The Current Climate of the IP: Teleconnections and Natural Variability Mechanisms

- The NH pattern of atmospheric variability that most influences the IP climate is the North Atlantic Oscillation (NAO), which is closely associated with rainfall and, to a lesser extent, wind, temperature and sea level variations, from interannual to decadal timescales.
- When the NAO is positive (negative), winter precipitation is greatly reduced (enhanced) in most of the IP, particularly in the southern half (Fig. 5).
- The past upward trend in the NAO accounts for some (~1/3) of the winter decrease in precipitation.
- Climate simulations for the 21st century project an upward NAO trend, which would result in a reduction of winter precipitation in the IP.
- The influence of ENSO on the IP is less clear but appears to be significant in autumn and spring for both temperature and precipitation.
- The influence of the NAO and ENSO on the IP climate has not been stationary.
- The NAO signal over Europe may be associated with different mechanisms, indicating an indirect influence from ENSO and forcing from the tropical Atlantic.

The Current Climate of the IP and Surrounding Seas: Observed Trends

- **Temperature:**
  - Progressive warming during the 20th century (Fig. 2), particularly prominent in the last three decades (1957-2005).
  - The warming for the recent period is more pronounced in spring and summer.
  - The rate of recent warming is close to 0.5°C/decade (50% larger than the NH continental average and almost three times larger than the global average).

- **Precipitation:**
  - Annual precipitation in the last three decades has decreased compared to the 90s and 70s, mostly due to rainfall reductions in late winter (February-March; Fig. 3).
  - The recent decrease in the IP is part of a large-scale pattern of reduced precipitation in the Mediterranean region, partly related to an upward NAO trend (Fig. 3).
  - The first decade of the 21st century may have been the driest since 1950 (note: not so in the new, updated EOBs v6 data set).
  - The strong interannual variability and the lack of reliable early century data prevents a conclusive statement as to whether precipitation has decreased to a historical minimum.
  - The pronounced decrease in winter precipitation predicted by climate models for the end of the 21st century is not yet apparent in observations.

- **Ocean Temperature and Salinity:**
  - From 1950 to 2005, SST in the Bay of Biscay has increased by 0.12°C/decade in the SW and by 0.35°C/decade in the NW. These values are consistent with the average increase of 0.19 to 0.13°C/decade estimated for the NH for the period 1979 to 2005 (IPCC).
  - The warming has affected the entire water column. During the 90s the temperature of the upper 1000 m increased by 0.15°C and 0.3°C, respectively.
  - A decrease of 30% in the intensity of Atlantic upwelling since the 1960s (10 years) has been observed, which has decreased primary productivity and slowed down the renewal of coastal waters.
  - In the western Mediterranean (Fig. 4), a temperature increase has been reported at deep layers, but with large uncertainties.
  - Greater confidence exists for an overall increase in salinity, particularly at intermediate layers (~0.003/psu/year), at least during the second half of the 20th century.

- **Sea Level:**
  - Mediterranean coast: sea level records spanning the entire century show the spatial pattern of the February-March trend for the period 1960-2011.
  - Atlantic coast: tide gauges have recorded a sustained sea level rise of around 1.4 mm/yr when the entire 20th century is considered and of more than 2 mm/yr during the second half of the century.
  - Mediterranean coast: sea level records spanning the entire century indicate a rise of about 1.2 mm/yr (the same order as the global mean). However, trends observed during the second half of the 20th century are weaker (0.3 - 0.7 mm/yr), becoming non-significant or even negative between the 1960s and the beginning of the 1990s.
  - A pronounced increase in atmospheric pressure between the 1960s and the 1990s and a temperature increase weaker than the global mean may explain the different evolution of Mediterranean mean sea level compared to the open ocean.

The Climate of the IP in the Future: Anthropogenic Impacts

- Regional climate model projections for the end of the 21st century indicate pronounced increases in mean seasonal temperature (Fig. 6), larger in summer (0°C) in scenarios with the greatest anthropogenic impact than in winter (2-3°C).
- A decrease in precipitation throughout the entire year, again larger in summer than in winter, is also projected. On average, the models project increasing aridity and conditions over most of the IP. With greater uncertainty, the models suggest an increase in extreme precipitation events, for both dry spells and intense precipitation episodes.
- An increase in extreme high-temperature events (>30°C) is also predicted, particularly in the south of the IP.

Motivation for the report:
- IPCC reports need to be complemented with regional climate reports that assess the scientific knowledge of climate change in particular regions of the world. This is especially important for areas such as southern Europe and the Iberian Peninsula (IP) which have been signaled as very vulnerable to climate change.
- “Climate in Spain: Past, Present and Future” is a collaboratively-build (100 contributors) assessment report that reviews the existing evidence of changes in the climate of the IP (past and present), assesses our understanding of the physical processes associated with natural climate variability in this region and discusses projections from regional climate models.

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