6.   Attributing causes of regional climate change
6.a Global warming

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Overview of section 6a (very preliminary)

1. Temperature

    -   Evidence of an attributable human influence from global to subcontinental studies with regional focus/detail (e.g. Stott et al. 2003, Christidis et al. 2010)

    -   Consistency with regional climate projections (Bhend and von Storch, 2009)

2. Hydrological cycle - Circulation

    -   Increase in precipitation consistent with model projections but much stronger in observations (Zhang et al. 2007, Bhend and von Storch 2008)

    -   Observed changes in circulation stronger than predicted (e.g. NAO, Gillett 2005, Wang et al. 2009)

3. Changes in the Baltic Sea

    -   Increasing sea level tied to global warming and thus mostly anthropogenic (sea-level rise counteracted by isostatic rebound) - no attribution yet (even at global scale).

    -   Multidecadal variability in the Baltic Sea makes detection of an anthropogenic warming difficult (Hansson and Omstedt 2008)

Overview of section 6a - continued

4. Are impacts of current climate change attributable to human influence?

   - Human influence on lengthening of growing season and earlier spring onset detected (Christidis et al., 2007)

   - Rosenzweig et al. (2008) find consistency with warming across a wide range of physical and biological time series (not specifically for the Baltic Sea area)

   - Do we want to include impacts in this chapter, given there is no standard method to assess attributable influences on non-climatic parameters?

Proposed strategy for chapter 6a

- There is still only a very limited set of attribution studies available for the Baltic Sea region. Therefore, I propose a three-tiered approach:

    1. Assess the consistency of observed changes with changes at the next level of aggregation for which attribution assessments are available (e.g. continental or subcontinental studies, global studies with regional detail).

    2. Include regional attribution-like studies (consistency assessments and others) if available

    3. Compare the observed changes from chapter 3 with the projections from chapter 4 (plausibility argument) - **this might be to far away from the 'assessment' spirit, as such a comparison may lead to genuine, new and unpublished findings**

- If you agree to point 3 above, I would like to 'institutionalize' good collaboration with chapters 3 and 4 to ensure consistency

    - Either one of the authors of chapter 3 and 4 participates in chapter 6 or

    - I get included in the drafting processes of these chapters as a 'hearer'

- In any case, consistency between chap. 3, 4, and 6a is crucial

Yet unassigned topics for section 6

1. What does detection and attribution mean?

   1. Detection: Observed change is not due to natural (internal) variability alone --> external forcings must contribute

   2. Attribution: Identify which forcings are the most plausible explanations for the observed change

   3. Regional attribution is difficult as many of the hypothesized forcings are not yet well understood (e.g. land-surface changes, aerosols), that is we are not able to provide quantitative (sometimes not even qualitative) statements on the expected response

   4. Consistency with individual forcings can be examined (e.g. GHG and sulfate forcing either from projections or transient simulations)

2. How do we deal with D'n'A in BACC II?

   1. See proposed strategy on previous slide

Open questions - comments

- I wouldn't want to think of global warming as a cause of regional climate change (chicken and egg problem). Rather, I'd refer to globally 'uniform' forcings (e.g. GHG, Solar, and Volcanic) in contrast to much more local forcings such as aerosols and land-use change.

- Attribution being inherently relative (to other plausible explanations), I am not sure whether the division between different **causes** is a good approach, as the reader will have to relate the different assessments in the subchapters to get an overall assessment. Therefore, I propose to rather structure the assessment around the different **aspects** (variables) and discuss all causes there.