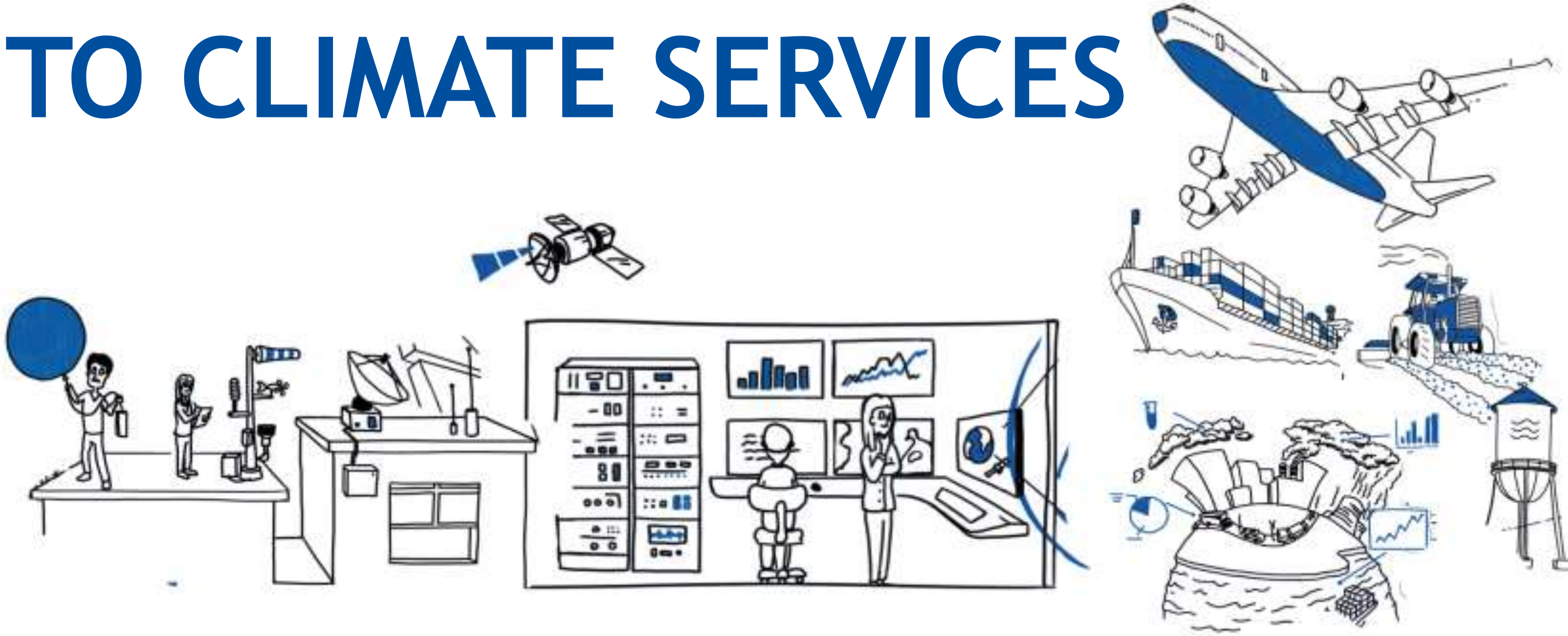
GCOS

KEEPING WATCH OVER OUR CLIMATE

FROM OBSERVATIONS TO CLIMATE SERVICES



Workshop on Improving the value chain from observations to climate services, Entebbe, Uganda, 31/10-02/11 2018

Valentin Aich

WORLD METEOROLOGICAL ORGANIZATION

UNESCO | IOC

International Science Council

UN environment

Outline

1. Floods in West Africa –

    From observation to adaptation and back

2. Climate Change assessment in Afghanistan –

    Passing on uncertainty

3. There is a time for everything –

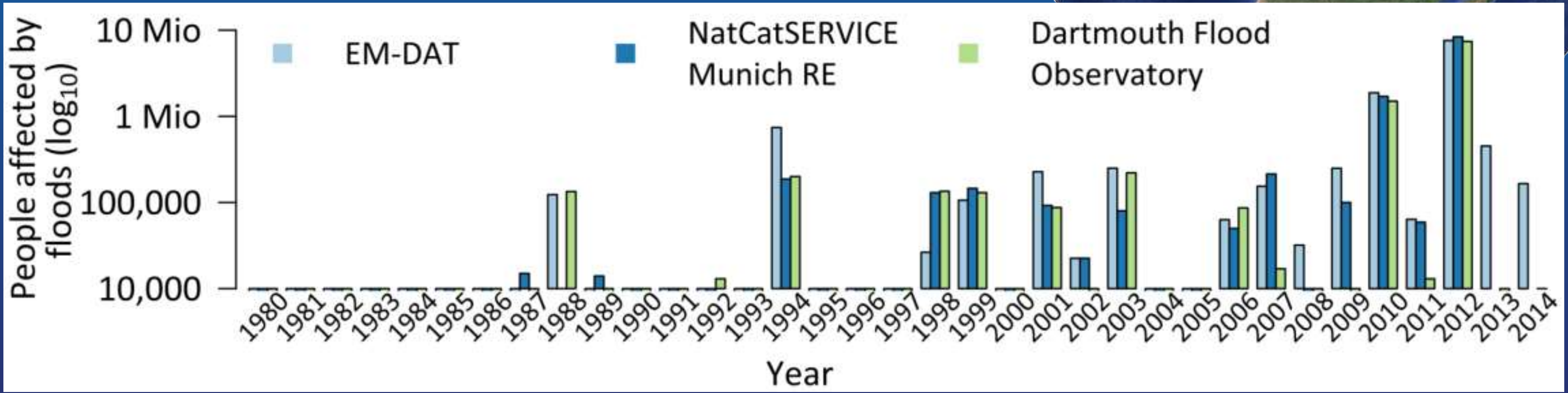
    Timeliness of reporting observations

4. Conclusions

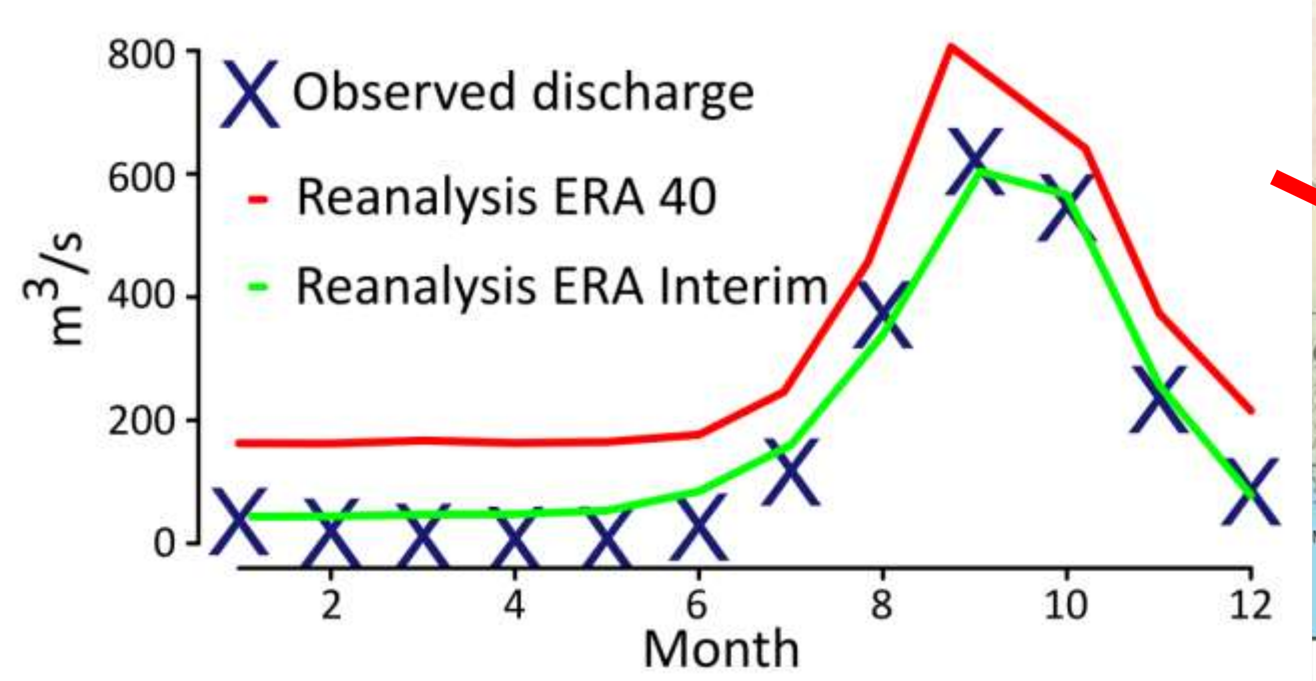
Catastrophic flooding in the Niger River Basin

- Lack of flood warnings increases risk
- Lack of mid to long term adaptation increases risk

→ Climate Services including these two examples could reduce the vulnerability significantly

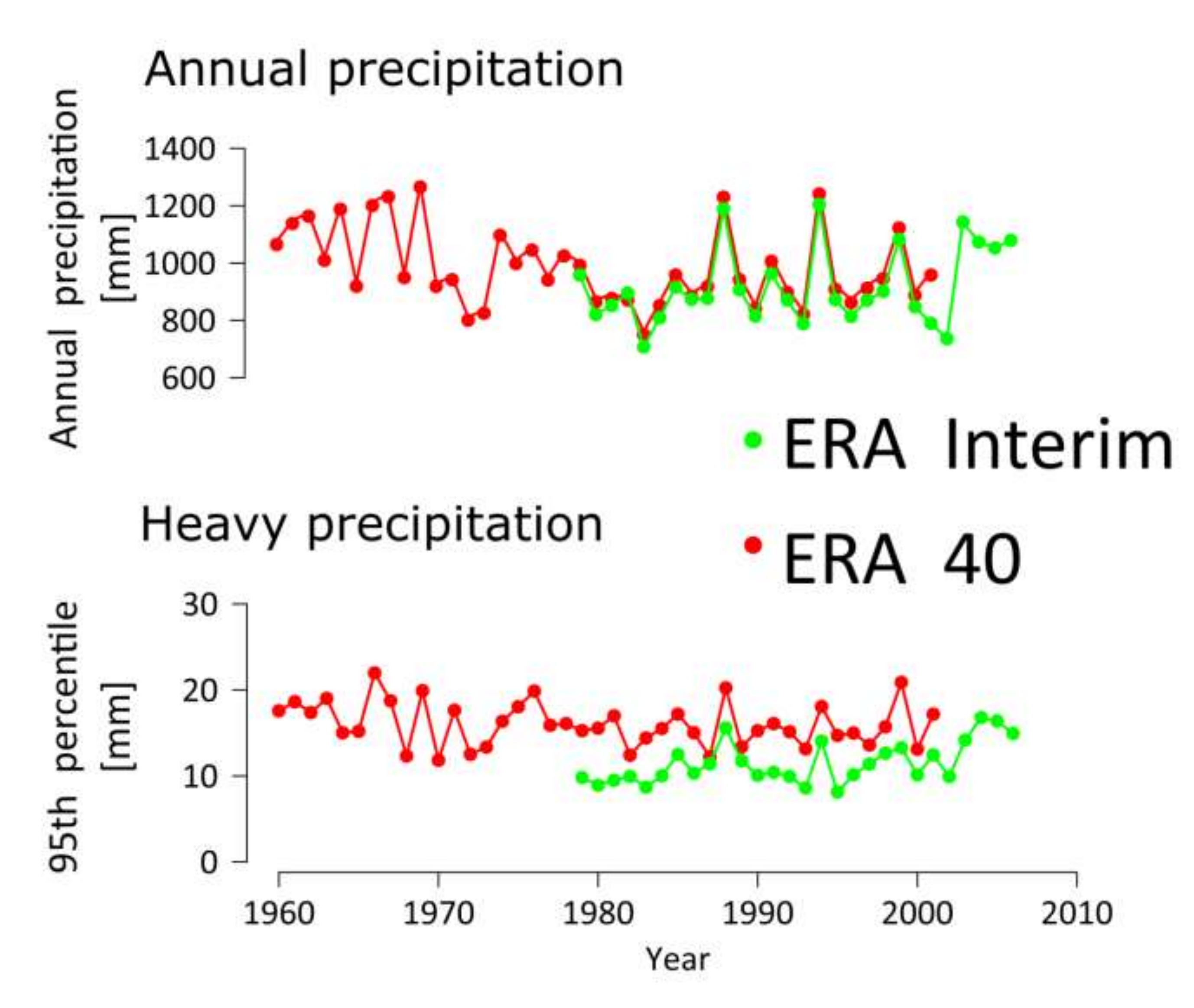


Hydrological models used for flood forecasting need calibration
→ for calibration, usually climate reanalysis is used to drive models



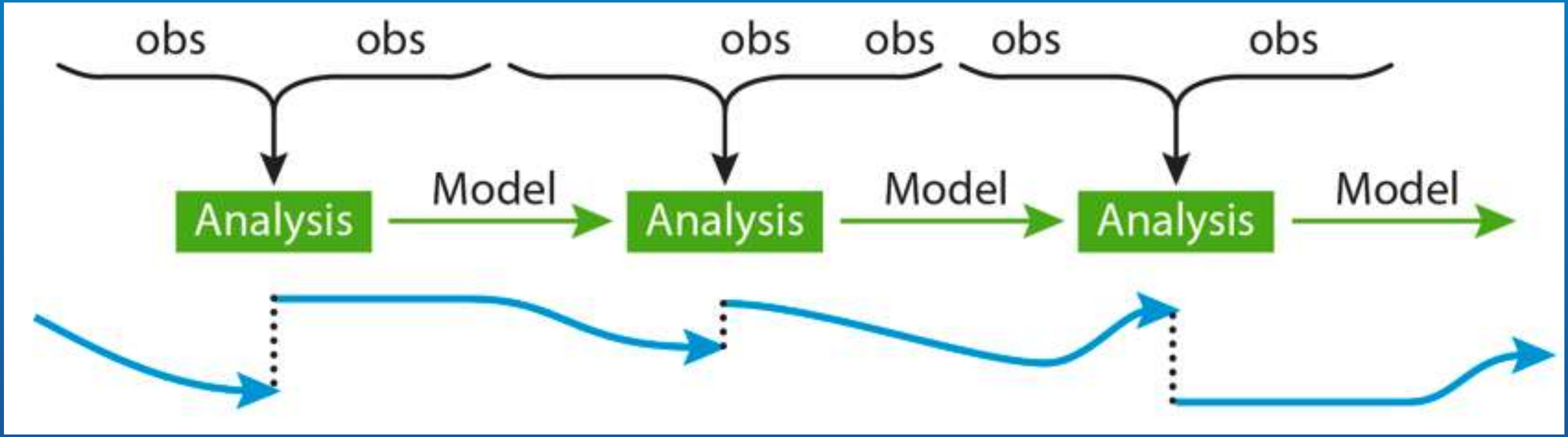
→Model calibrated with ERA 40 (older) in this region would be of limited use for flood forecasting

"The number of observations assimilated in ERA-Interim has increased from approximately 10^6 per day on average in 1989, to nearly 10^7 per day in 2010."
Dee et al. 2011



→Need for more/better observations to improve reanalysis

Observations needed to drive the model



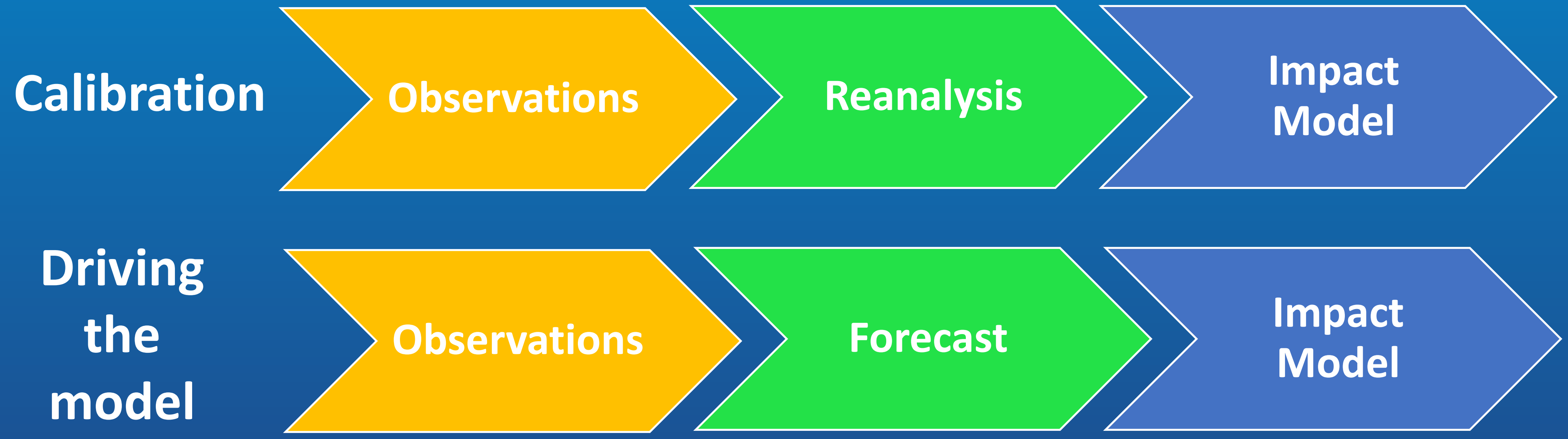
Simplified concept of Reanalysis, ECMWF

- **Reanalysis need all sorts of observations: temperature, precipitation, pressure, humidity, SST, Wind, soil moisture, …**

→ Even if only precipitation would be of interest for flood forecasting, all kind of observations are important , e.g. radiosondes are one of the most crucial observations

Chain from observation to a product use for services

Flood Forecasting (used for warnings):



Climate projections (used for mid to long term adaptation):

→ All products depend on observations

→ Even small improvements in the observing network can make a big difference

Case study 2: Climate Change Assessment for Afghanistan

- Afghanistan is amongst the countries of the world, most prone to natural hazards: droughts, floods, flash floods, landslides, avalanches, earthquakes, …
- Climate Change may aggravate the situation, but little scientific evidence

- Usual steps to assess climate change (simplified):

  1. Analyse Observations to understand trends in the past
  2. Analyse Climate Model Projections to better plan adaptation for future

Observations in Afghanistan

Several decades of conflict, very few time series of surface observations available

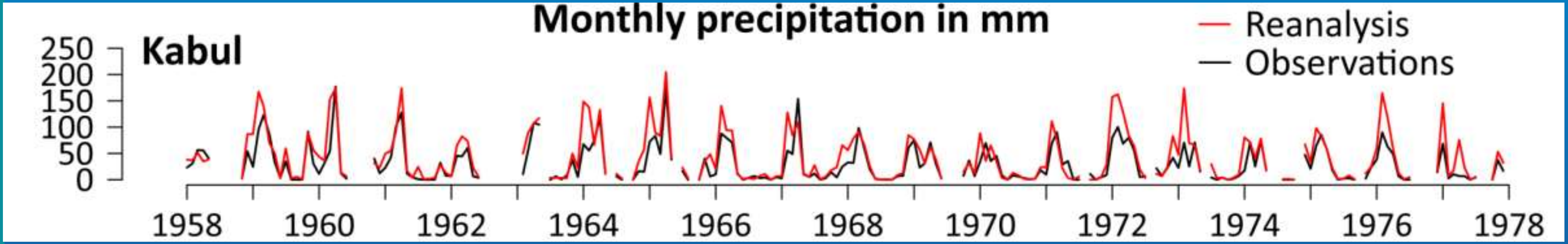
Data got lost due to conflict

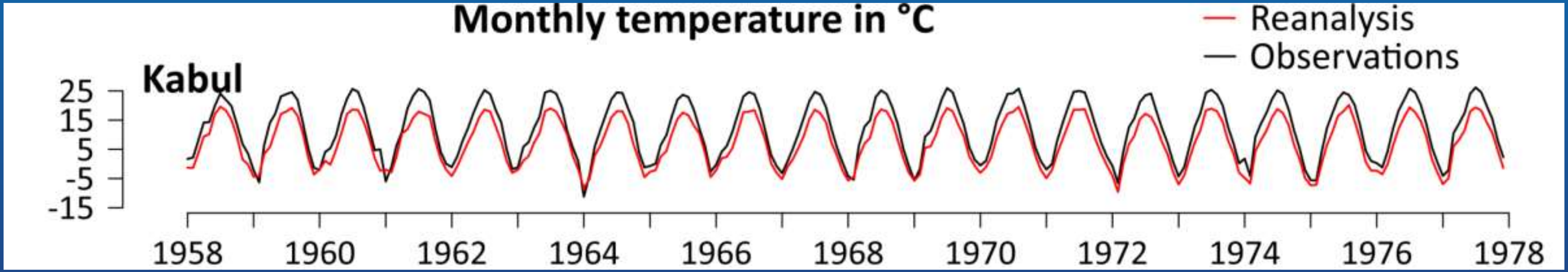
Data not digitized

→ No time series long enough to analyze past climate (30a)

→ Validation of reanalysis using the sparse observations

For the past: Validation of reanalysis





→ Missing data causes uncertainty in validation

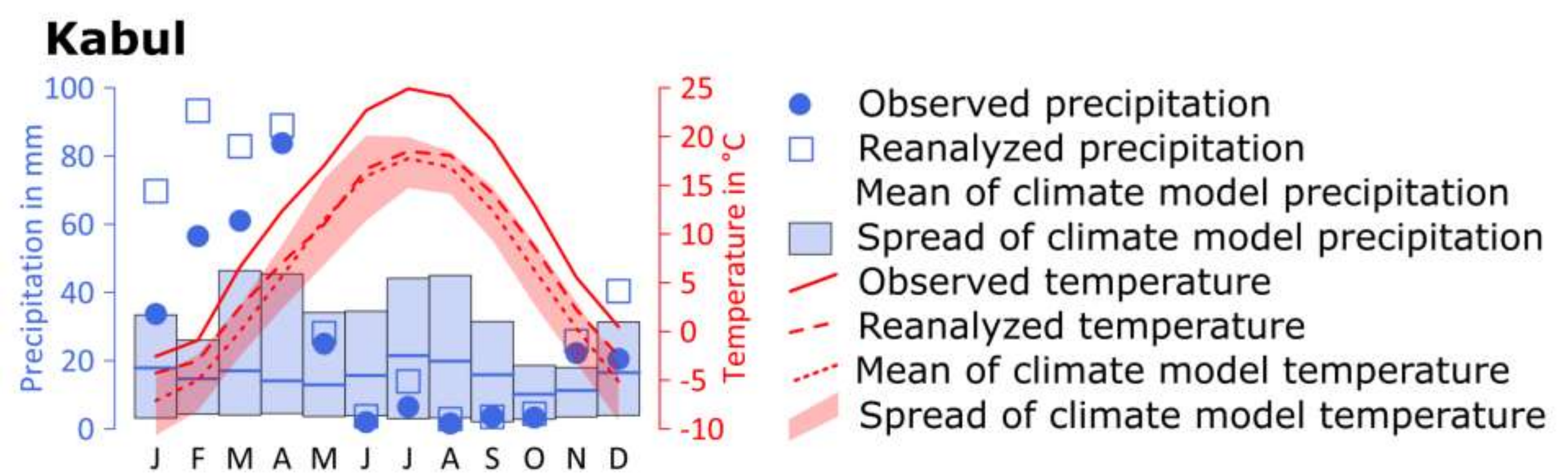
→ Heavy precipitation cannot be validated, therefore very high uncertainty

→ Still, Reanalysis can prove to capture general climate pattern for temperature and precipitation

For the future: Validation of climate model, using reanalysis

Ensemble of 12 available regional climate models (CORDEX South Asia)

Validation of model hindcast:



→ Temperature reasonably reproduced

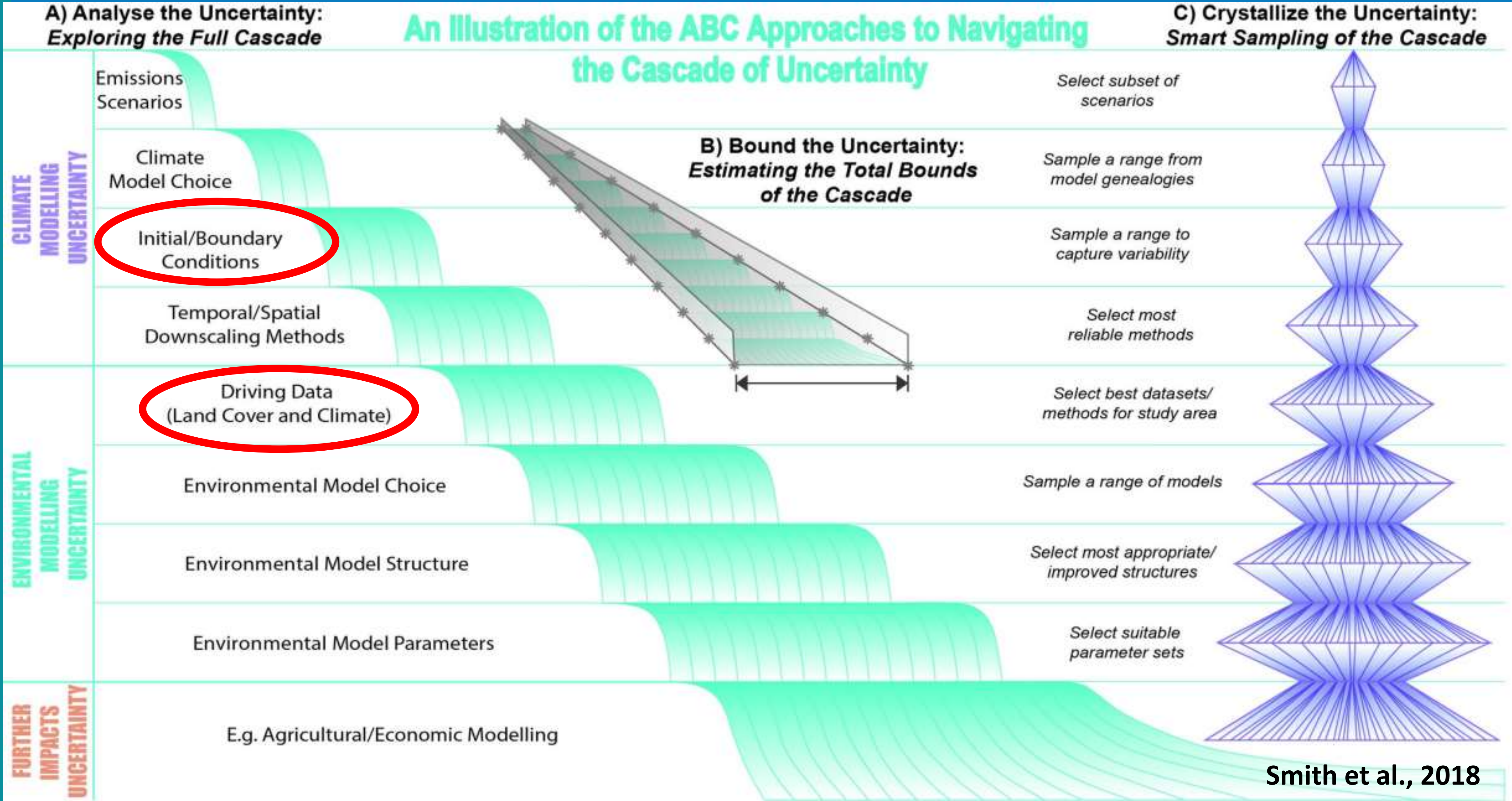
→ Precipitation pattern not captured by the models → cannot be used!

→ Uncertainty in results and bad model performance mainly due to insufficient observations

→ High uncertainty hinders adaptation and increases costs

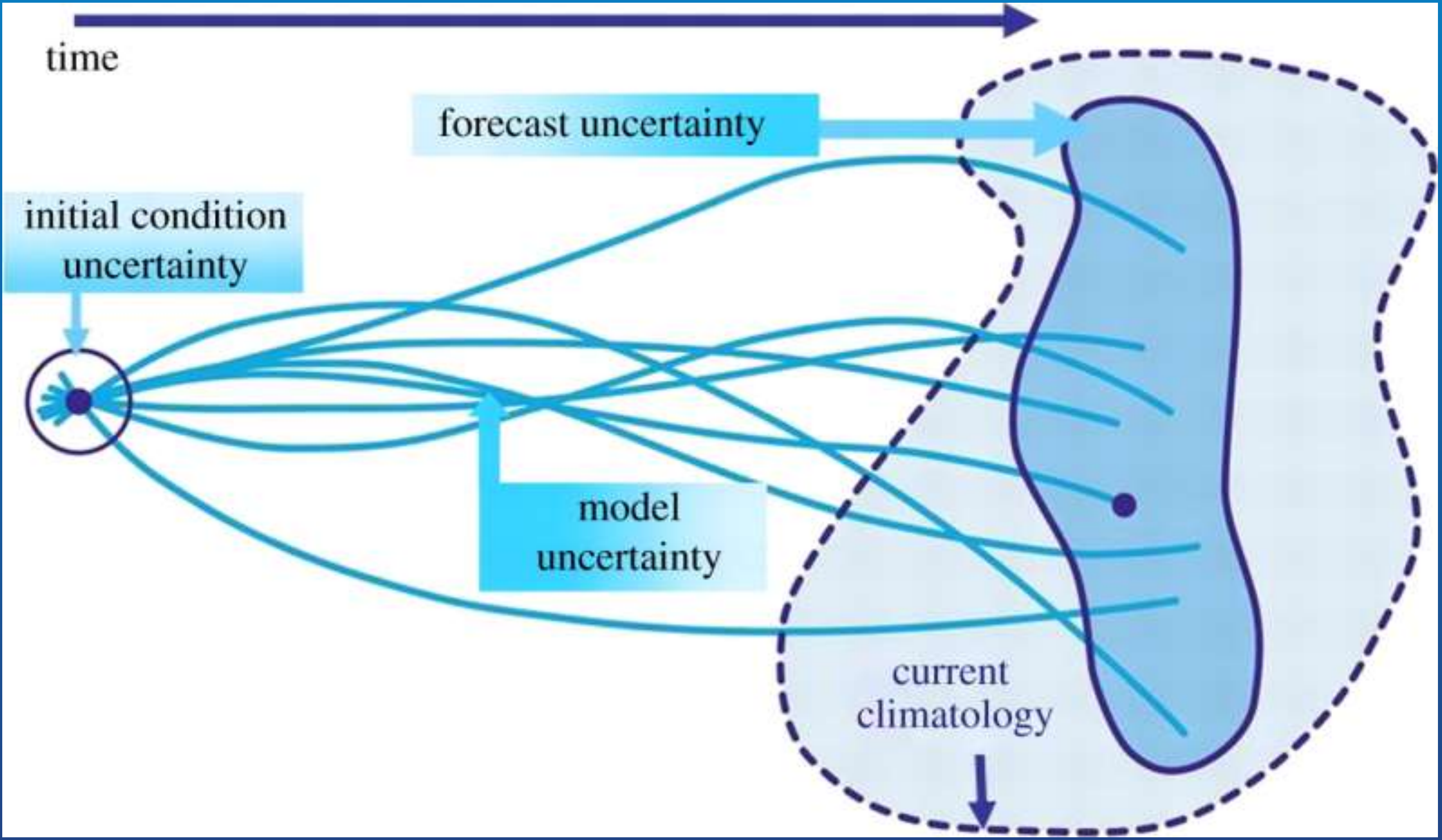
→ Maintenance of long time series is of utmost importance

Uncertainty in modelling: the cascade of uncertainty



Smith et al., 2018

Importance of initial conditions in forecasts



Slingo et al, 2011

→ Performance of models for weather and climate depend strongly on quality and quantity of observations
→ Uncertainty can be reduced significantly by observations, small improvements can help a lot; and vice versa…

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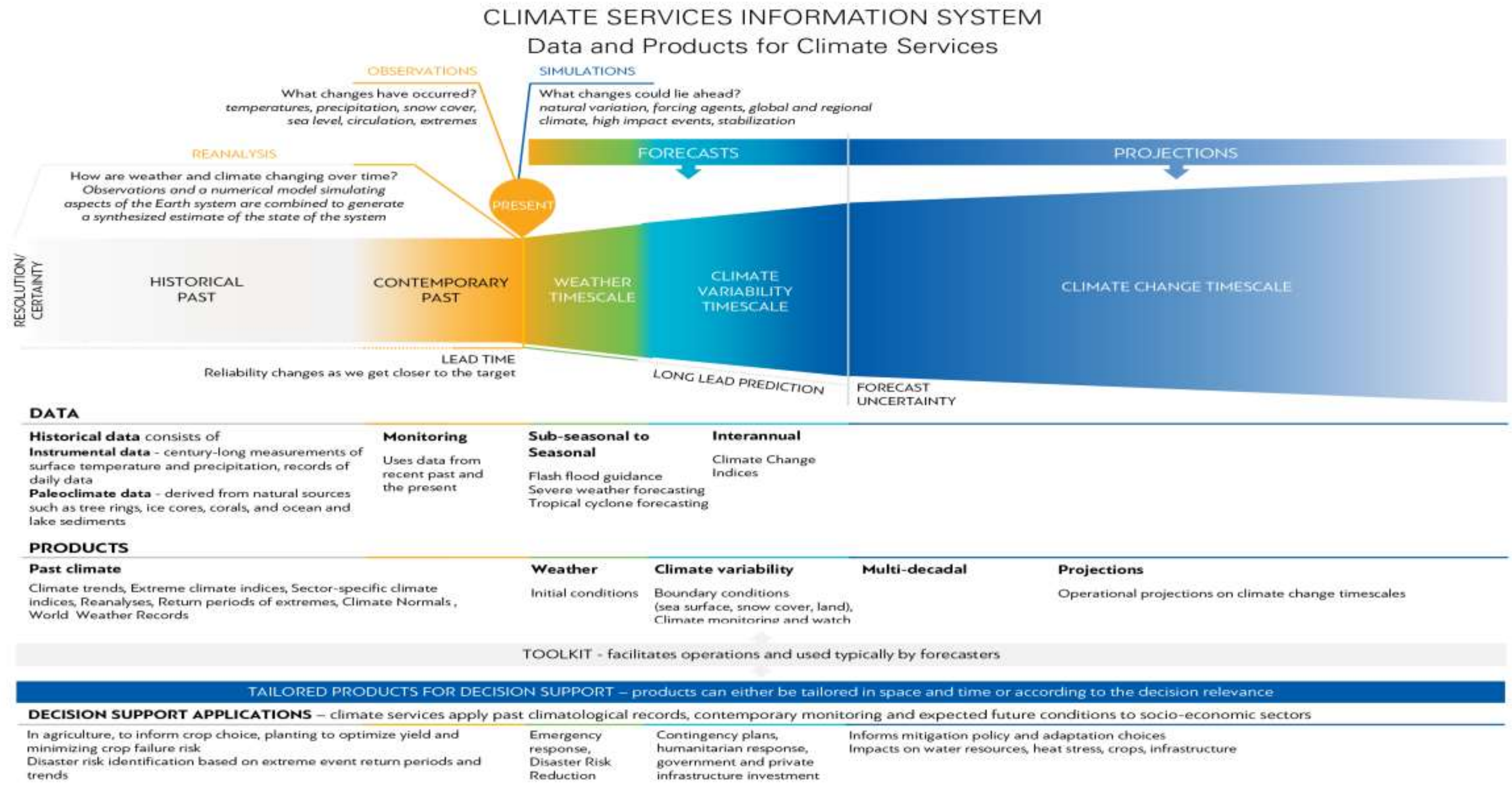
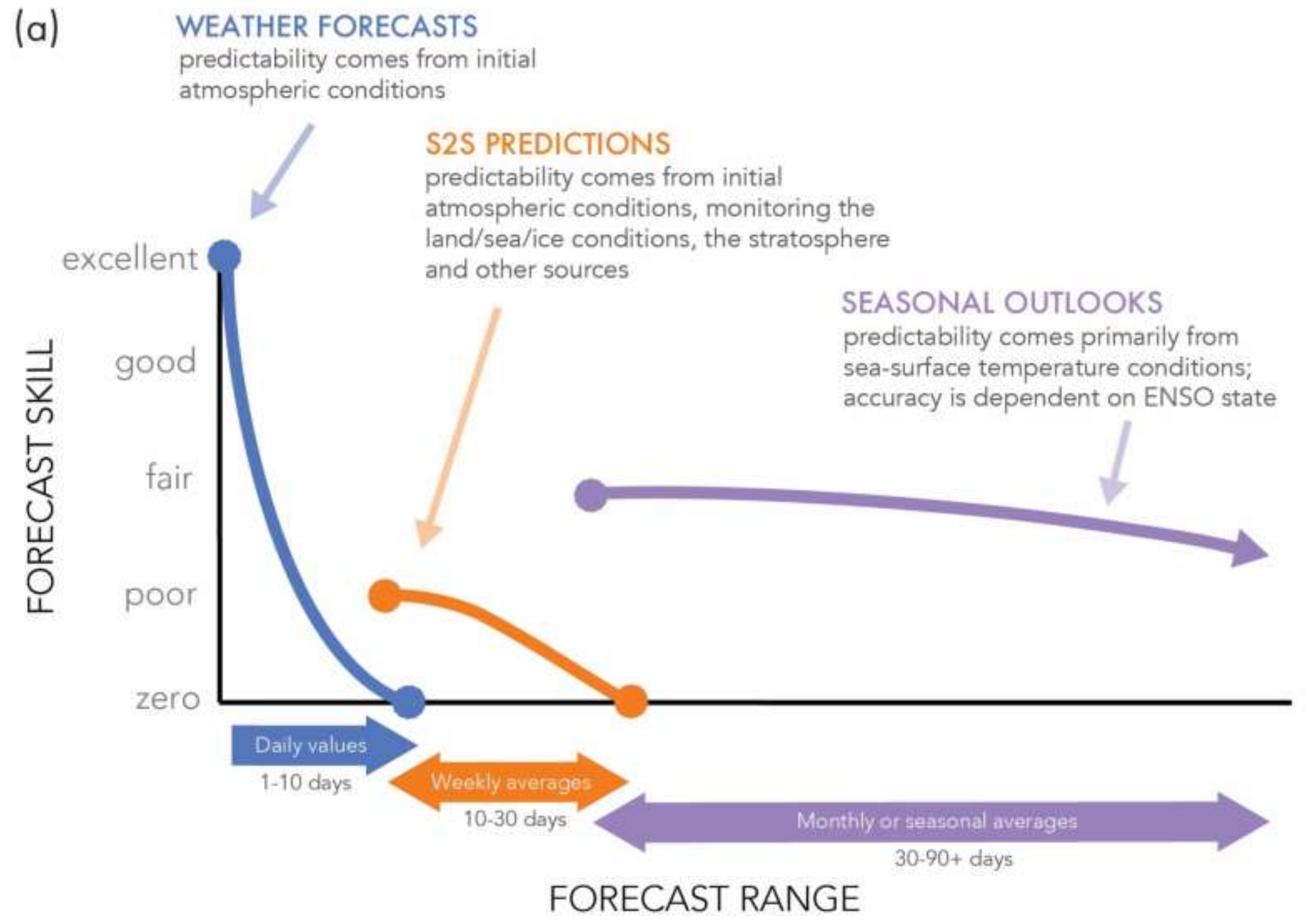
GLOBAL CLIMATE OBSERVING SYSTEM

Timeliness of reporting observations



Timeliness of reporting

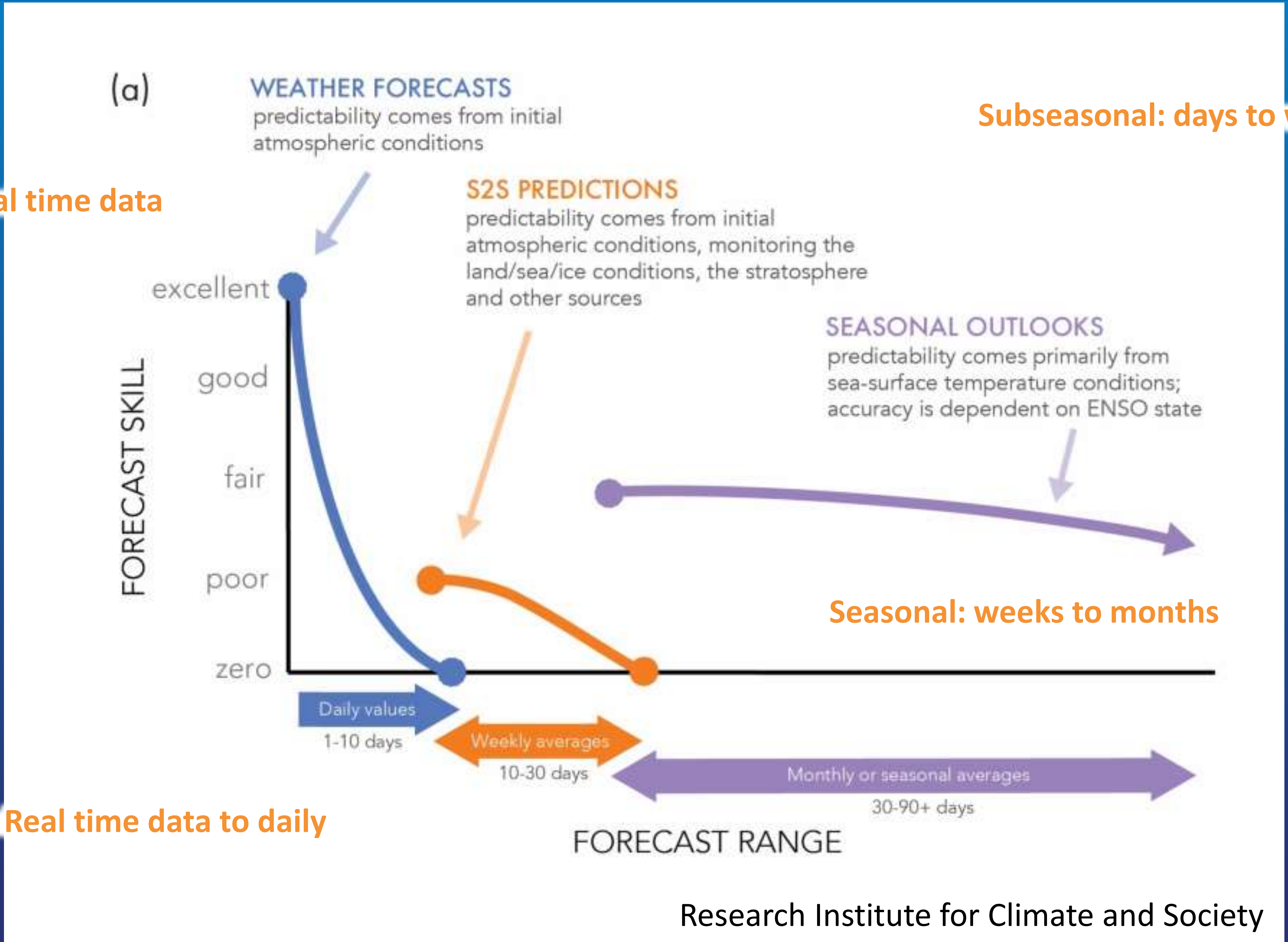


Research Institute for Climate and Society

Timeliness of reporting

Nowcasting: Real time data

Subseasonal: days to weeks

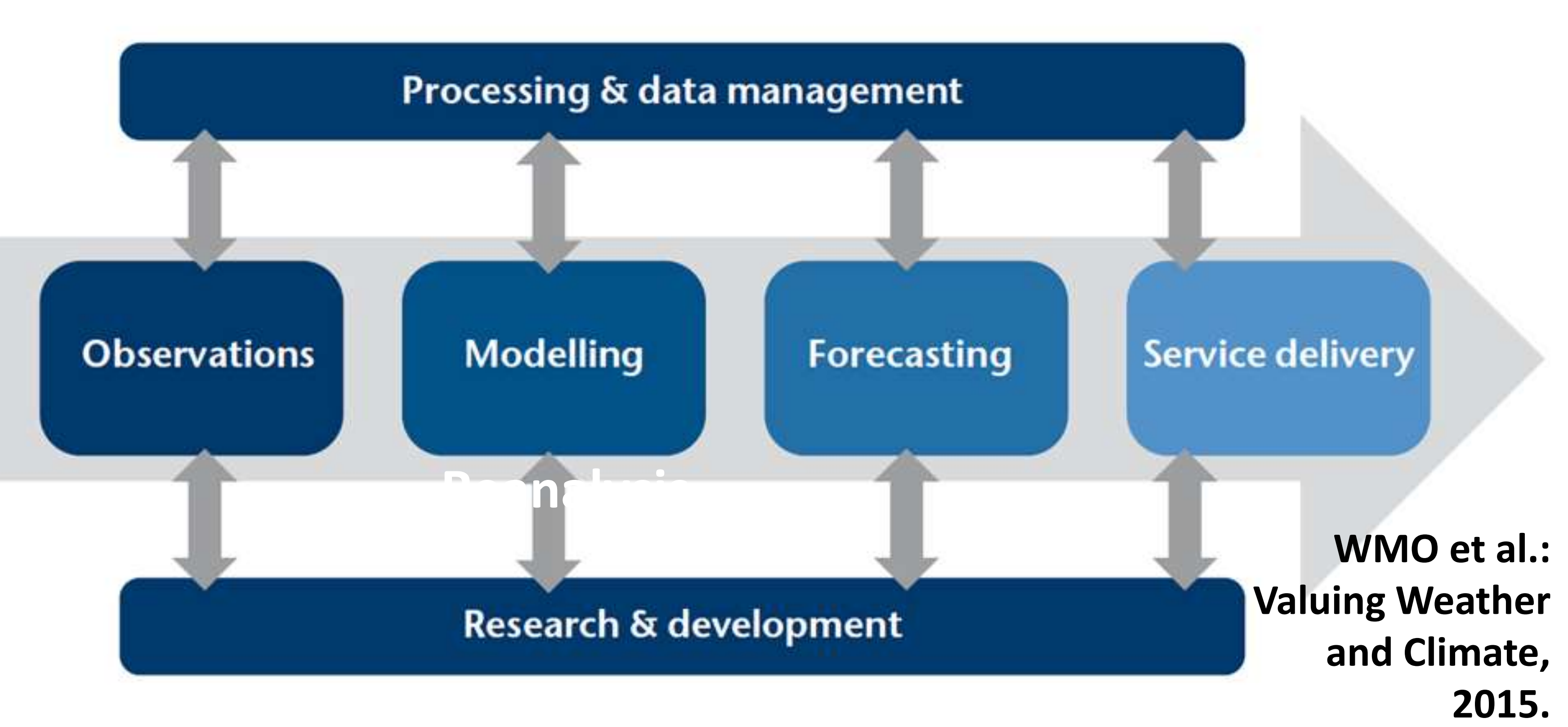


Seasonal: weeks to months

Projections: Annual +

Forecasting: Real time data to daily

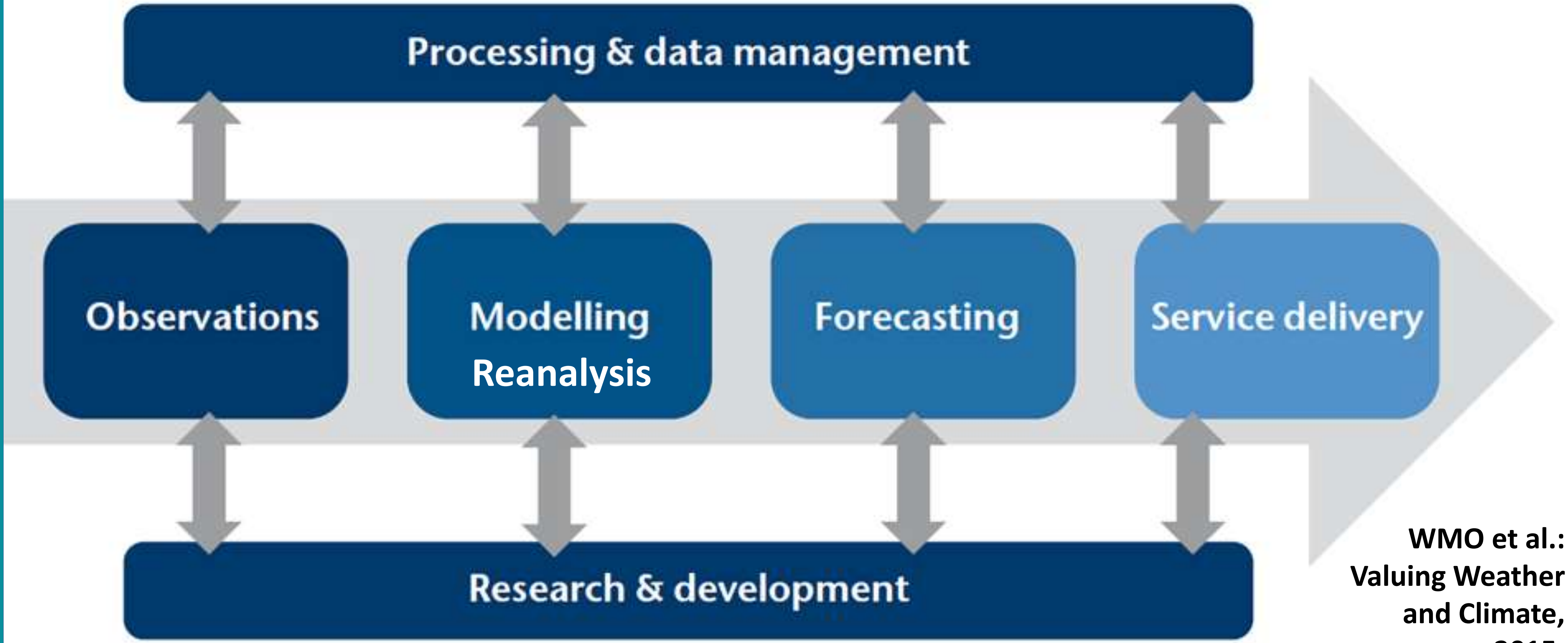
Conclusions



WMO et al.: Valuing Weather and Climate, 2015.

1. All Climate Services depend on Observations
2. Quality and quantity of observations decide on the efficiency and effectiveness of adaptation
3. Even small improvements in observation data availability can help a lot; and vice versa.

Going into more detail



WMO et al.: Valuing Weather and Climate, 2015.

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