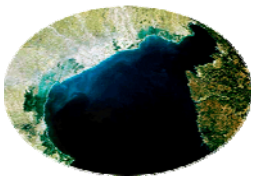

The climate in the Venetian and North Adriatic region: variability, trends and change

workshop

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TOPIC T3. Land motions and relative sea level

Understanding Past and Predicting Future Local Sea Levels: The Contribution of Vertical Land Motion

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Short abstract:

Coastal inundation is increasingly recognized at national and international levels as an issue with potentially extreme societal impact. Consequently, there is an urgent need for scientific decision support that would help to manage and mitigate the impacts of coastal inundation, storm surges, and human activities on coastal communities and ecosystems. Decision making with respect to mitigation in the coastal zone is an extremely complicated issue for various reasons, including but not limited to: (i) The time scales involved are long from a human perspective, with coastal engineering typically dealing with infrastructure with a life time of 50 to 200 years. (ii) The economic scale of the problem is extreme. Reliable and precise predictions of coastal inundation risks, for example through Local Sea Level (LSL) rise, would be invaluable for decision support. However, considering the aleatory and epistemic uncertainties in the processes that contribute to the hazards and risks in coastal zones over the 50 to 100 year time scale, accurate predictions cannot be made. What can be provided at best are reasonable scenarios, which describe a set of plausible LSL trajectories based on the best information available about the present trends and specific assumptions about future evolution of the system. Scenarios thus give a better indication of the range of plausible futures than analyses based solely on aleatory uncertainty of present trends. Unfortunately, applying this approach to the coastal zone often emphasizes the large uncertainties and wide range of plausible futures (particularly if a realistic variety of assumptions is considered).

The upper Adriatic is particularly susceptible to coastal inundation, and understanding past changes in LSL is a prerequisite for developing the capability to set up reasonable scenarios of LSL forcing, which are required to explore and assess the plausible range of future LSL trajectories. Since LSL is the difference between the sea surface height and the vertical position of the land surface, vertical land motion, in particular with respect to the geoid, contributes to LSL changes, and in some location constitutes the dominant forcing. On time scales of decades to centuries, main processes contributing to vertical land motion include tectonics, and the redistribution of mass on the Earth's surface including sediments, land water storage, glaciers, and ice sheets. Locally, sediment compaction, peat

compaction, and anthropogenic activities such as water, oil and gas extraction can impact both vertical land position and geoid.

In the Northern Adriatic, all these process are relevant and result in vertical land motion on the order of a few millimeters per year. Uncertainties of, for example, 2 mm/yr would amount to uncertainties in LSL scenarios for the next 100 years of 20 cm, which would be a major contribution to the error budget of LSL projections. Therefore, reducing the uncertainty attached to our knowledge of vertical land motion in the northern Adriatic and unraveling the contributions of the different processes is of considerable importance for LSL projections.

The presentation will review the current state of knowledge with respect to past vertical land motion in the northern Adriatic focusing on the uncertainty of the motion with respect to the Center of Mass of the Earth system (CM) and the geoid. The relative contribution of the various processes to the past LSL changes provides a starting point to set up scenarios for future vertical land motion and geoid changes. The range, including realistic uncertainties, of the contribution of vertical land motion to future LSL changes will be discussed based on realistic forcing scenarios compiled from past changes, IPCC assessments, and additional assumptions.