A wide range of infrastructure and population at risk exists around the coastline of the US. Water level ranges, magnitudes, and frequencies will all contribute to the stability, operation, and performance of infrastructure and coastal projects. Breaking a total water level (TWL) down into the contributing components is essential to understanding risk as well as potential changes over time. Projecting future conditions over the project life recognizes that there will be both stationary and nonstationary contributions to the total water level (TWL) over time necessitating the consideration of scenarios in project alternative development. Understanding which component of TWL or combination of components controls performance (and at what time scale) is critical to the design and evaluation. Depending on the location of the project site, TWLs are a combination of a range of contributors and will vary in both space and time in a manner relevant to project stability and performance. The critical water level of interest will not always be the extreme high water level. At times the design water level may have more to do with duration, its combination with another design variable, or the range of water levels across the project site. The proposed USACE approach to total water levels strives to improve transparency and understanding of actual total water level components over different spatial and temporal scales. The revised TWL approach requires clarity and detail in identifying all contributing TWL components along with the specification of dominant components and important component combinations. A detailed summary of data sources along with any potential component or coverage gaps will highlight contributions to uncertainty in the analysis. Description of design and performance categories will identify frequencies of interest and relevant time scales along with important design thresholds. Provision of the details of characteristics of controlling water levels and potential interactions with adjacent water bodies will inform the decision-makers on effective project alternative selection. Communication of the frequency of occurrence of components, influence on other design variables, and translation to project performance over time, as well as the potential for exceedance over time will be essential.

Comparing Actual Mean Sea Level Values and Trends to Projections – Heidi Moritz, US Army Corps of Engineers, Gresham, OR (co-author: M. Huber)

Sea level change and its impacts, along vulnerable shorelines, has generated more concern over the last couple of decades. The question is often asked, "What rate of change is currently being
The Comparison Tool of Current Observed Rate to Future Projected Rate of Sea Level Change, or SeaComp, was developed to allow the user to compare Actual Mean Sea Level values and trends which are computed monthly at specific locations, to the Sea Level Change Projections as described in ER 1100-2-8162. Developed using the R-Shiny programming language and platform, this online comparison tool captures monthly water level data from CO-OPS, computes the monthly tidal datums and SLC rates, and plots those values on top of the USACE SLC Projections. The concept and methodology of computing monthly Mean Sea Levels and Sea level Trends was reviewed by U.S. Army Corps of Engineers (USACE) Subject Matter Experts and the National Oceanic and Atmospheric Administration’s (NOAA) Center for Operational Oceanographic Products and Services. After review by Subject Matter Experts, a computational foundation for the following products was established: (1) visualization of the historical MSL trend, (2) visualization of inter- and intra-annual variability of MSL by location, (3) identification of the recent MSL changes, and (4) comparison of the current MSL trend with USACE projected trends. Innovative graphics and products help convey important location-specific information as well as address the range of design and function uses that will be important to the engineering and planning community.

Peak Flow Modification Due to Climate Change, Calculation Tool and Sub-regional
Conclusions - Kaveh Zomorodi, Dewberry, Fairfax, VA

A new tool was developed in spreadsheet format to predict the changes in peak discharges (Qp) and the risk associated with climate change. Input data to the tool includes current rainfall frequency-depth-duration (from NOAA Atlas 14 or similar sources), the location zip code, drainage area, curve number (CN) and time of concentration (Tc). The user can optionally consider the impact of peak rate factor and drainage area exponent in discharge calculations. The tool evaluates a rainfall temporal distribution for each recurrence interval (T). The change in 24-hour design storms due to climate change are obtained from EPA’s SWMM-CAT (Climate Adaptation Tool) which is built into this tool. The user may select from three climate change outcomes for near term (2020-2049) or far term (2045-2074) future projections. The modular form of the tool allows easy update or replacement of the climate change component. Peak discharges for current and future conditions are calculated by a unique method and are automatically adjusted to be statistically consistent with their corresponding recurrence intervals. Application of the tool to various locations in Virginia showed that consistent results are obtained for each sub-region. As a pilot case, the tool was applied to ten basins in Northern Virginia to derive sub-regional relationships and conclusions. The results showed that the percent increase in Qp per unit area is always larger than the percent increase in 24-hour design storm depth. Increased flooding risks were analyzed by estimating the Tr of future Qp based on current conditions (or estimating the Tc of current Qp based on future conditions). In Northern Virginia, the future 100-year Qp would be equivalent to the current 125 to 130-Year Qp (in Near Term) or to the current 150 to 165-Year Qp (in Far Term). Within Northern Virginia the drainage area of the basin adequately explains changes in recurrence interval of design floods with smaller faster-responsive urbanized drainage basins showing the largest changes. Additional failure probability and the extra number of failures expected for structures designed to the current 10- and 100-year standards were calculated for example cases. The tool also allows
optional calculation of changes in water surface elevation in a given stream cross section. Examination of the changes in stream flood elevations obtained for a few streams showed the impact to be highly case-dependent. The maximum rise in Base Flood Elevation was nearly half a foot in Near Term and one foot in Far Term. An example application of the regional relationships for Northern Virginia is included in this presentation to show how these relationships can be used to obtain the required results without having access to any sophisticated calculation tool.