Digital Transformation supporting a Sustainable Future

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Irish Centre for High-End Computing

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Sustainable Economy & Environment

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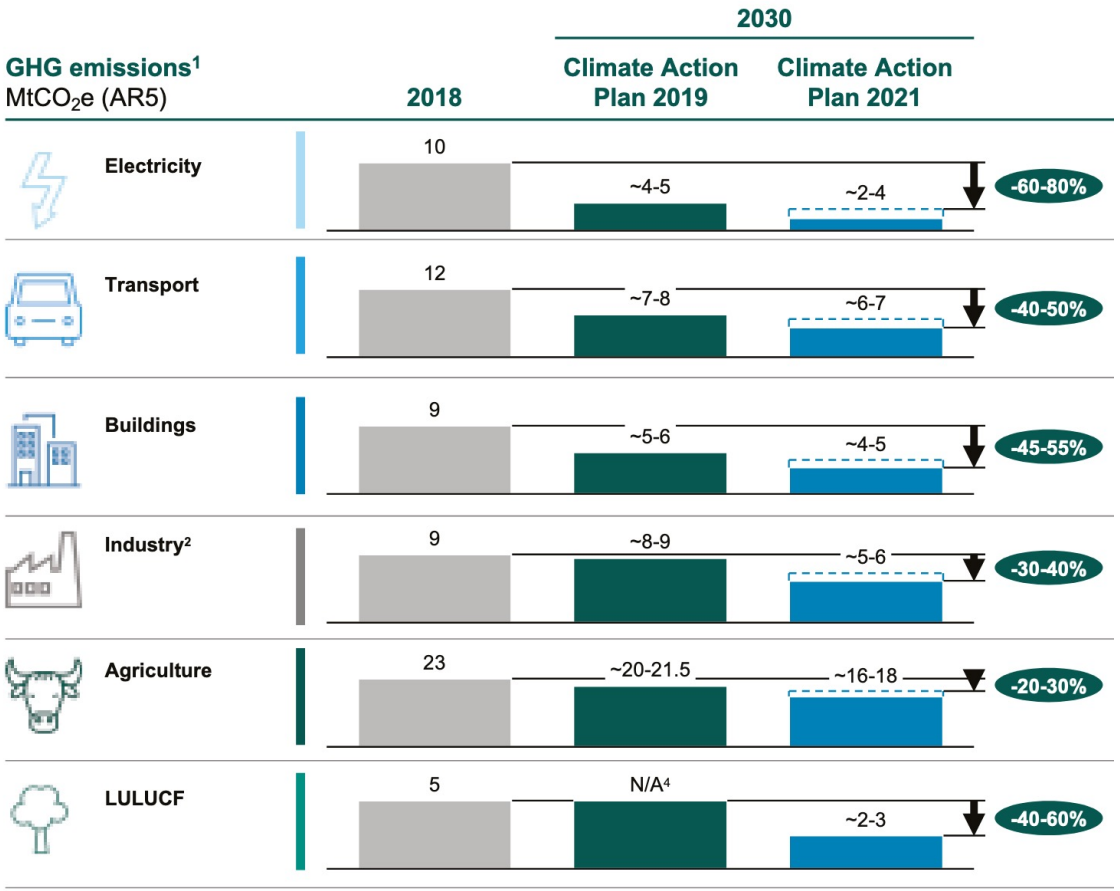
Ireland & Renewable Energy



CAP21 https://assets.gov.ie/203558/f06a924b-4773-4829-ba59-b0feec978e40.pdf

- By 2030, 80% of Ireland's electricity from renewable sources
- Ireland has highest share (38%) of onshore wind energy in its electricity mix of any European country

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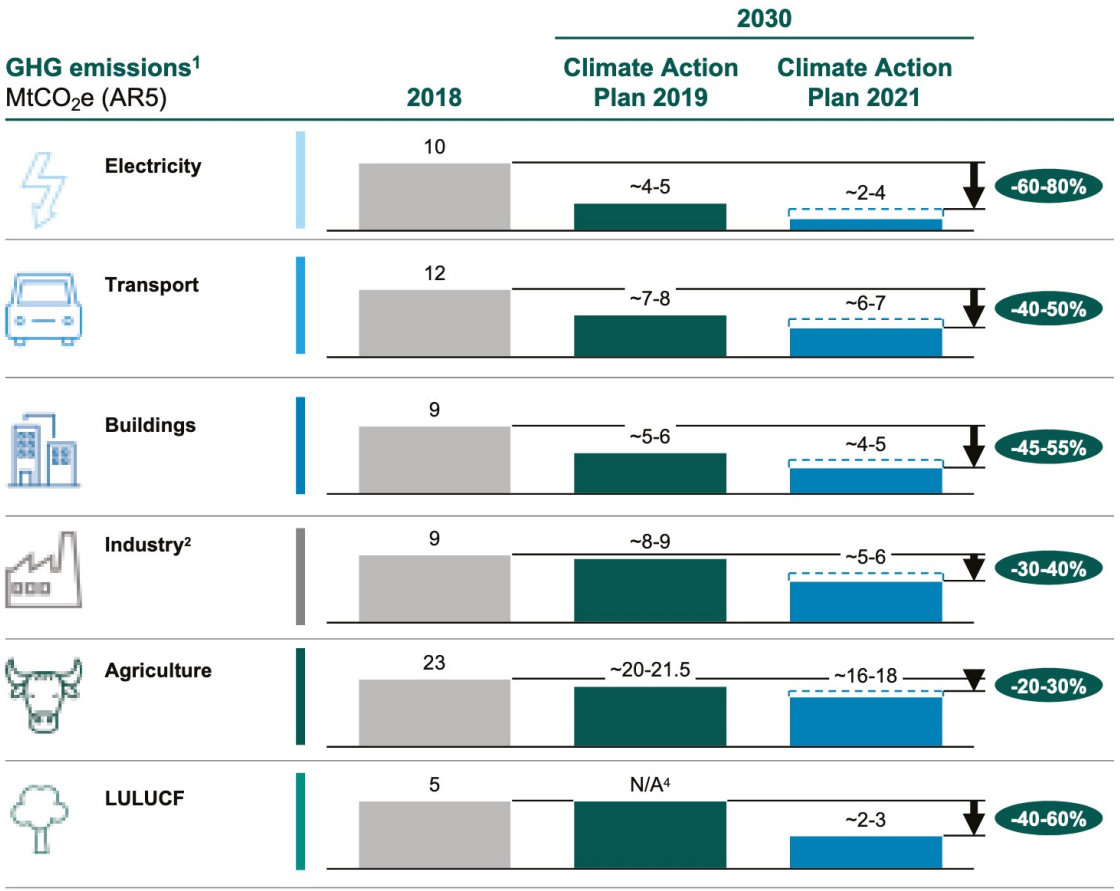

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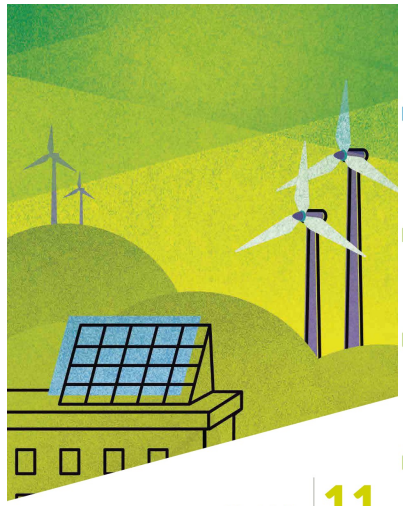
To achieve renewable energy ambitions, Ireland to add a further by 2030

- 4 GW of onshore wind capacity
- 5 GW of offshore wind capacity (fixed and floating)
  - Grow by 2050 to 35 GW
  - Grow from currently one offshore wind farm

Public consultations underway with investments and infrastructure developments expected to start

Development will involve

- Wind farms and turbines
- Ports infrastructure for operations & maintenance services
- Logistics & supply chain
- Electricity grid planning & integration
- Smart energy grid development
- Assess & ensure environmental protection and sustainability
- More …



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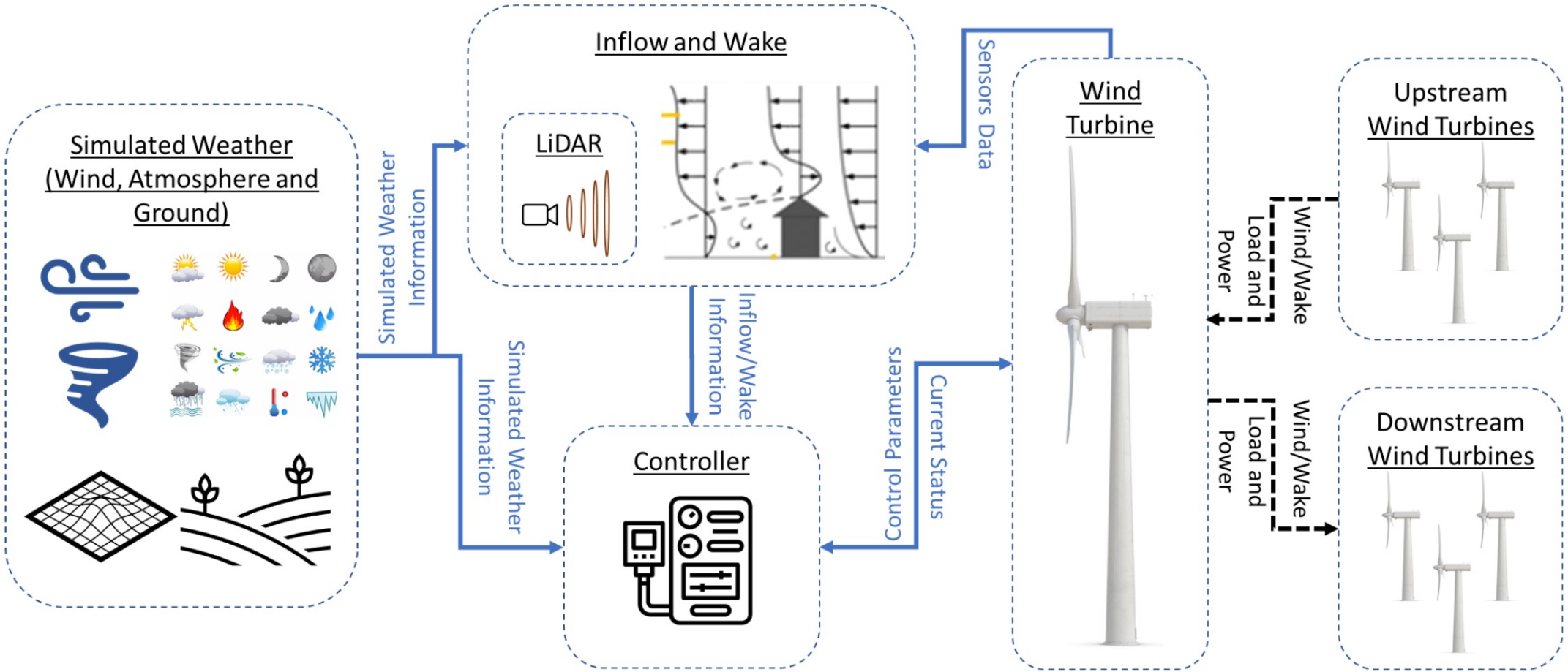
Wind Turbines & Operations



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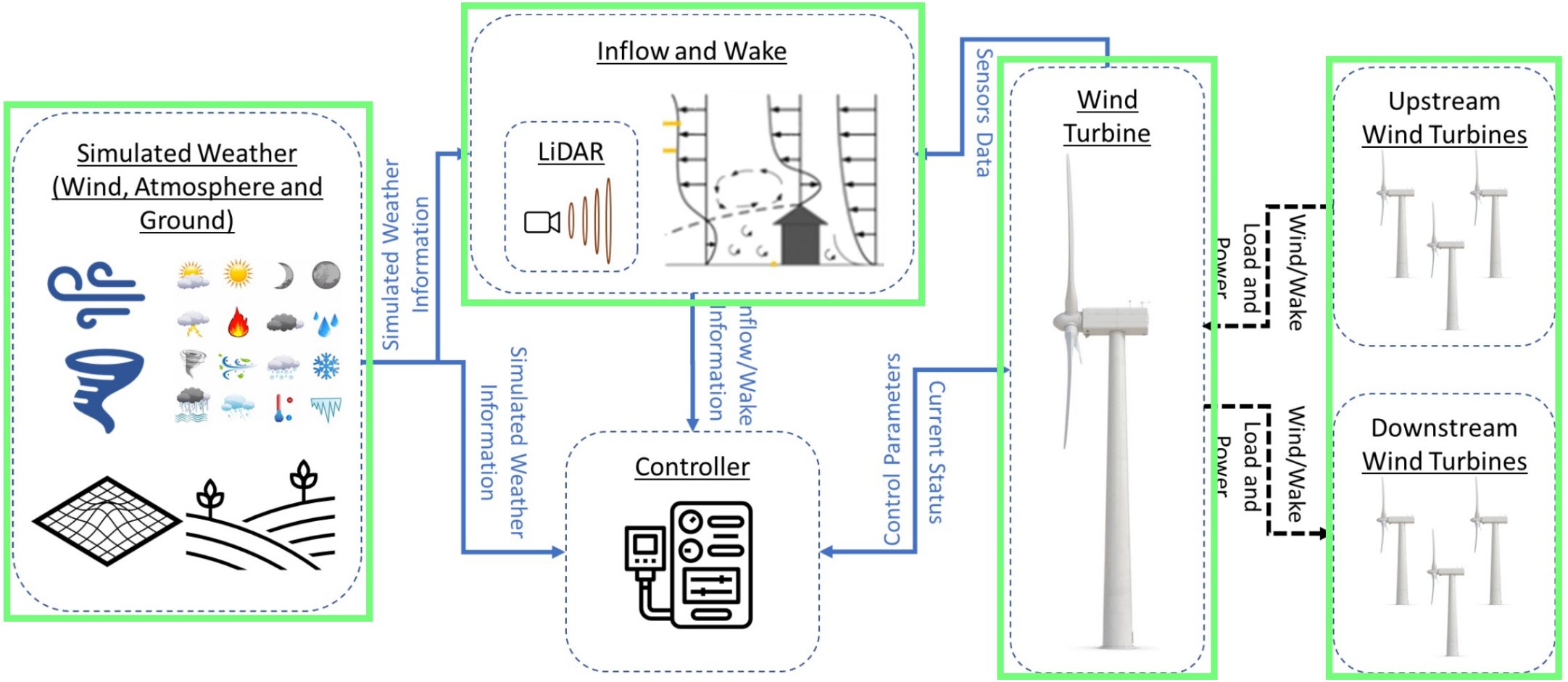
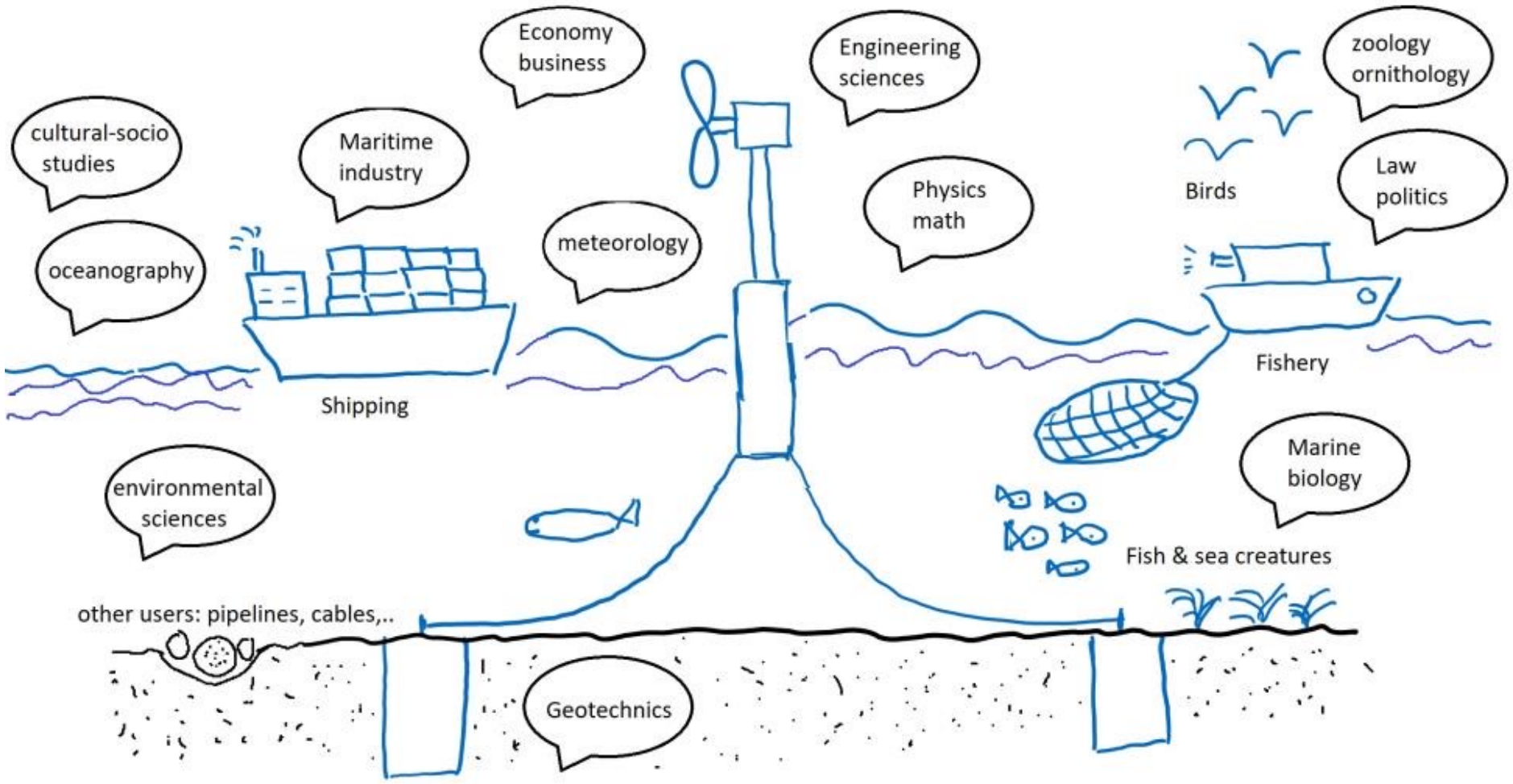
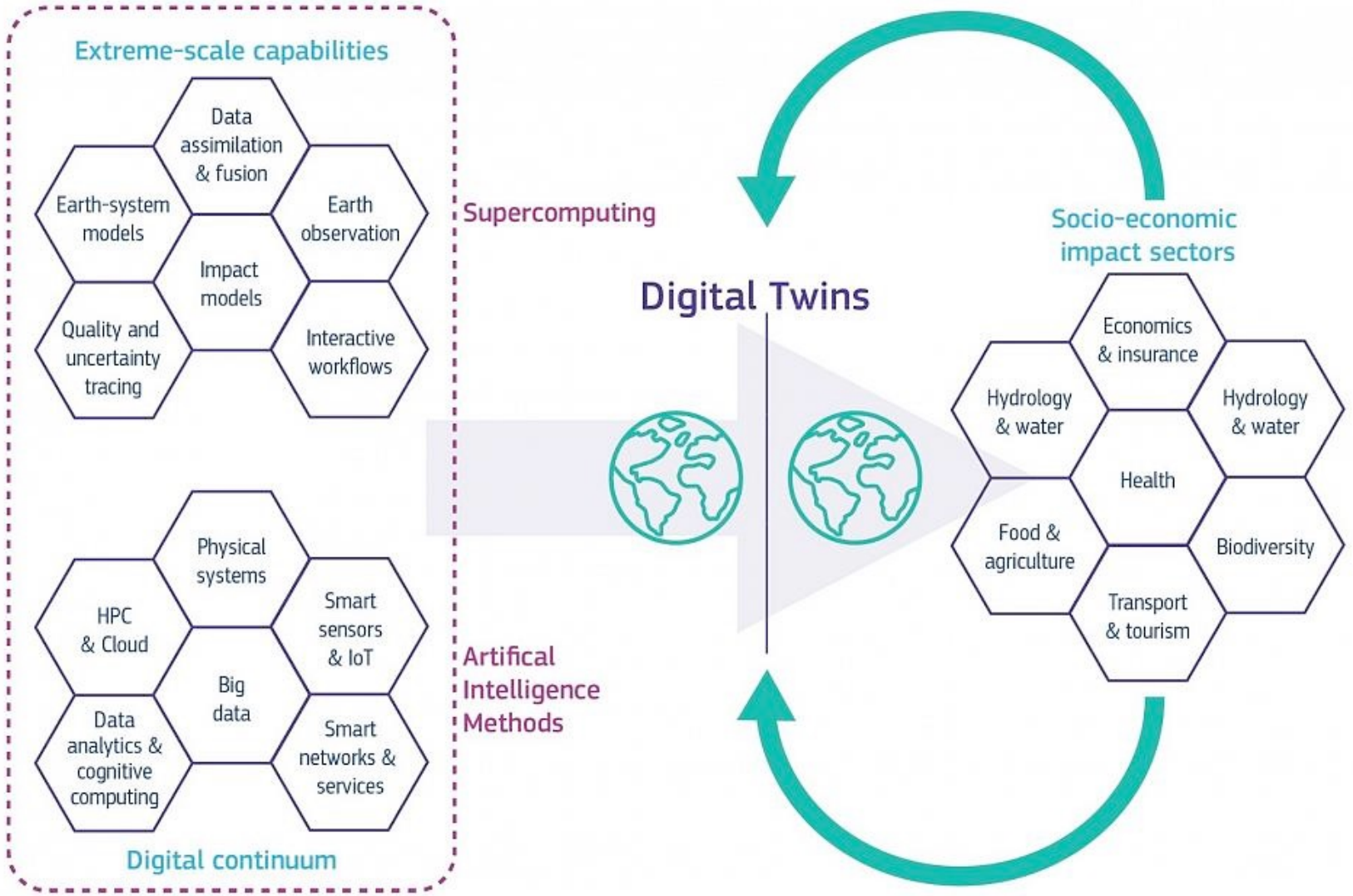


Wind Farms & Ecosystem



Digital Twins for Design & Policies



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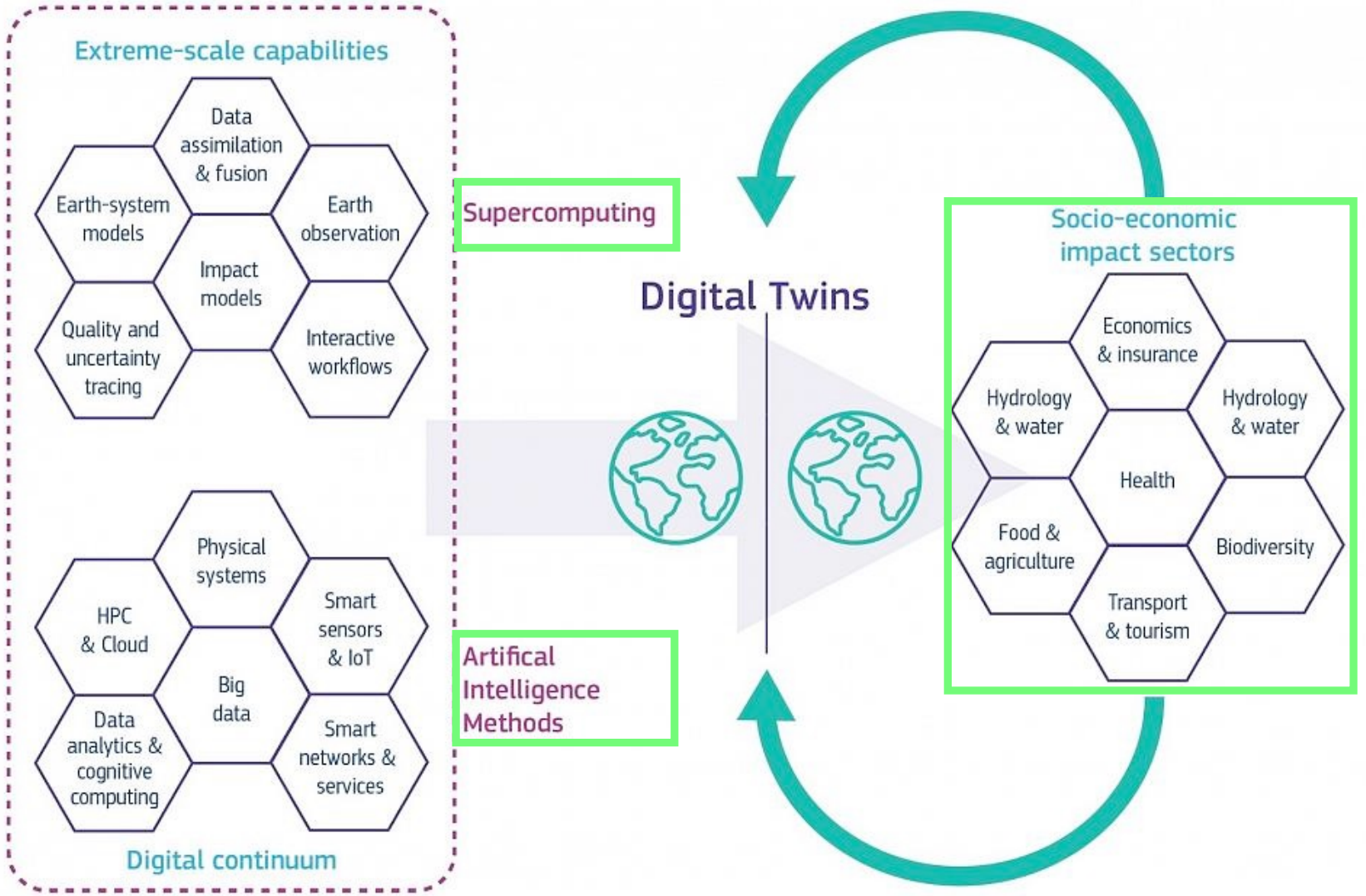

Projecting climate change scenarios

- ICHEC climate research involves simulating **global climate change** using the EC-Earth model. The resulting datasets comprise ***Ireland's contribution to CMIP6 and directly inform the IPCC AR6 reports***.

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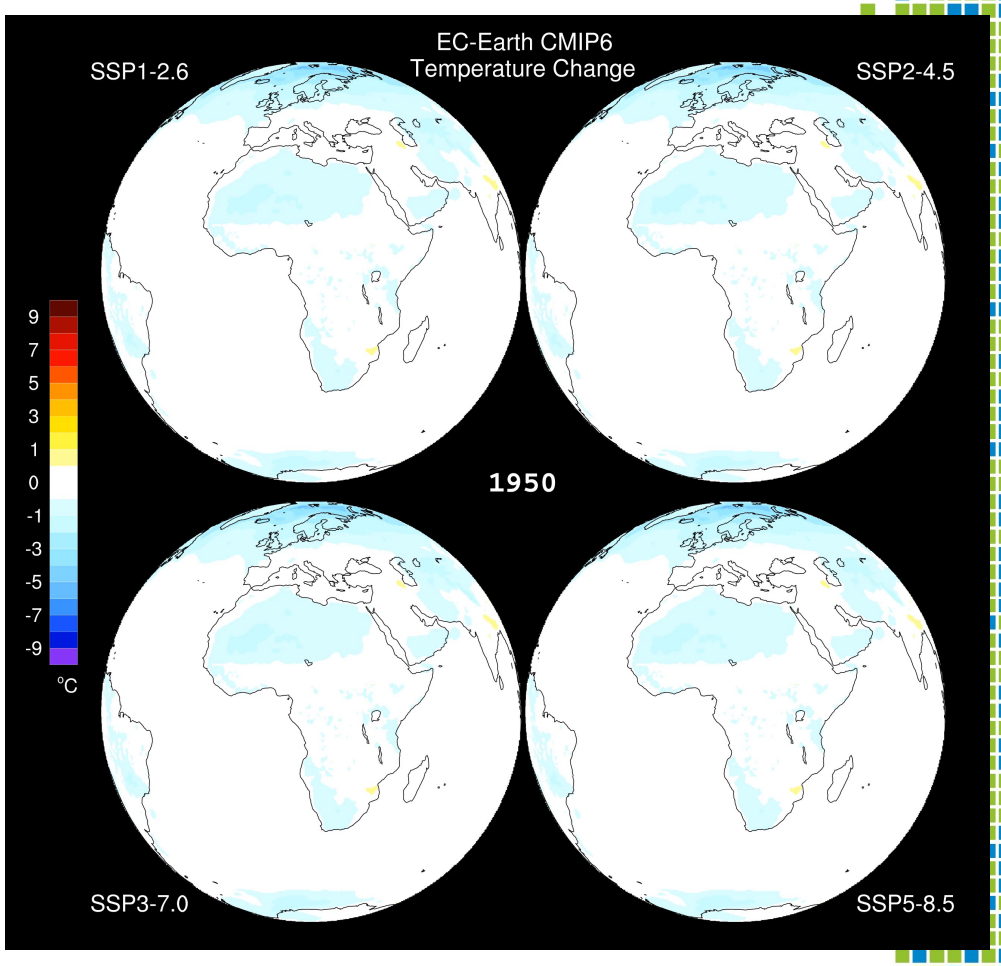

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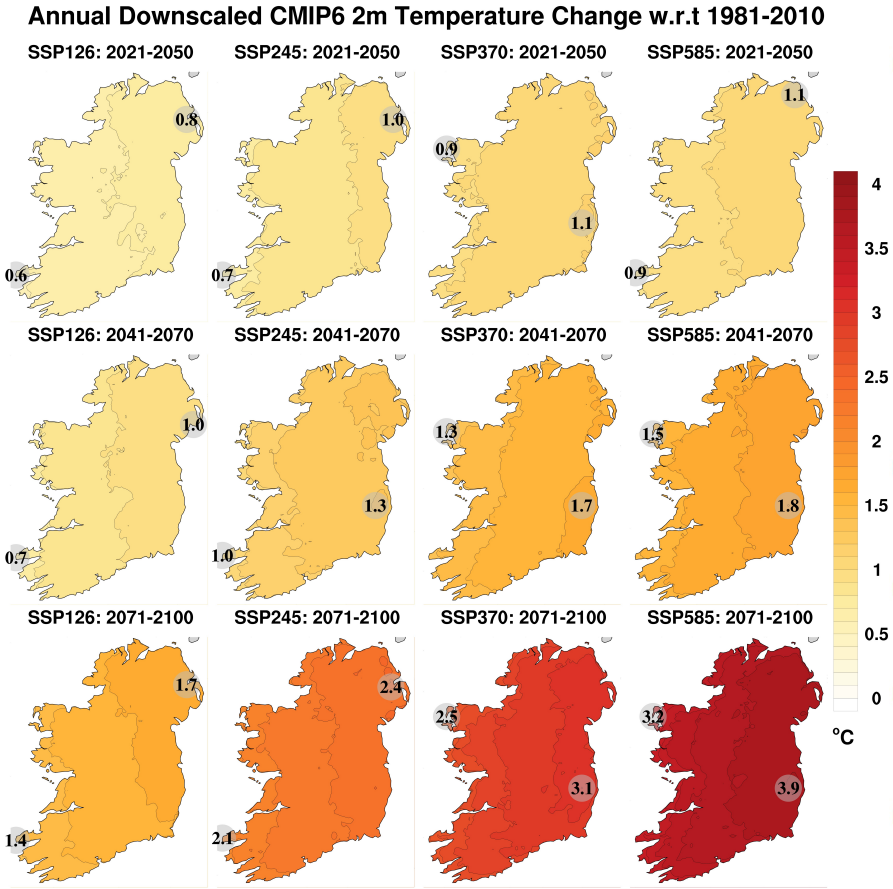

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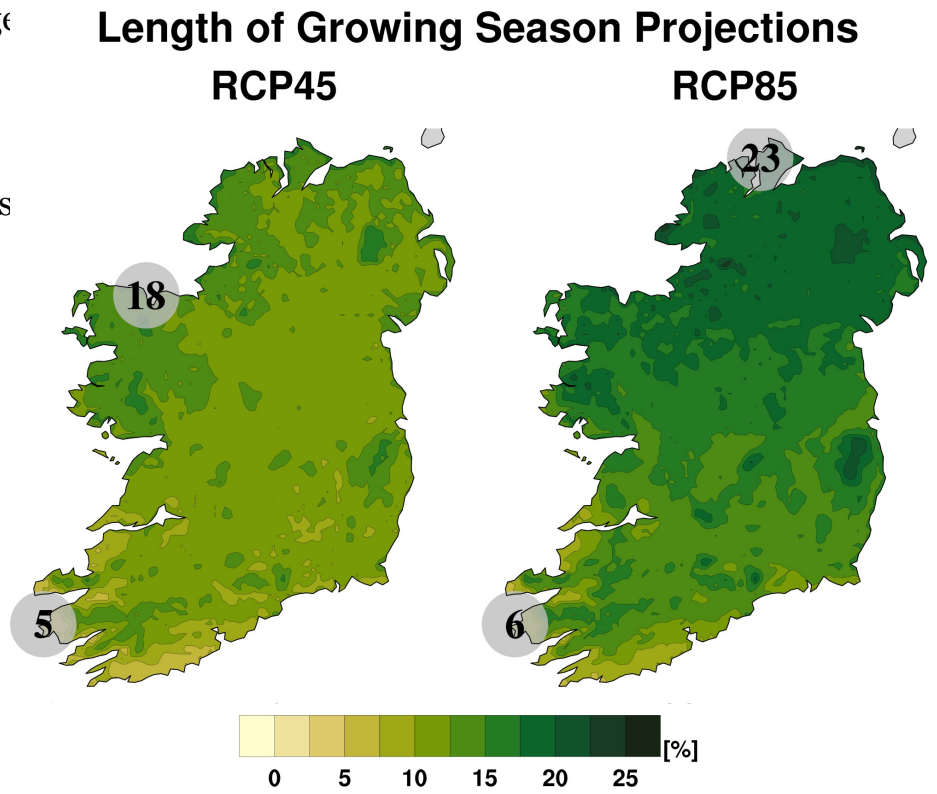

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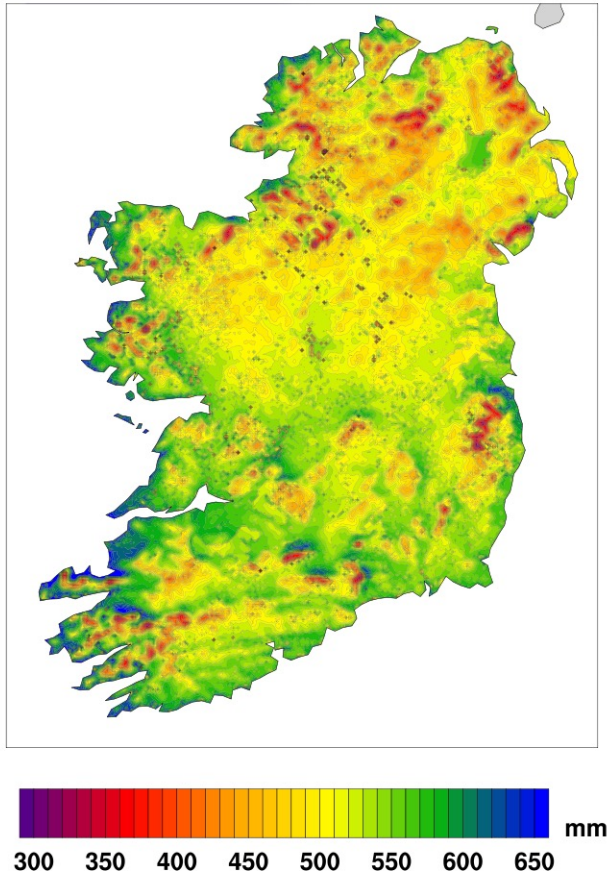
  - Feeds into wide range of applications in ***agricultural, public health, energy (wind, wave and solar), insurance, socio-economic planning and fundamental studies in observed climate change trends*** and variability.
    - High-Resolution Agri-Climate Datasets for Ireland
    - High-Resolution Wind & Solar Energy Maps for Ireland

First Evapotranspiration Maps for Ireland

CLM-ERAInterim Annual ET (1981-2015), 1.5km



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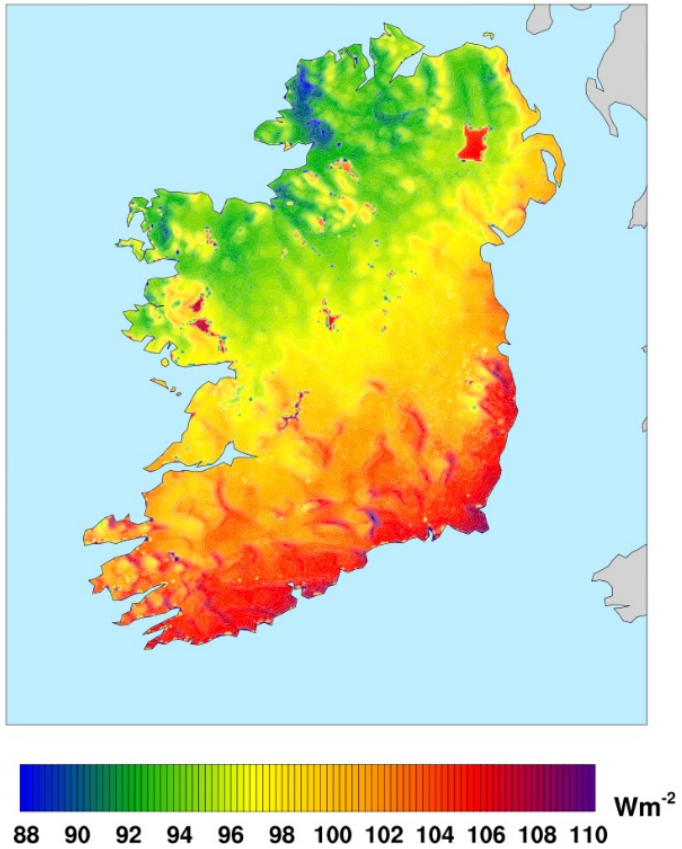
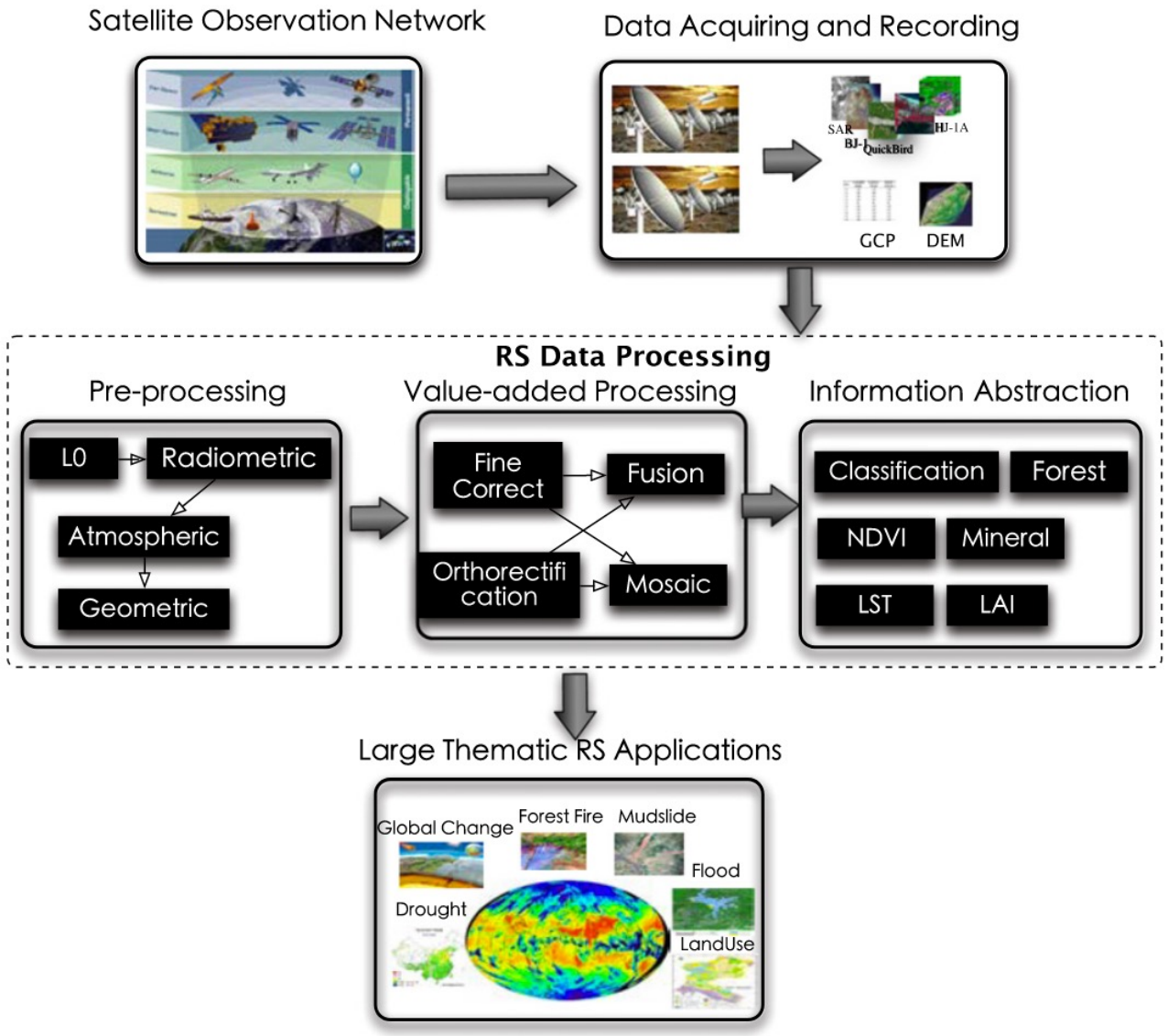
First Solar Energy Maps for Ireland

Mean Surface Net Downward SW Radiation. 1981-2000



Earth Observation & Analytics



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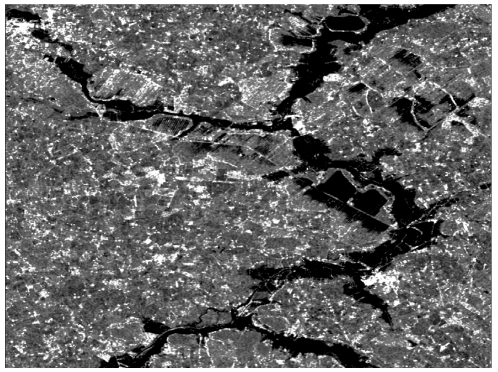
Analysing hydrological systems

- Hydrology, the greatest climate challenge
  - Model impact of land use change on flooding, droughts, water storage
  - Initial work with OPW and GSI
  - Larger/better model will require working more with Met Éireann, the Marine Institute, Teagasc, etc.
  - Requires highly heterogenous, “AI-Ready” datasets
- Digital Twins = Climate models for Policies & Decision



Estimating flooding under trees, groundwater via visible and Radar Images

AI-Ready Earth Observation (AIREO)

AIREO Training Dataset Specification

FAIR (findable, accessible, interoperable and re-usable) data principles are at the heart of this specification, which provides a common structure for EO Training Datasets. Innovations for fairifying data include documentation of data provenance, proposed standardised quality indicators, automation of quality indicator checking and the introduction of AIREO Compliance Levels to rapidly assess the maturity and completeness of a dataset.

Go to the resource

AIREO Training Dataset Best Practice Guidelines

The AIREO Best Practice Guidelines outline how to generate and document AIREO-compliant datasets following the AIREO specifications. The guidelines consider best practice from both the EO and AI/ML communities, as well as specific recommendations relevant to the AIREO specifications. The innovations introduced in the AIREO specification are described in more detail in the Guidelines from a data providers perspective.

Go to the resource

AIREO Training Dataset Pilot Datasets

Four pilot datasets are provided for users to demonstrate the AIREO innovations in practical terms. Each dataset is accompanied by a Jupyter Notebook using the AIREO Python Library functionality.

- AI4Arctic Automated Sea Ice Products dataset
- Common Agricultural Practice (CAP) Austria dataset
- Forest Observation System (FOS) dataset
- Spacenet7 Dataset

Go to the resource

AIREO Python Library

The AIREO Python library is being developed to support users in creation and application of AIREO-compliant datasets. For the initial version, basic functionality is provided allowing loading and exploring the pilot datasets as well as populating critical metadata and running automated checking.

Go to the resource →

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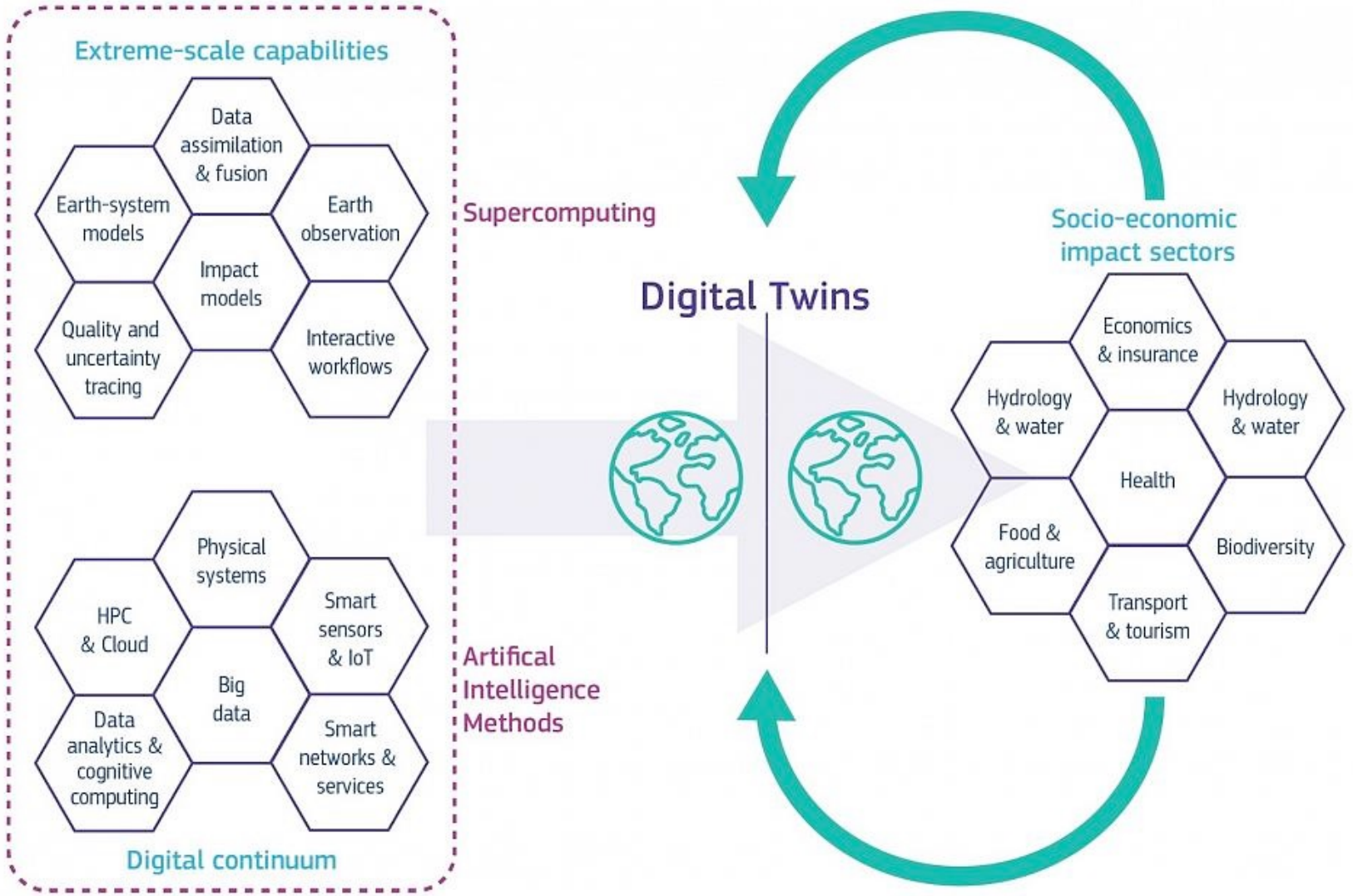
HPC & Data for Digital Twins



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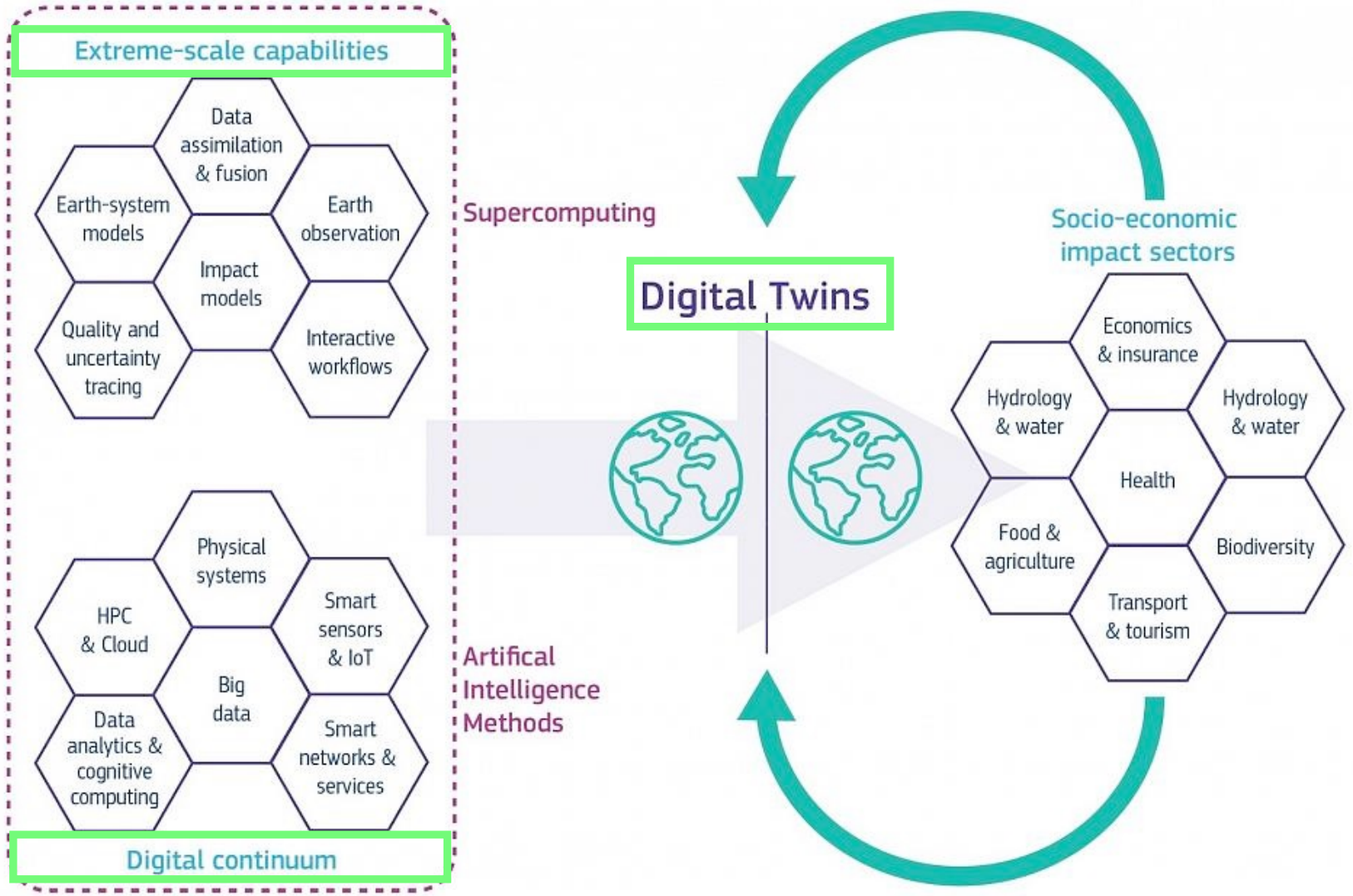

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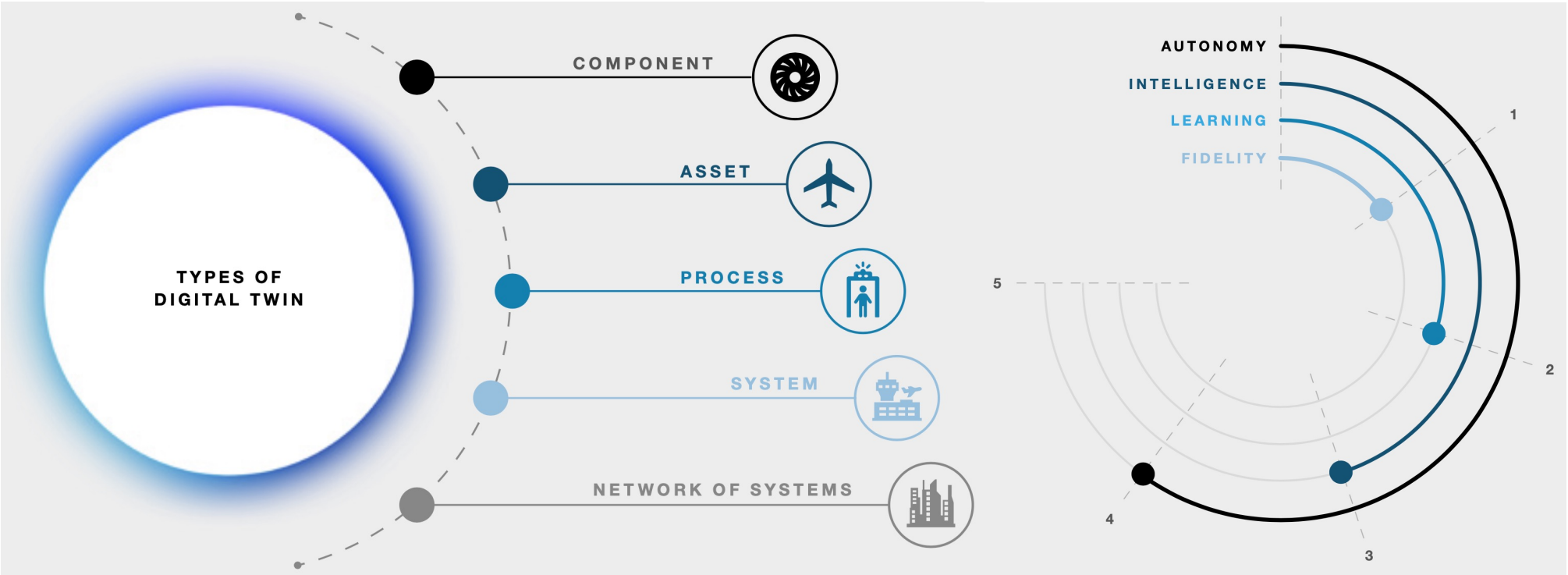
Types of Digital Twins



Autonomy: Ability to act without human input

Intelligence: Ability to replicate human cognitive processes and to perform tasks

Learning: Ability to learn from data

Fidelity: Degree to which measurements, calculations, specifications approach true/desired standard

www.arup.com/-/media/arup/files/publications/d/digital-twin-report.pdf

ICHEC's Role in Ireland & Europe

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NUI Galway
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Thank you.

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