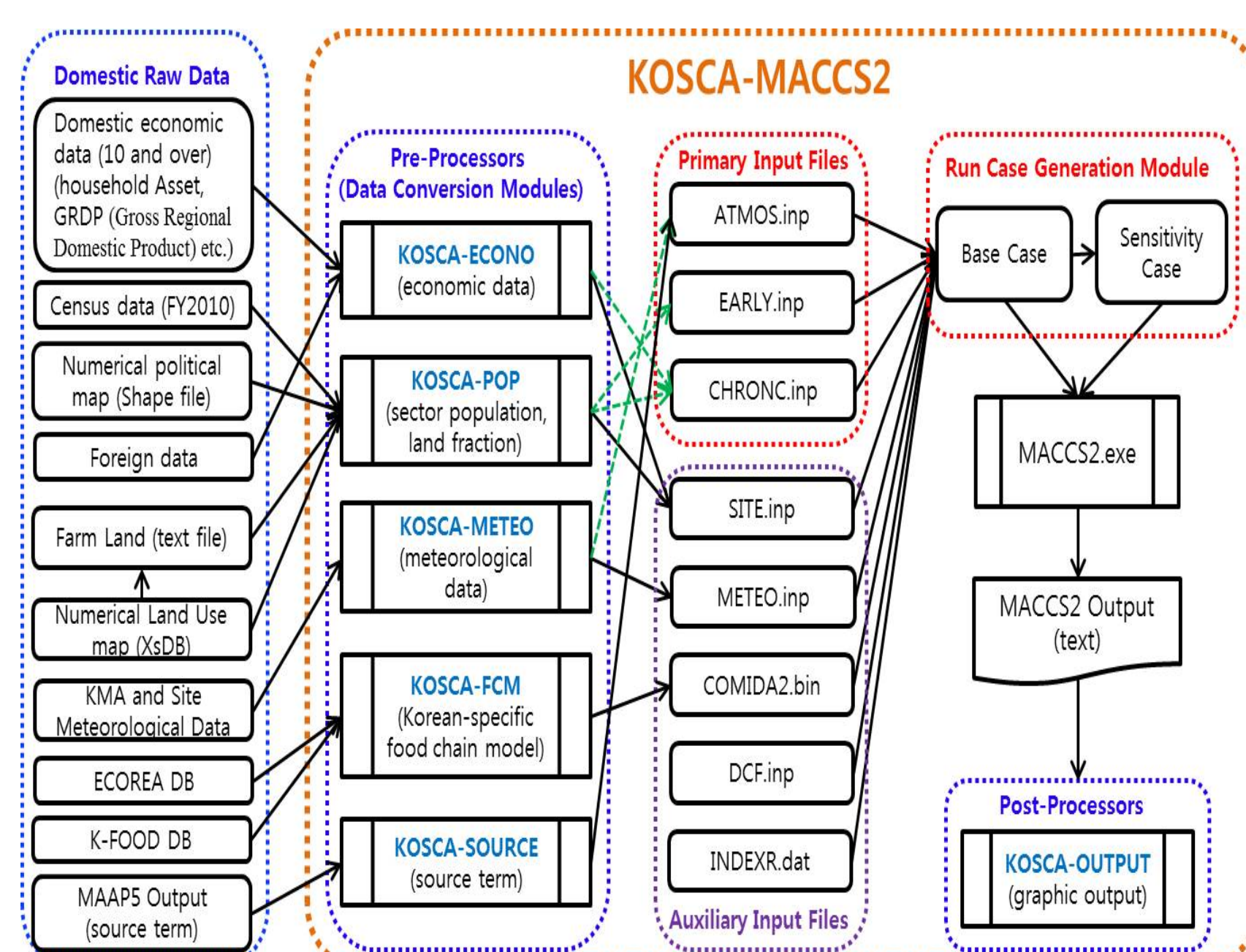
❖ Using 2010 census data and the recent digital geographic map of the administrative district, currently the sector population can be calculated by one of three methods:

- Allocation of population by the ratio of area belonging to the sector. (area-ratio allocation method)

- Allocation of population to the sector containing center point of administrative district (center point counting method)

- The use of the pointwise population data (pointwise data counting method)

❖ Of the above three methods, if the pointwise calculation method is only high in resolution of the grid population data (approximately 100m x 100m or less), it is the most efficient way in terms of accuracy and applicability.

❖ However, the current KOSCA-POP was only capable of low-resolution grid population data (1 km x 1 km non-public data) at the time of development, forcing it to adopt the area calculation method based on the census data.

❖ The big problem with the area-ratio allocation method

- Non-population areas (e.g., mountain, river, lake areas, etc.) are also allocated a number of people by the proportion of the area.

Development for the POPCON program

❖ A GIS-based population conversion program (POPCON) was developed with the primary purpose of automatically converting the national grid population data provided by the NGII (GIS-based grid population data with 100m x 100m high resolution using the GRS80 UTM-K coordinate system) into input forms used by KOSCA-POP (the Bessel ellipsoid TM central origin coordinate system, so-called Korean 1985 Modified Central Belt)

❖ Main functions of POPCON

- Converting the nationwide grid population data of the shape file format provided by NGII to the text file format of KOSCA-POP

- When converting to a text file, select the field separator and the field property (e.g., total population, female, male, population to age interval, etc.)

- Management of the population data files divided into metropolitan cities or municipalities

- Converting UTM-K coordinate systems to various user-specified coordinate systems

❖ User Interface of POPCON (left figure below)

❖ It should be noted that if the coordinate system of the recognized GIS-based national grid population data is changed in the future, the POPCON should be revised accordingly.

❖ Refer to another paper [PO6E11] for V&V of POPCON.

❖ An Illustration of the POPCON Application (right figure below)

- After the POPCON conversion to the Daejeon City lattice population data to which the research site belongs, the results of KOSCA-POP's sector-specific population data can be found to be visually error-free, with non-populated areas (e.g., mountains and lakes) calculated as zero

- Refer to another paper [PO6E11] for more illustrations of POPCON applications
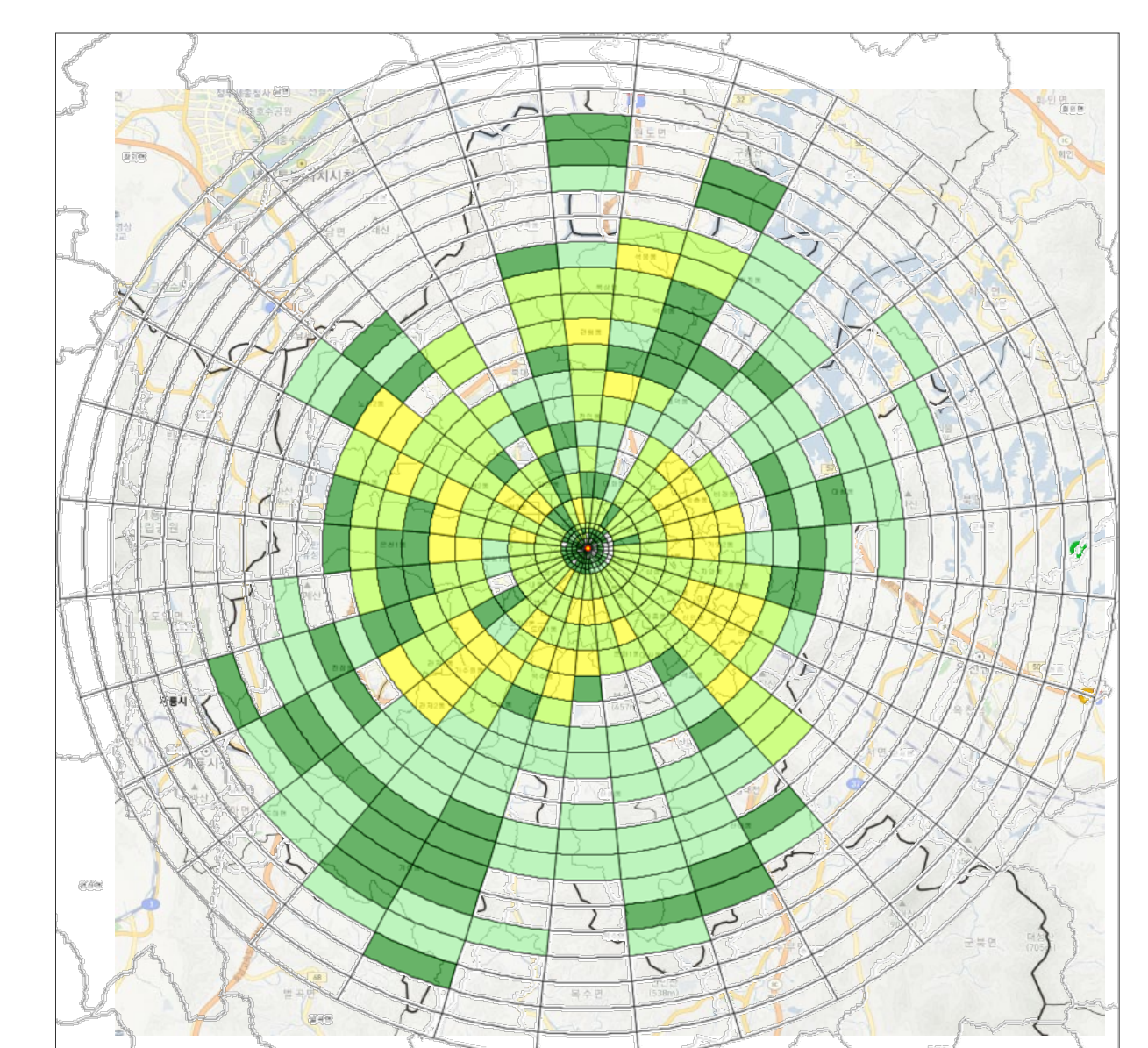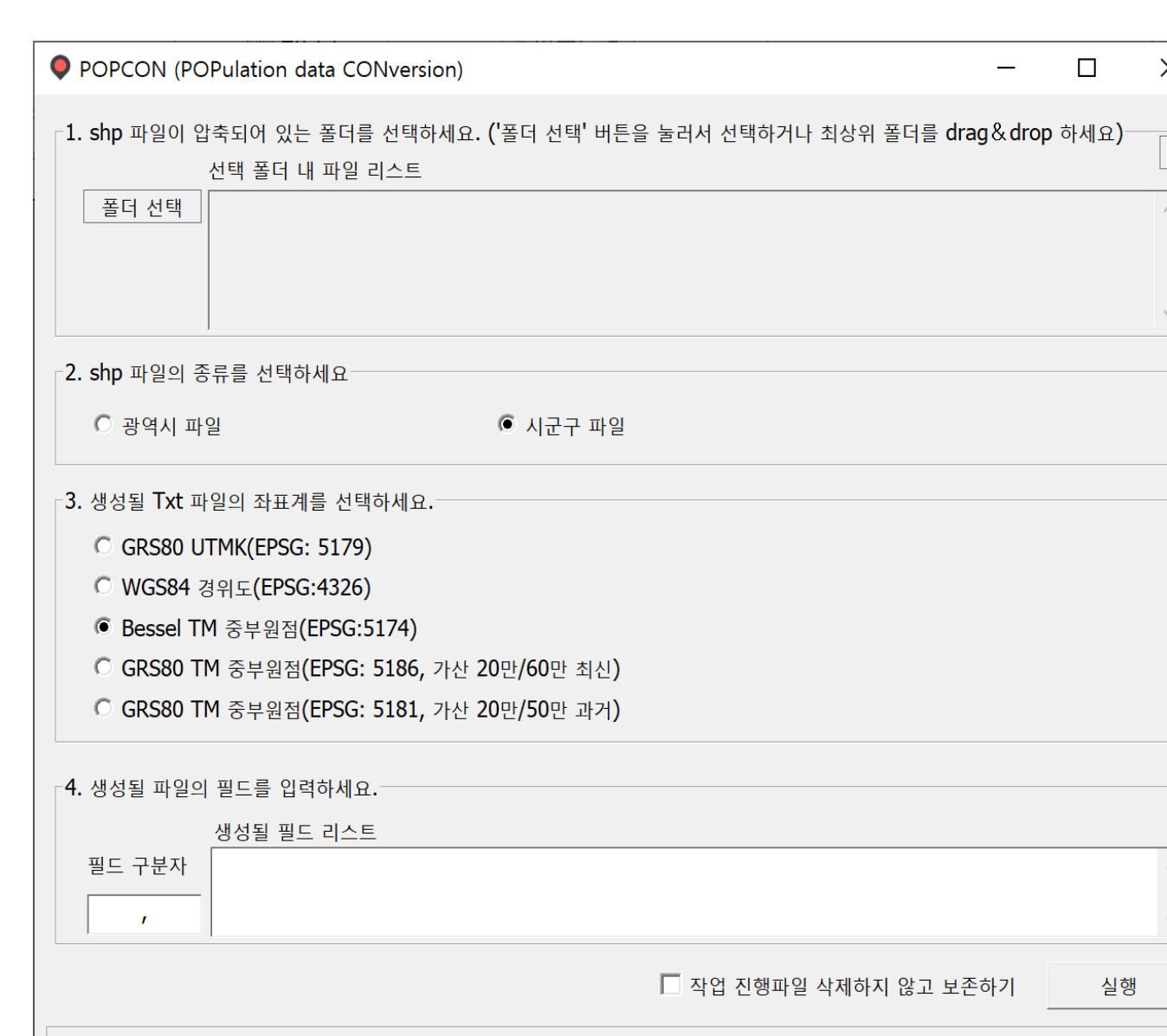
Conclusions

❖ The GIS-based population data conversion program, POPCON, was developed to generate sector demographics efficiently for off-site consequence analysis from the national grid population data provided by NGII.

❖ POPCON has made it possible to calculate sector-wise population data by more accurately and quickly pointwise counting method in KOSCA-POP preprocessors for creating MACCS2 input data for offsite consequence analysis.

❖ It can be used as a development tool for various sector-wise population input data for future offsite consequence analysis of nuclear facilities/sites.