


WATCH
Water and Global Change

Drought and Large-scale Floods



Hydrological Extremes at a global scale: historic and future climate

WB4 partners

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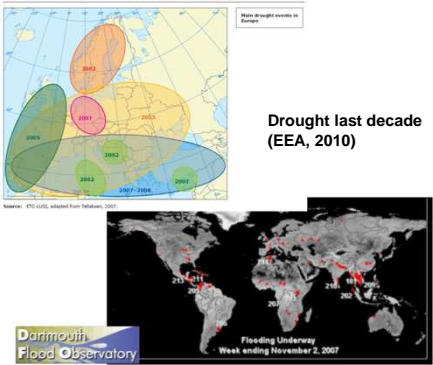
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Hydrological Extremes at a global scale: historic and future climate

Main objective:

to advance our knowledge on the impact of global change on hydrological extremes (drought & large-scale floods)


- What are the characteristics of extreme historical events?
- Are there consistent patterns in the spatial occurrence of extreme events?
- Are we seeing an increase in the frequency and severity of extreme events (trends)?
- What about the future (21st century)?



Drought last decade (EEA, 2010)

Darlington Flood Observatory
Flooding Underway
Week ending November 2, 2007

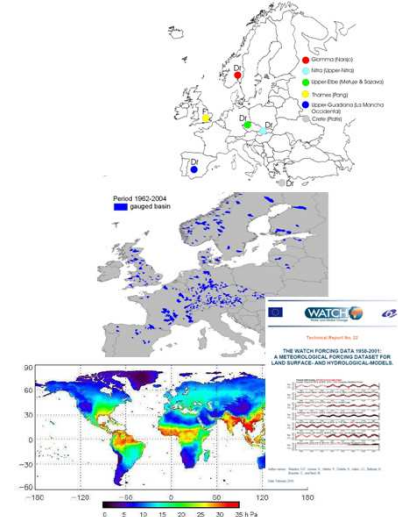
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DATA


- **OBSERVATIONS**
 - WATCH Test Basins
 - Discharge data from the UNESCO-FRIEND European Water Archive
 - WATCH Forcing Data (WFD, global, 0.5°, 20th century)
- **MODELING OUTCOME**
 - WATCH Test Basins, RBHMs
 - WATCH Forcing Data (global, 0.5°, 21st century, 3 GCMs, A2 and B1)
 - Large-scale models: GHMs, LSMs (WFD, global, 0.5°, 20th century)
 - Large-scale models: GHMs, LSMs (global, 0.5°, 21st century)





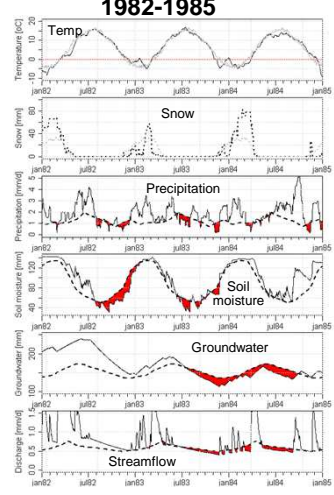
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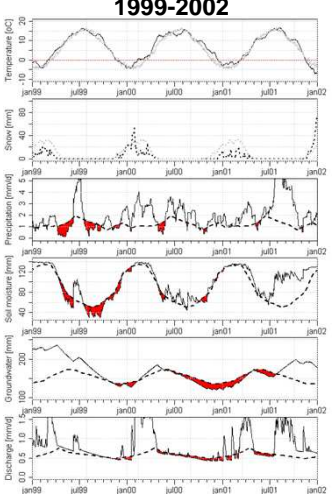


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1982-1985



1999-2002




Test Basins

Drought Propagation

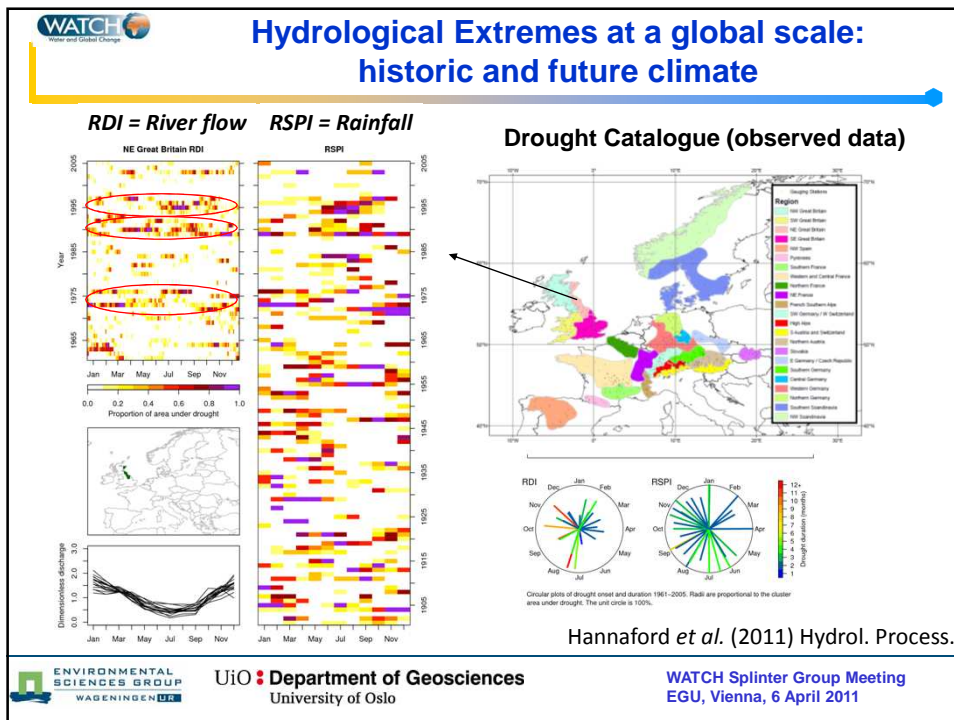
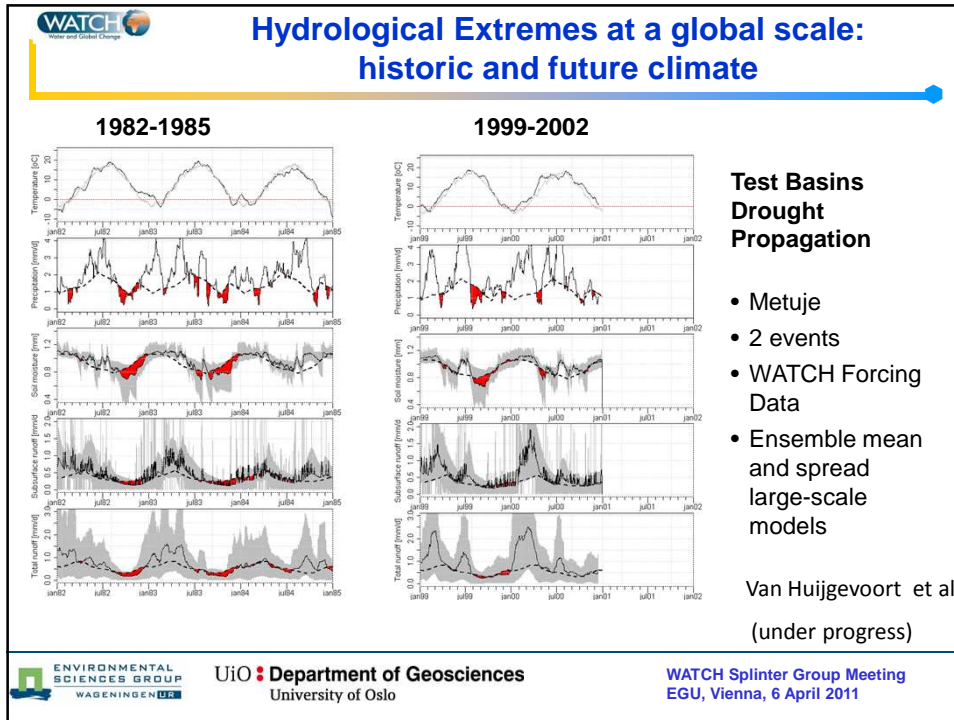
- Metuje
- 2 events
- Local weather data

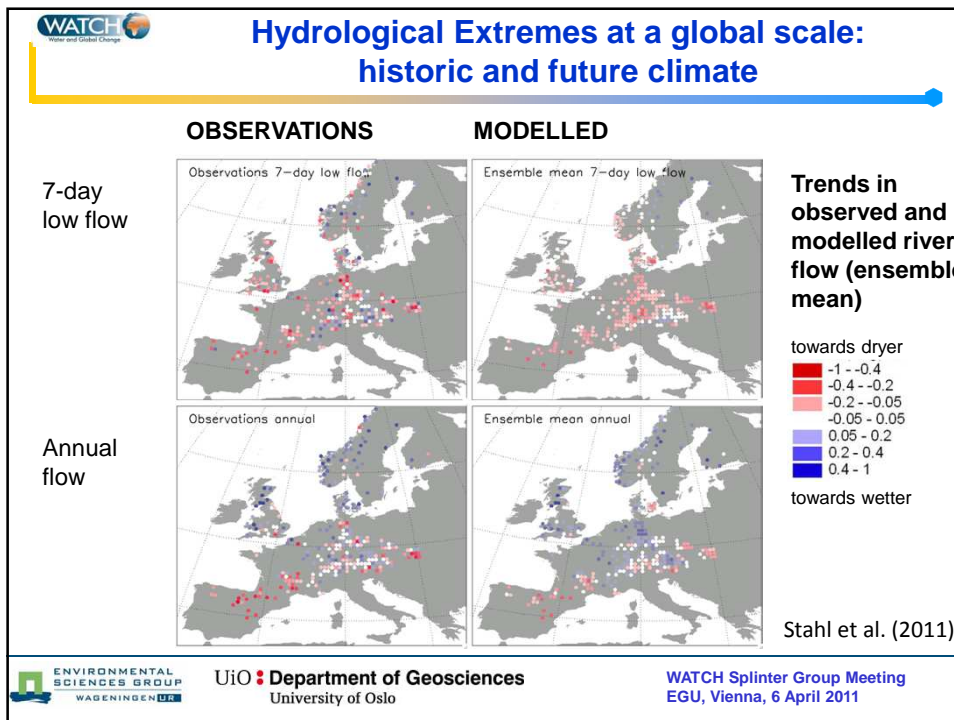
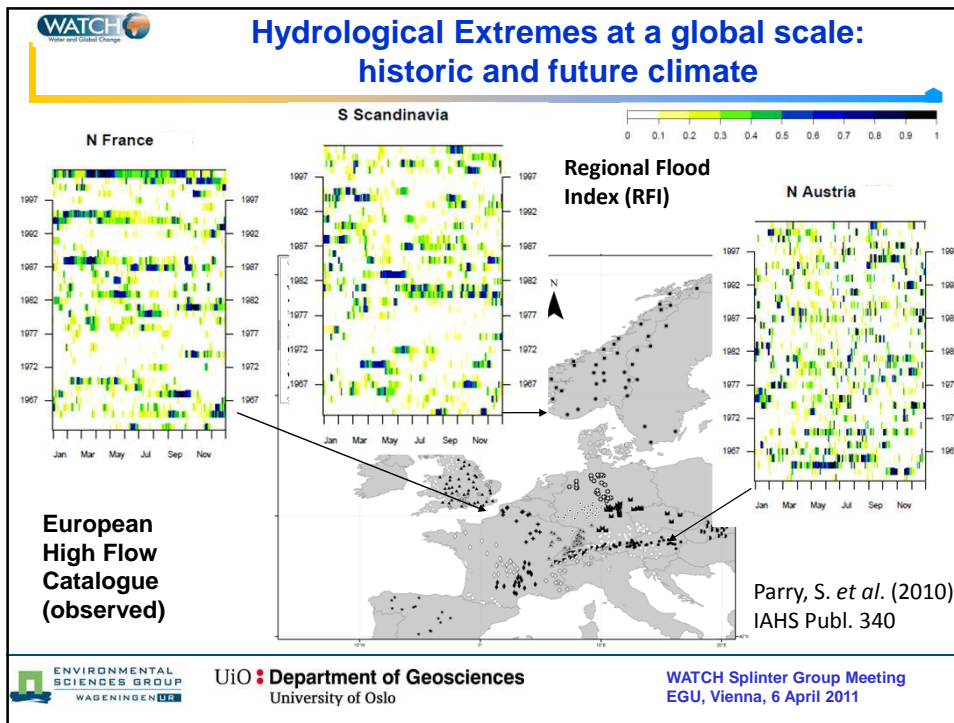
Van Loon et al.
(under progress)

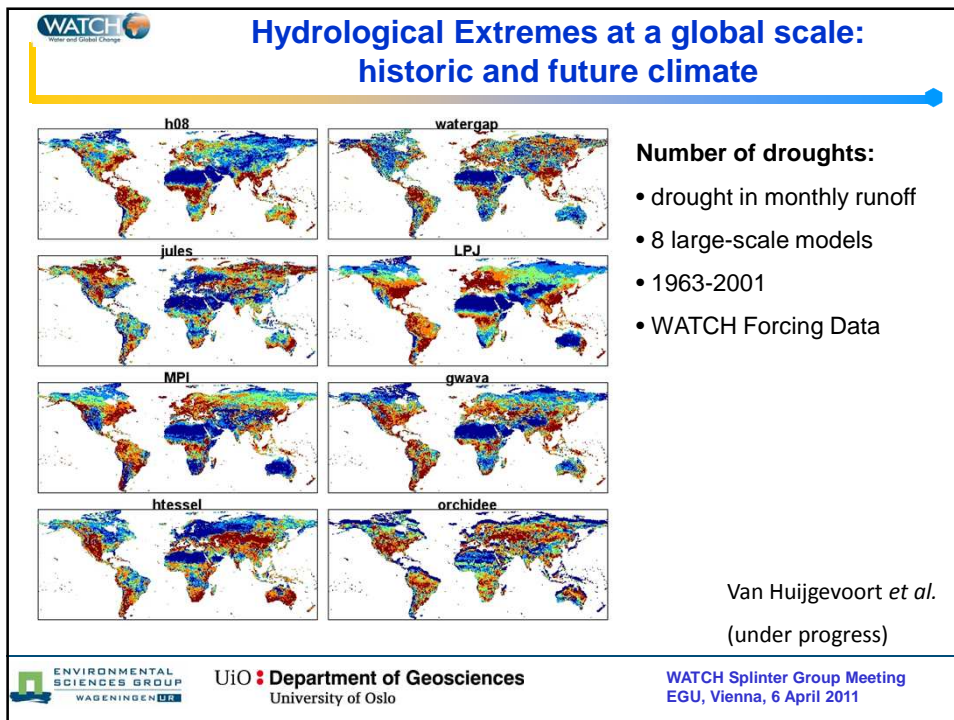
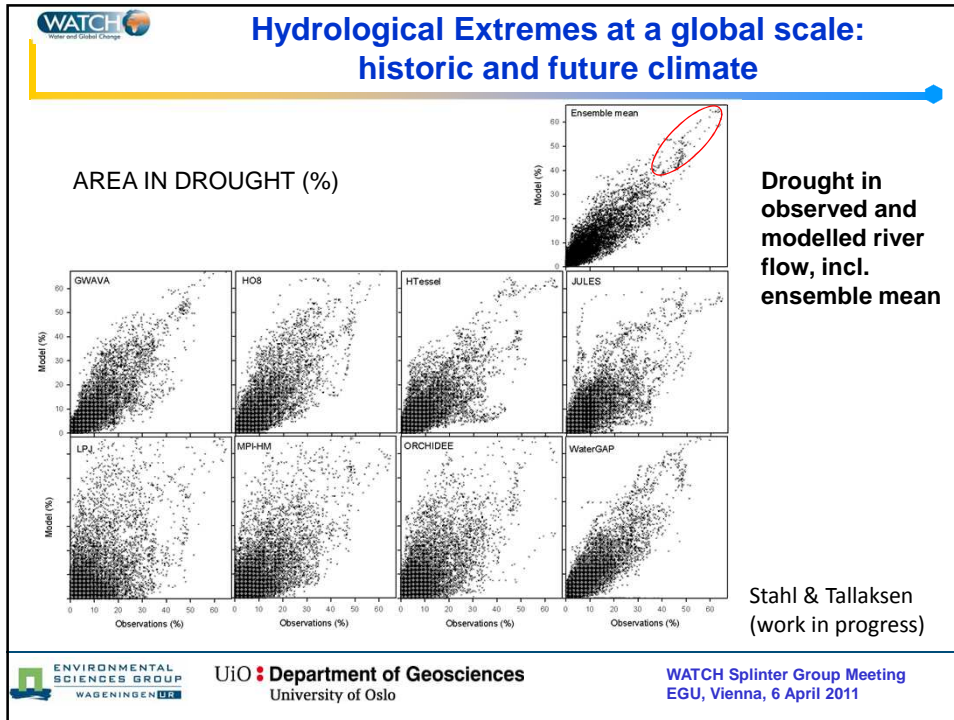


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Synchronicity in drought occurrence

Year: 1976 Month: 8

Latitude [degrees] vs Longitude [degrees]

Drought clusters:

- Drought in runoff
- August 1976
- WaterGAP
- WATCH Forcing Data

Van Huijgevoort, Hazenberg et al.
(under progress)

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Intercomparison models and observations

River Irrawaddy, Asia

River Burdekin, Australia

River Fraser, N. America

River Liard, N. America

Intercomparison models and observations

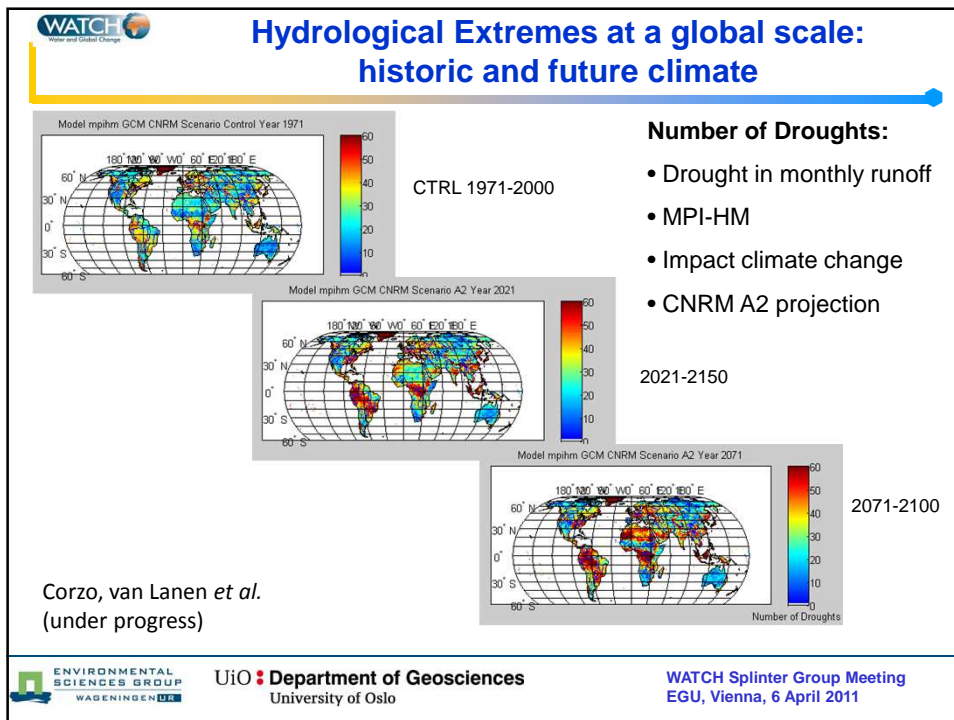
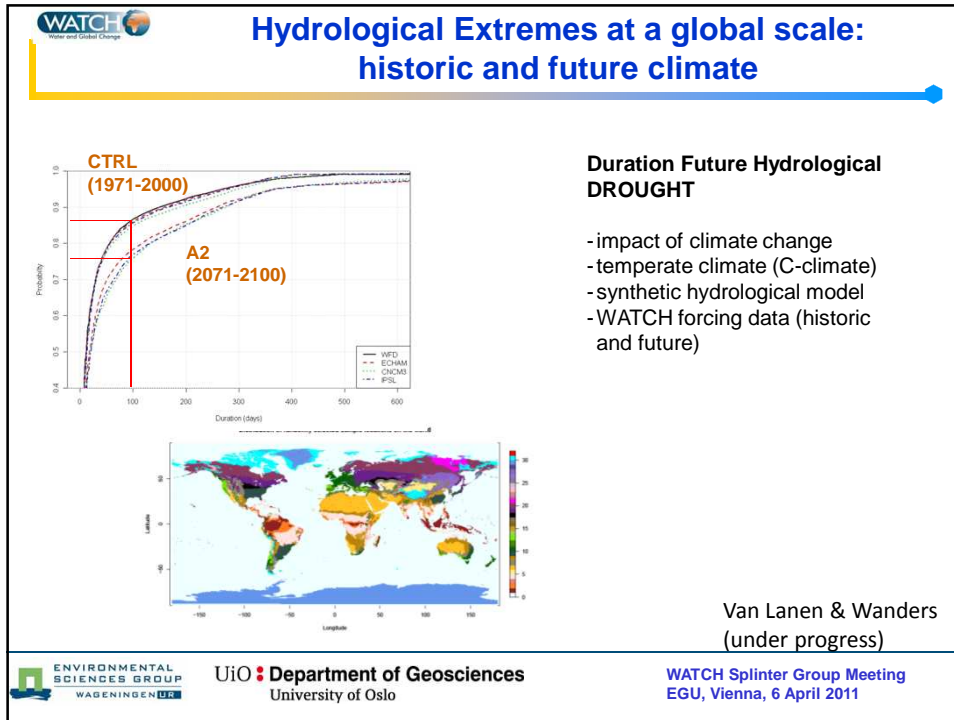
- OBS
- H08
- Jules
- LPJ
- MPI-HM
- WaterGAP

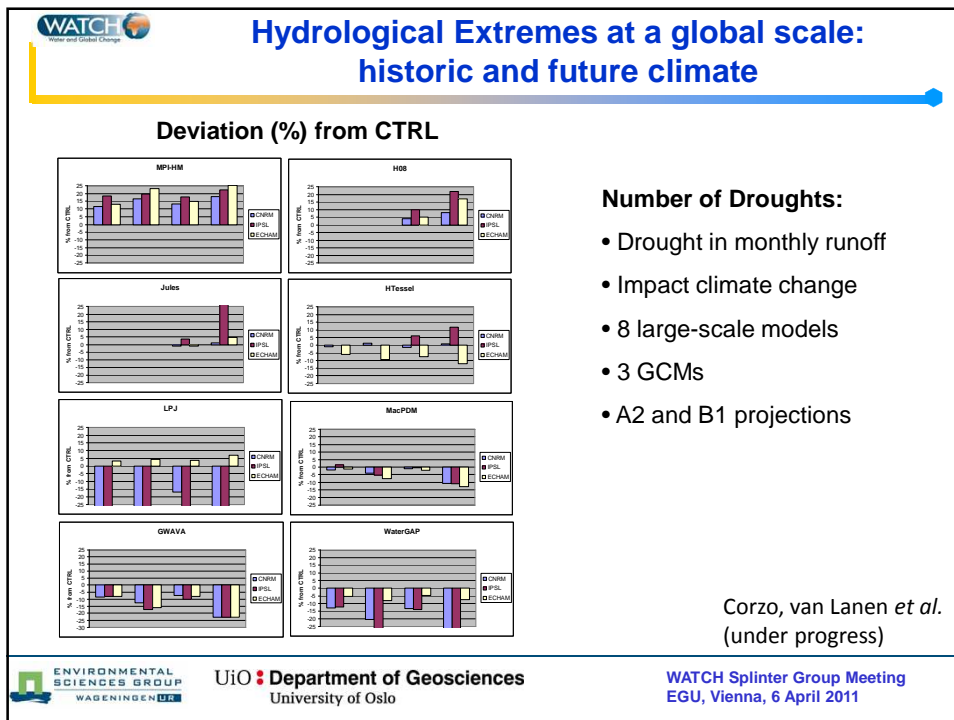
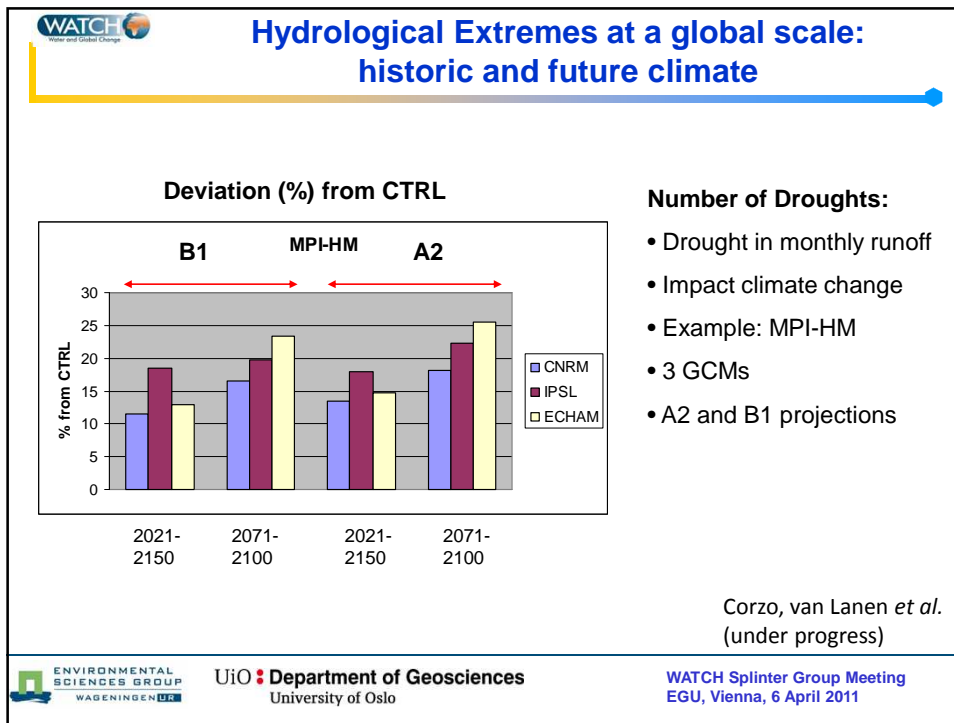
Van Huijgevoort *et al.*
(under progress)


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What did we learn?


- **Intercomparison of observed and modelled large-scale extremes is essential to assess the impact of climate change on future drought**
 - data availability prerequisite

- **Historic extremes**
 - consolidated data: catalogues;
 - observations: lower monthly flows from April onwards in most of Europe;
 - models seem to reproduce major droughts;
 - modelled droughts in flashy catchments and wet climates (A- and C climates) closer to observations;
 - model ensemble mean performs better;
 - models capture trend in annual flow; monthly trends not well represented.









What did we learn?

- **Future extremes (likely):**
 - droughts better predicted in wetter climates (A- and C-climates) and flashy river basins than in dry environments with large storage;
 - durations longer (C-climate);
 - ensemble mean better prediction than individual large-scale models.

- **Future extremes (remarks):**
 - large-scale models: occurrence no unidirectional signal
 - change in number of dry regions complicates assessment of climate change on drought;
 - inconsistencies driving forces (bias correction)

