

UKCP18 Technical Note: Hunter-style Sea-Level Rise Allowances

1. Introduction

The current Environment Agency guidance on coastal flood risk allowances for use in Flood Risk Assessments is documented in “Flood risk assessments: climate change allowances”, available at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

This document describes a different data set, which (for historical reasons) has a similar name. In order to make a distinction, the data set described here is referred to in this document as “Hunter-style Sea-Level Rise Allowances”. The Hunter-style Sea-Level Rise Allowances **do not** replace the current Environment Agency guidance. A summary of similarities and differences between the two data sets is given in the following table.

	Environment Agency Allowance	Hunter-style Sea-Level Rise Allowance
Method	Based on UKCP18 sea-level rise projections. For RCP8.5, two location-specific allowances are selected by expert judgement: 70th percentile from UKCP18 RCP8.5 and 95th percentile from UKCP18 RCP8.5.	Based on UKCP18 sea-level rise projections. For each RCP, a single location-specific allowance is evaluated using a weighting technique applied to the whole sea-level rise probability distribution. Weighting depends on the present-day return level curve. Further details in main text.
Intended application.	E.g. Flood Risk Assessment. Forms the current official guidance.	To inform development of the next generation of guidance.

Treatment of uncertainty	One pathway (RCP8.5) considered. Two different percentiles levels considered. H++ option included.	Three pathways (RCP2.6, RCP4.5, RCP8.5) considered. All percentiles levels effectively combined within each pathway. H++ option not included.
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The Hunter-style Sea-Level Rise Allowances are fully documented in "Sea-level rise allowances for the UK", Howard and Palmer, 2020, Environmental Research Communications, <https://doi.org/10.1088/2515-7620/ab7cb4>

This technical note gives a brief summary. The Hunter-style Sea-Level Rise Allowances come from the use of a method called "Hunter's Allowance" (see Further Information, below). The Hunter-style Sea-Level Rise Allowances are provided in four text files. For each of three representative concentration pathways RCP2.6, RCP4.5, RCP8.5 there is a file containing the Basic Allowance. The fourth text file contains the Antarctic Dynamic Uncertainty Allowance.

2. Basic Allowance

The Basic Allowance is founded on the probability distributions of all components of time-mean sea-level rise considered by UKCP18 except the Antarctic dynamic uncertainty. For the Antarctic dynamic contribution, we include the mean projection in the Basic Allowance.

The benefit of the Hunter-style Sea-Level Rise Allowance is that in situations where some uncertainty is tolerable, the Hunter-style Sea-Level Rise Allowance combines the uncertainty in projections of future mean sea-level rise with the risk which is implicit in present-day levels of protection to give a single suggested increase in those levels to maintain the same risk at some time in the future. The Hunter-style Sea-Level Rise Allowance thus avoids some of the subjectivity involved in selecting a suitable amount by which to raise an asset as a defence against mean sea-level rise, *once the mean sea-level rise distribution has been chosen*. However, the Hunter-style Sea-Level Rise Allowance does depend on the distribution of projected mean sea-level rise. Here we use the UKCP18 projections and thus our Hunter-style Sea-Level Rise Allowances are consistent with UKCP18 as far as possible.

All values are given in metres to three decimal places. The baseline year for the Hunter-style Sea-Level Rise Allowances is 2017, consistent with the Environment Agency publication "Coastal Flood Boundary Conditions for the UK: Update 2018" available to download from: <https://environment.data.gov.uk/dataset/84a5c7c0-d465-11e4-b0bd-f0def148f590>

3. Antarctic Dynamic Uncertainty Allowance

UKCP18 used a lognormal distribution to represent the Antarctic dynamic ice melt contribution to future mean sea-level rise. The Hunter-style Sea-Level Rise Allowance for a lognormal distribution is infinite. So it is not possible to give a finite Hunter-style Sea-Level Rise Allowance which is completely consistent with the UKCP18

approach. Instead, the UKCP18 Antarctic dynamic ice melt contribution is here capped at 0.5 metres, and an Antarctic Dynamic Uncertainty Allowance is evaluated based on the capped distribution. This addition is intended to serve in situations where there is a lower tolerance of uncertainty. In such situations, the Antarctic Dynamic Uncertainty Allowance can simply be added to the Basic Allowance. The mean of the Antarctic dynamic contribution is not included in the Antarctic Dynamic Uncertainty Allowance, to avoid double counting.

The Antarctic Dynamic Uncertainty Allowance is almost independent of representative concentration pathway and so we provide only one file of Antarctic Dynamic Uncertainty Allowance. We anticipate that it will be used in the context of RCP8.5.

In situations where any level of coastal flooding — no matter how small the risk — is intolerable (an example might be a major coastal infrastructure project), a review of some of the many publications discussing "high-end" sea-level rise scenarios and their application would be an essential complement to consideration of the allowances discussed here. For a brief list of such publications see section 6 of <https://doi.org/10.1088/2515-7620/ab7cb4>

Current Environment Agency guidance on H++ allowances is documented in "Flood risk assessments: climate change allowances", available at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

4. Caveats

The Hunter-style Sea-Level Rise Allowances given here do not take any account of projected future changes in wave setup or runup, nor of changes in the statistics of storm surge over and above the mean sea level, nor of changes in the tidal characteristics. Although current guidance for the UK suggests that these are most likely to be small contributions compared to the mean sea-level rise, some recent work has shown that such contributions and their non-linear interactions may not be small everywhere.

The Hunter-style Sea-Level Rise Allowances pertain to long-term (century-scale) mean sea-level rise. On shorter timescales, small short-period internal variations which are not considered here (such as the 18.6-year nodal tidal cycle or the North Atlantic Oscillation) may be relatively more important. For this reason, we present Hunter-style Sea-Level Rise Allowances from 2040 onwards.

5. Further Information

Further information about the UKCP18 Hunter-style Sea-Level Rise Allowance can be found in the open-access article "Sea-level rise allowances for the UK" Howard and Palmer, 2020, Environmental Research Communications, <https://doi.org/10.1088/2515-7620/ab7cb4>

Further information about "Hunter's Allowance" can be found in "A simple technique for estimating an allowance for uncertain sea-level rise" Hunter, 2012, Climatic Change vol 113 pages 239-52 <http://dx.doi.org/10.1007/s10584-011-0332-1>