General considerations as to how future projections of extreme precipitation could be integrated into infrastructure design

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Using Projections of Extreme Precipitation to Support Infrastructure Design
Adaptation Canada 2016, Ottawa, Ontario
13 avril 2016

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Preliminary considerations

- **What we know (with some certainty)**
  - **Extreme precipitations will increase**
  - **Level of service of build infrastructures (designed on past climate) will be jeopardized by CC**

- **What we don’t (exactly) know**
  - **Amplitudes of increases (at small spatial resolution for short durations)**

- **Some infrastructures build today will still be in place in 50 years even 100 years**

- **No choice to provide some guidelines (even approximate) for design criteria**

Infrastructure design

- **Design as it was**
  - **Characteristic time scale (e.g. 1-hour duration)**
  - **Targeted level of performance (e.g. 25-year return period)**
  - **Extreme precipitations estimates (e.g. IDF curves)**
  - **Others prameters (e.g. urban development, expected change in land use, watershed characteristics)**

- **Large uncertainties**
  - **IDF estimates (short recorded series, large return periods)**
  - **Design procedure (e.g. rational method based on many simplifying hypothesis)**
  - **Design based on many hypothesis (e.g. land use, urban development) and imperfect information**

Design and climate change

- Characteristic time scale (e.g. 1-hour duration)
- Expected lifetime of the infrastructure
- Mean (or some other metrics) of the level of performance over the infrastructure lifetime (e.g. probability to exceed capacity during the lifetime)
- Extreme precipitations estimates + projected change in extreme precipitations (e.g. IDF curves + some increases)
- Others parameters (e.g. urban development, changes in land use)

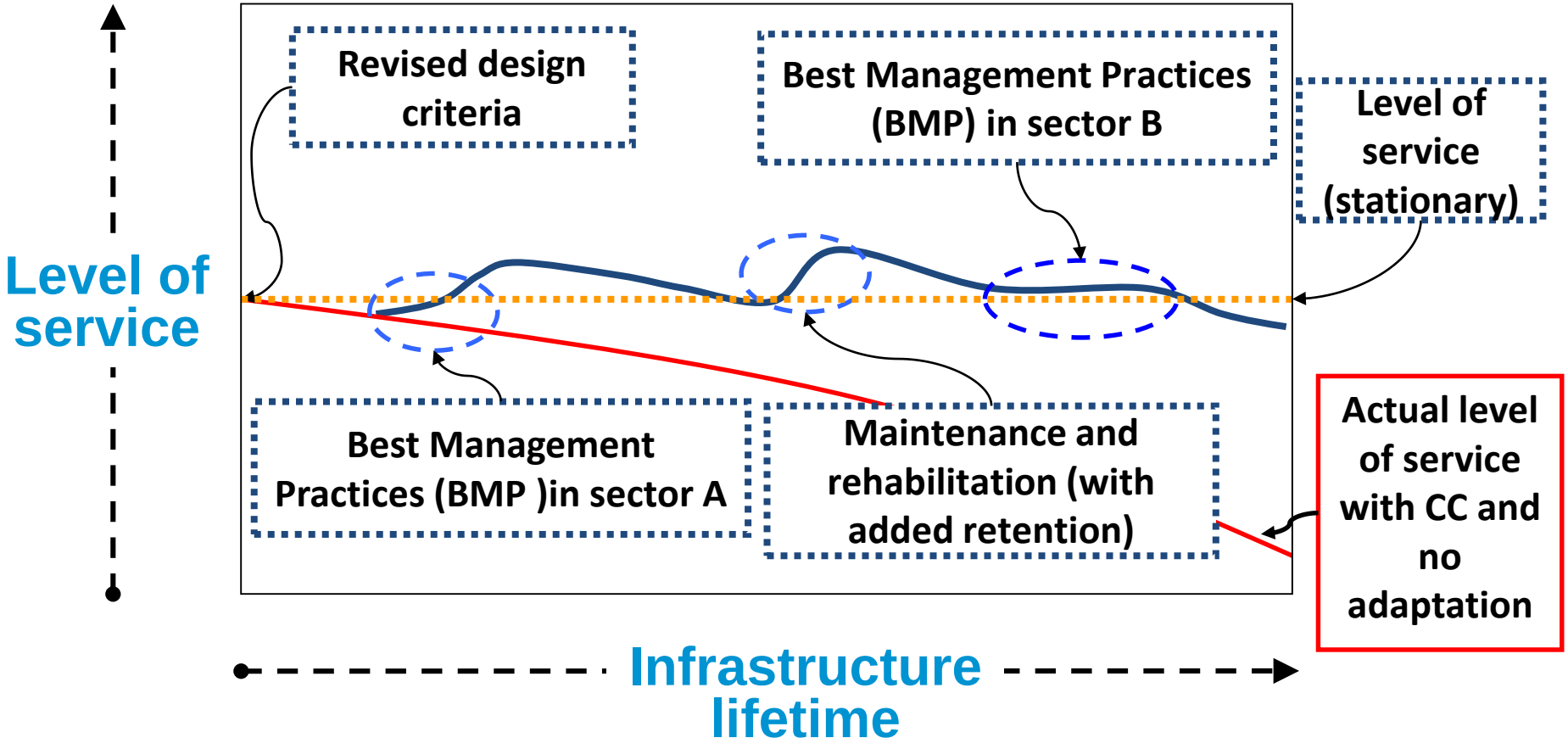
Major issues related to infrastructure design and climate change

- **Time scale**
  - **No need to consider climate change for infrastructures with short expected lifetime**
- **Level of service**
  - **Definition of ‘new’ metrics to assess the level of service (e.g. average exceedance probability)**
- **Need to combine many adaptation strategies**
  - **CC be part of rehabilitation and replacement strategies**
  - **Design and other measures (maintenance, retention, PGO, green infrastructures, etc.)**

Conclusions – Key messages

- **Actual design procedure is based on imperfect information - climate change add a level of imperfect information**
- **No option than to provide to practitioners the ‘best’ information on extreme precipitation in future climate**
- **Practitioners must be aware that climate projections are based on an evolving science**
- **Adaptation is an iterative process and on-going vulnerability assessment is a key element**
- **Keep it simple and as close as possible of current practice!**

Maintaining an 'acceptable' level of service in a context of climate change



Uncertainties related to infrastructure design

- **Four components**
  - **Projected increases in extreme precipitation (e.g. revised IDF curves)**
  - **Targeted level of performance over the infrastructure lifetime (e.g. probability to exceed capacity during the infrastructure lifetime)**
  - **Expected lifetime of the infrastructures**
  - **Others (e.g. urban development, expected change in land use)**

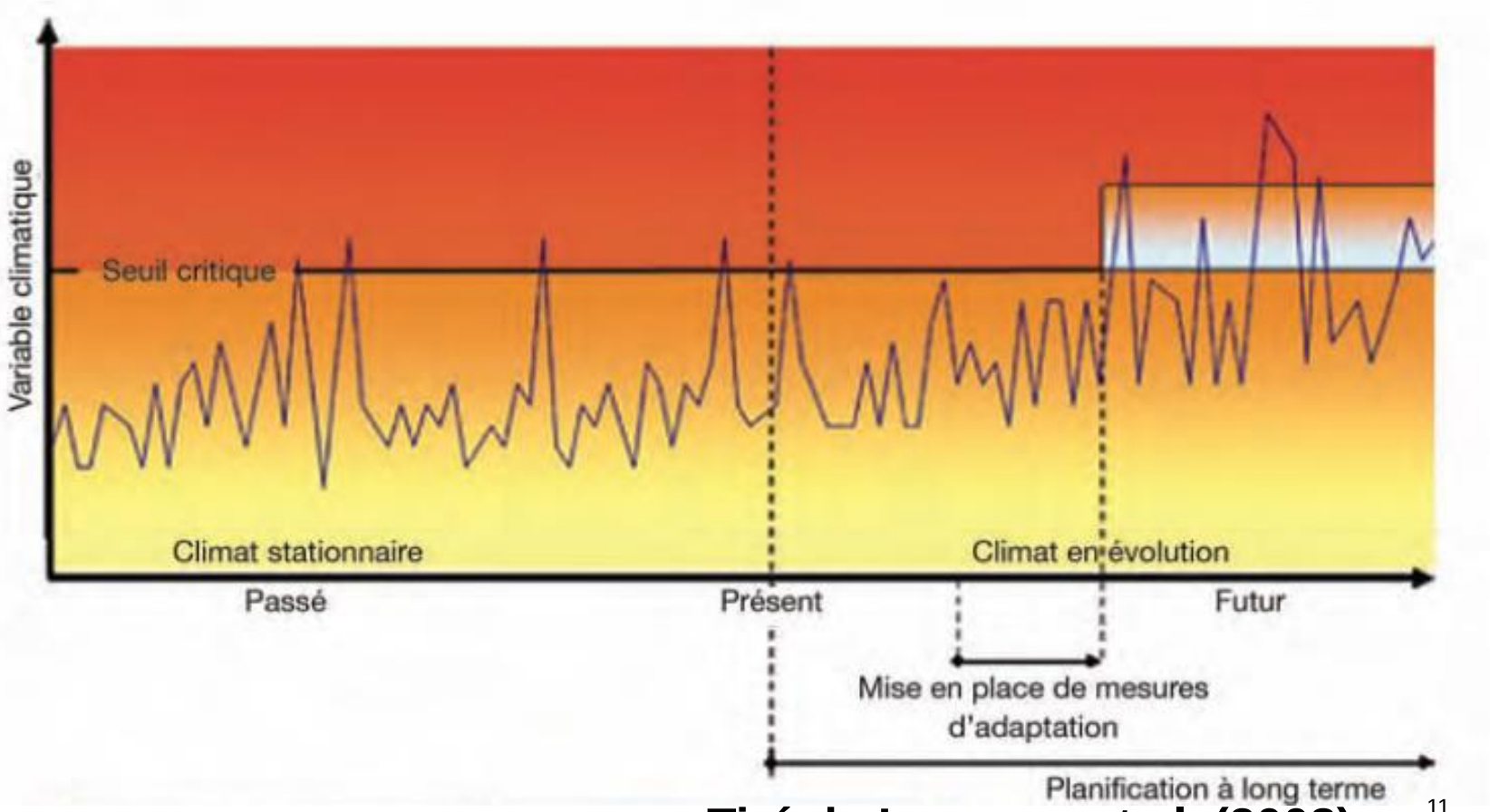
État des connaissances – études d'impact des CC

- **Plusieurs études à l'échelle internationale sur les impacts des CC sur la gestion des eaux pluviales**
- **Modélisation hydrologique (p. ex. SWMM)**
- **Accroissement des pluies extrêmes (p. ex. méthode delta, séries de modèles climatiques, downscaling statistique, pluies historiques, pluies de conception)**
- **Augmentations à des degrés divers selon secteurs des risques de refoulement et d'inondation**
- **Reposent sur plusieurs hypothèses (p. ex. projections climatiques, performance du modèle hydrologique)**

État des connaissances – évaluation des mesures d'adaptation

- **Quelques études à l'échelle internationale**
- ***Sustainable Urban Drainage Systems* (SUDS), *Low Impact Development* (LID), *Best Management Practices* (BMP), *Water Sensitive Urban Design* (WSUD)**
- **Solutions d'adaptation connues (conception, infrastructures vertes, rétention)**
- **Plusieurs travaux sur la révision des critères de conception (majoration recommandée)**
- **Modélisation utile pour évaluer l'efficacité de la mise en place à grande échelle de mesures d'adaptation**
- **Implantation progressive de mesures d'adaptation (ou réfection des infrastructures avec prise en compte des CC)**

Niveau de service et changements climatiques



Tiré de Lemmen et al. (2008)