A field campaign dedicated to fog modelling

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Introduction

- Fog forecasting is crucial for transport, and particularly for aeronautics

- Recent research studies at MF have shown :

  - the importance of local circulations on formation and evolution of fog,

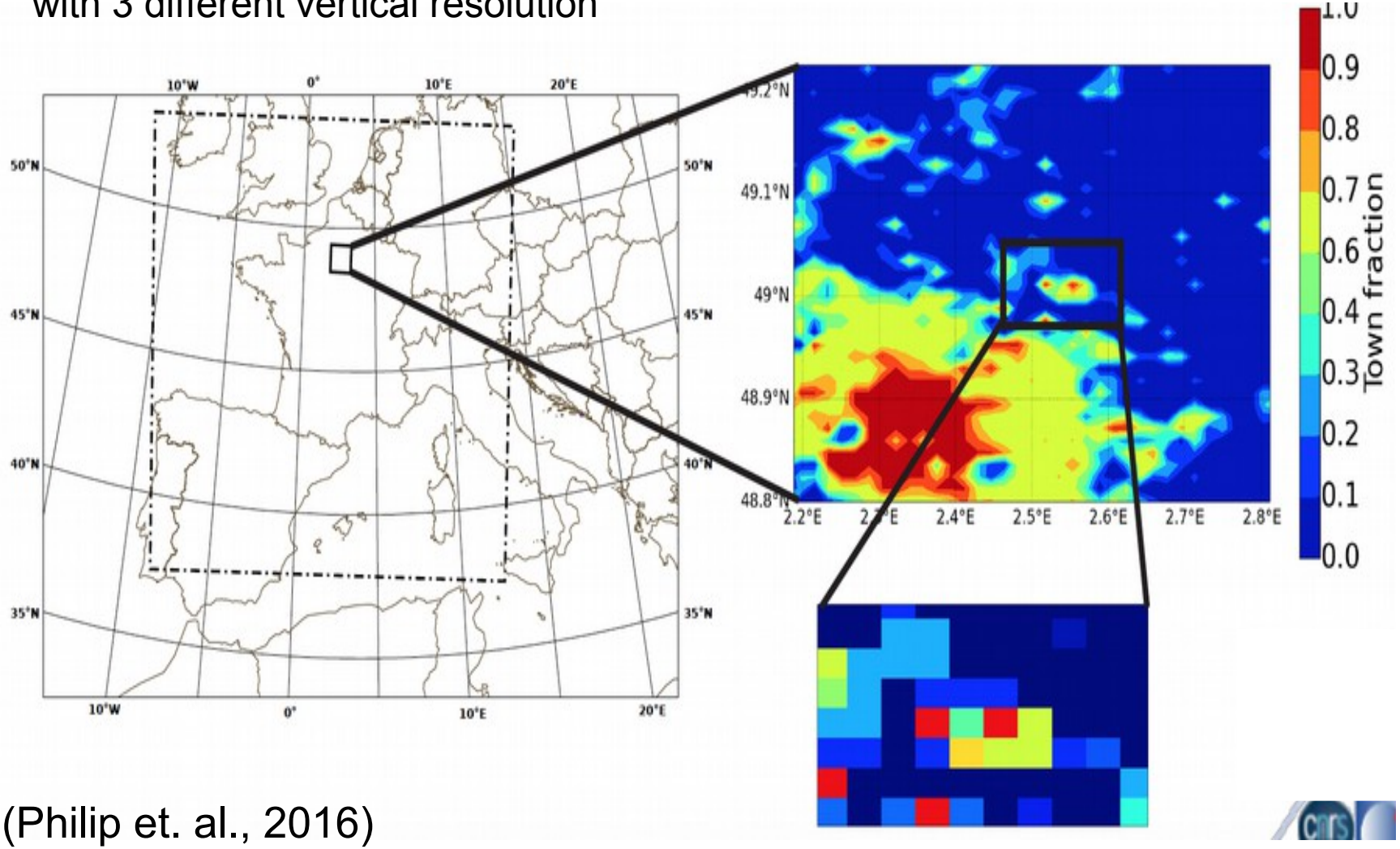
  - the benefits of a fine vertical model resolution above the surface,

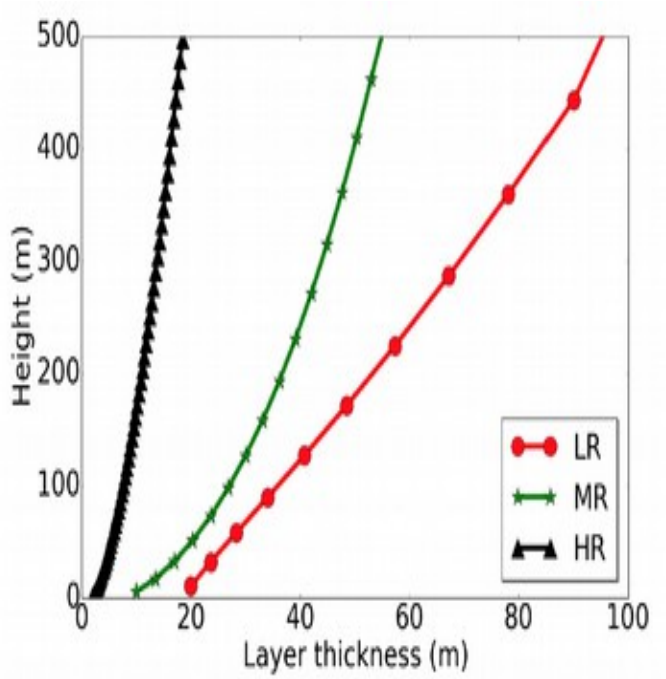
  - the underestimation of fog event related to stratus lowering in AROME model,

  - the need to parameterize fog deposition

Impact of vertical resolution (1)

AROME operational NWP model configuration (1.3km) used over a small geographical domain on Roissy airport with 3 different vertical resolution



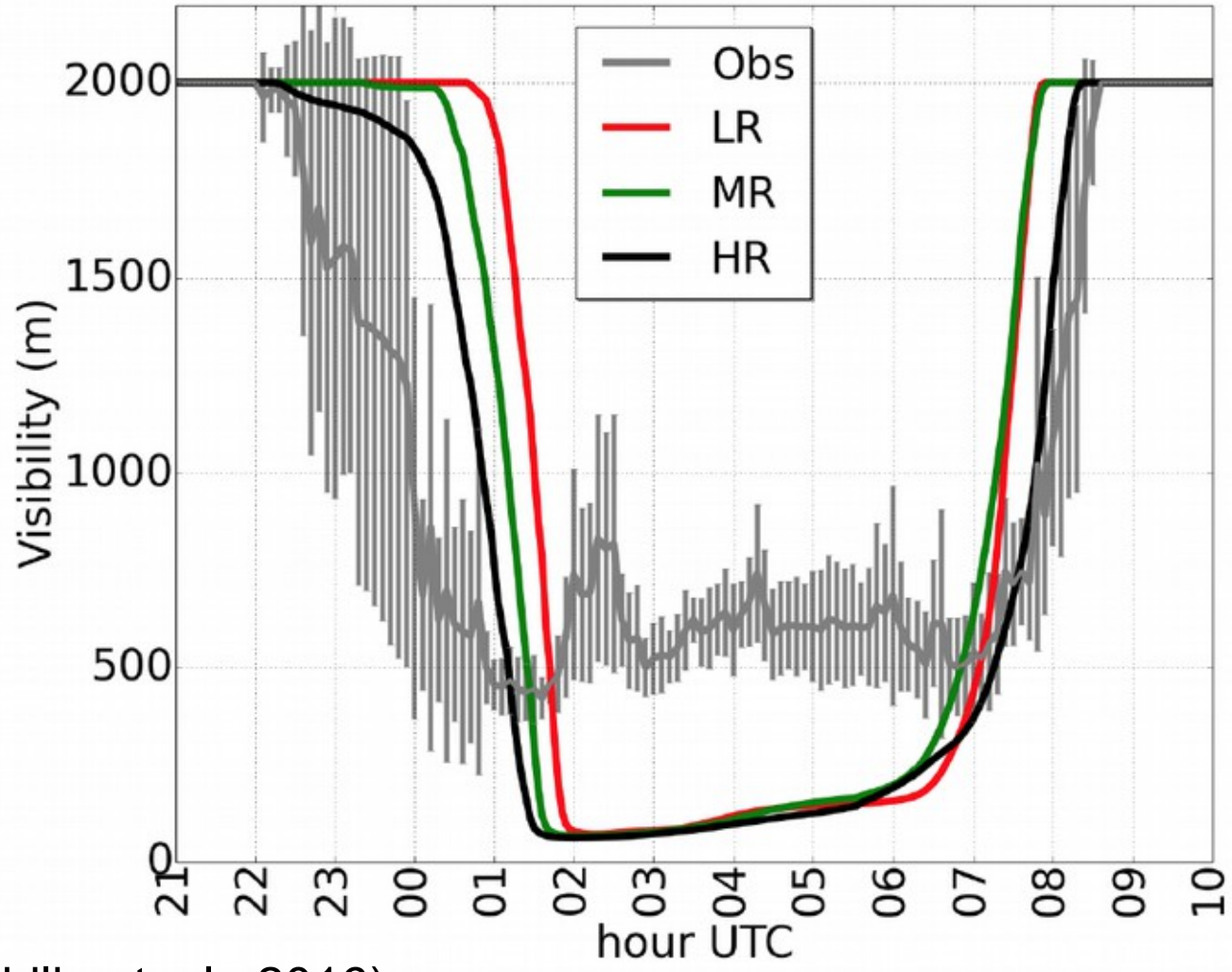


Résolution V	Nombre de niveaux < 250m
LR	7
MR	10
HR	36

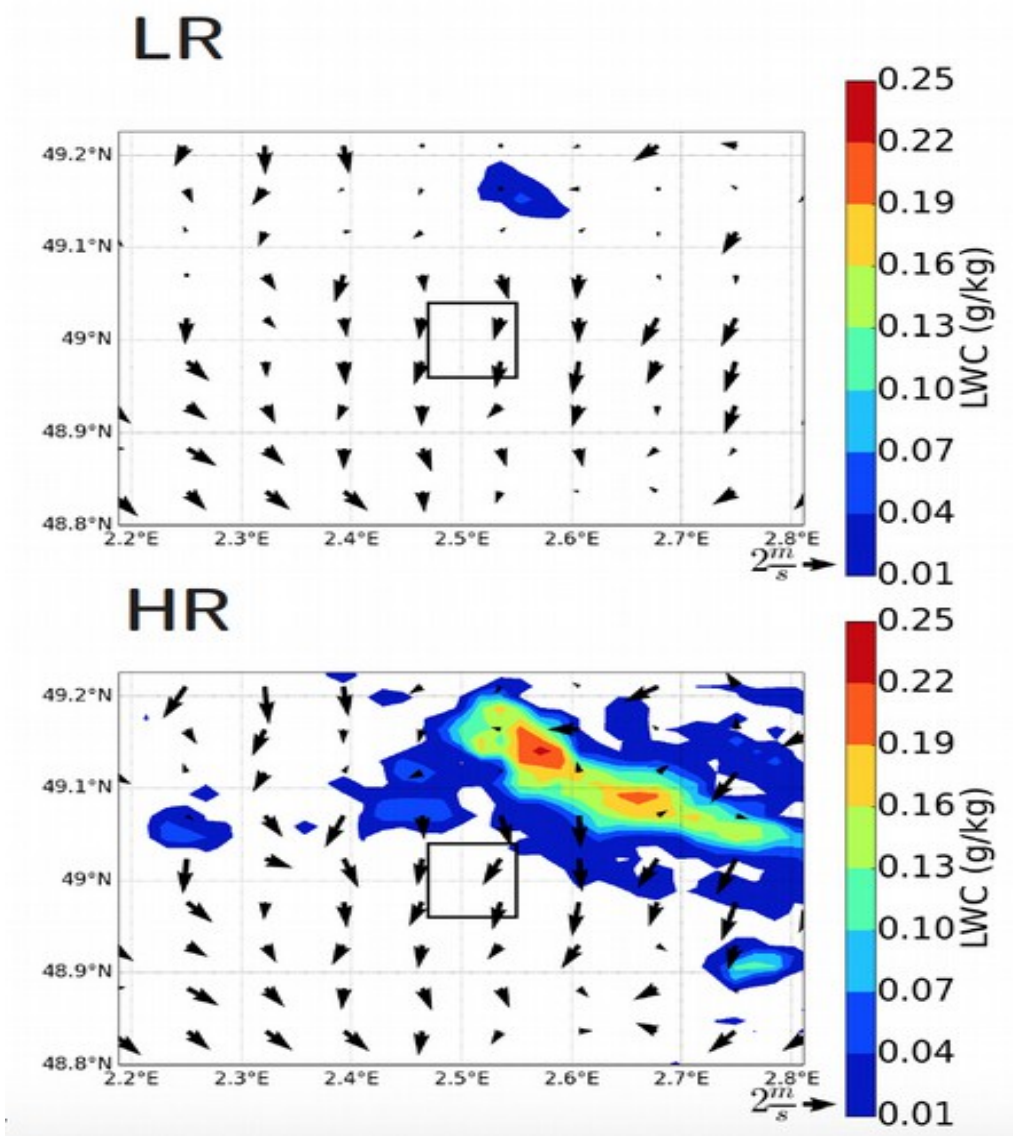
(Philip et. al., 2016)

Impact of vertical resolution (2)

Case study : 22 October 2012

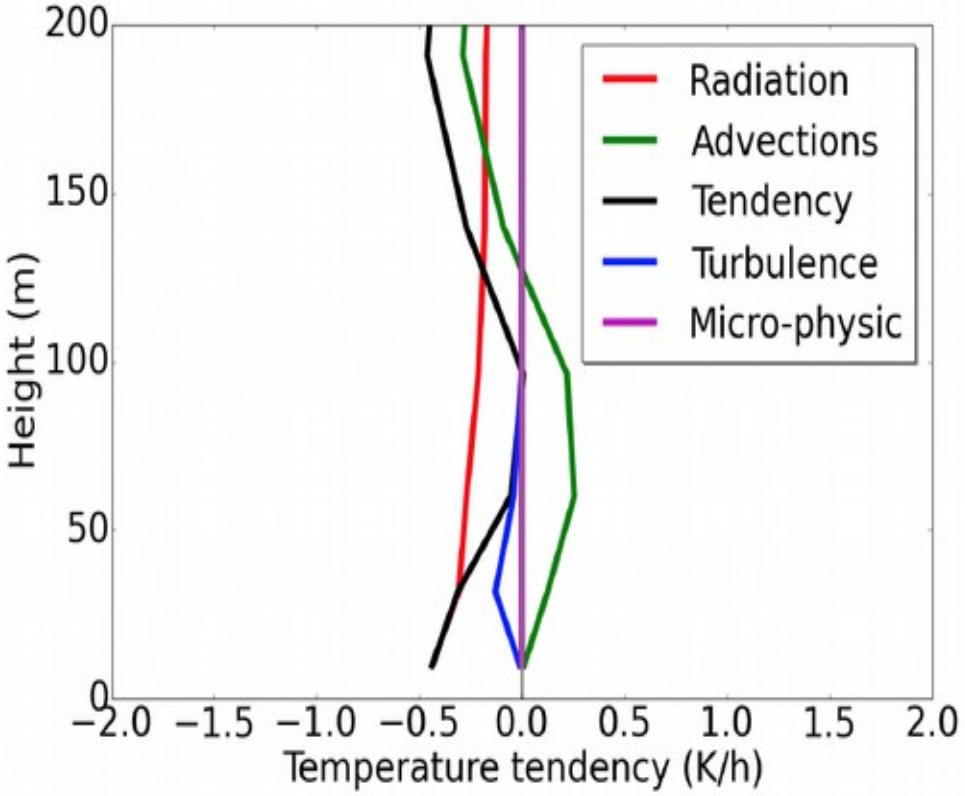


(Philip et. al., 2016)

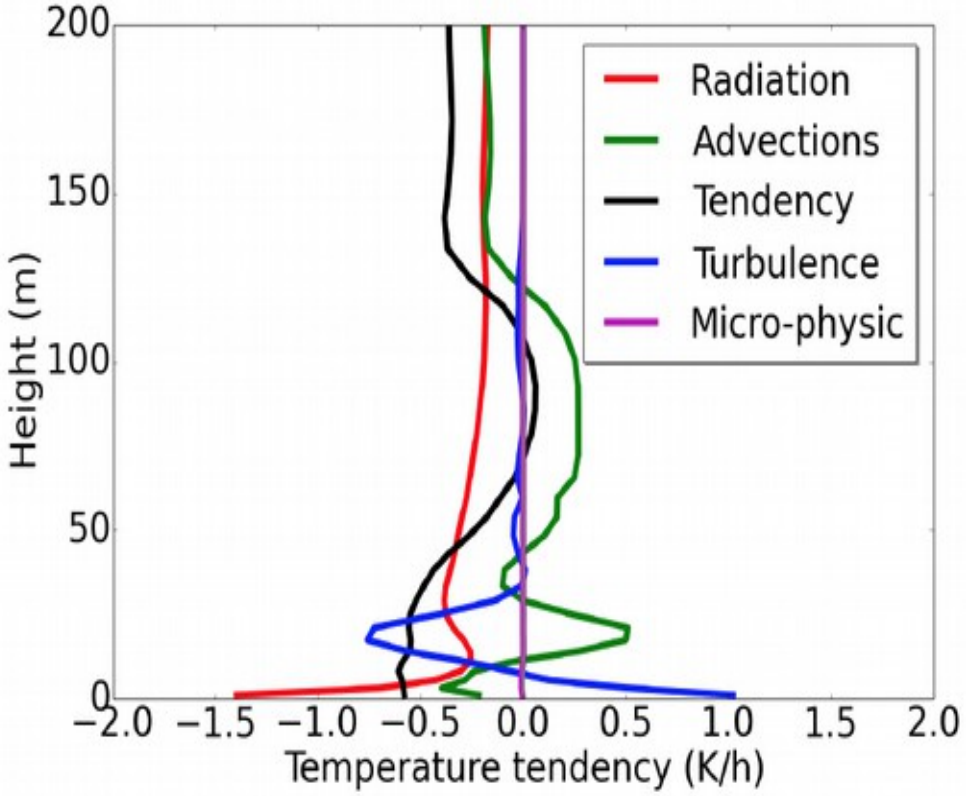


Impact of vertical resolution (3)

LR : 60 niveaux



HR : 156 niveaux



(Philip et. al., 2016)

Scientific questions

Dynamics
- Impacts of local circulations
- Impacts of surface heterogeneities
- Surface interactions
- Moisture vertical gradient and flux

Microphysics
- Impacts of aerosols on radiative cooling
- Impacts of aerosols on fog cycle evolution
- Cloud droplet deposition

Radiation
- Radiative transfer at high spectral resolution
- Retroaction of radiation on microphysics

Assimilation/forecast
- Stratus lowering forecast
- Nowcasting
- Impacts of local observation assimilation
- Evaluation of latest evolutions of surface schemes
- Cost/benefit ratio of using a 2 moments microphysics scheme
- Visibility forecast

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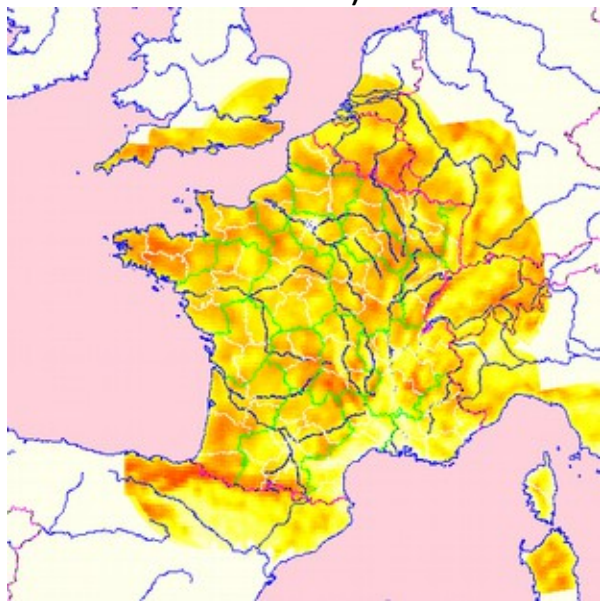
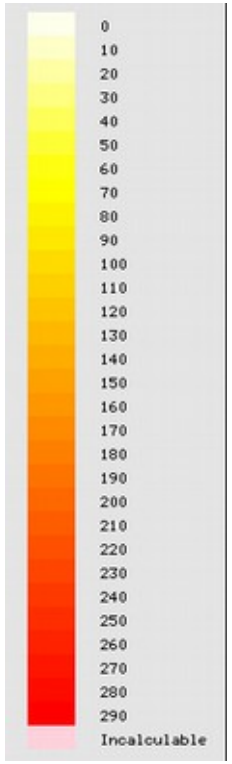
Field campaign

- Site location (South West of France)
- Advanced Instrumentation
  (cloud radar, drones, tethered balloons, etc.)

Number of days per year with high fog risk (CARIBOU, 2008-2014)





- Processes characterization

Local circulations linked with surface heterogeneities

Tri-dimensional heterogeneities

Echanges with the surface and vertical gradients in first meters above ground

Aerosols and microphysics contents

Radiation at high spectral resolution

Processes at cloud top

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« Fog » version of the AROME model

- AROME version developed for fog forecasting:
  - A square domain of ~150 km per side
  - Horizontal resolution of a few hundred meters
  - Fine vertical resolution
  - 2 moments microphysics scheme
  - Improved surface schemes (SURFEX)
  - Updated radiation scheme
  - Dynamical adaptation
- Real time simulations during the experimental campaign(s)
- Non real time : assimilation of new observations (W band radar, microwave radiometer, etc.)

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Schedule and collaborations

- First version of a scientific plan and an experimentation plan before end of 2017
- First campaign in winter 2019-2020
- National and international collaborations very much welcomed:

  - instrumentation during field campaign,

  - real time simulations during field campaign,

  - intercomparison project organized after the campaign,

  - research activities (process studies, etc.)