Event Plotting - AQUACAT

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This document investigates the different number and size of widespread events for different grid-cell threshold and inundation limits. This analysis is based on a 30-year "present-day" period of G2G outputs across Great Britain.

Data used and produced in previous scripts

```
if(substr(osVersion,1,3) == "Win"){
  data_wd <- "S:/run_hmfg2g/outputs/"
  wd <- "S:/"
}else{
  data_wd <- "/prj/aquacat/run_hmfg2g/outputs/"
  wd <- "/prj/aquacat/"
}

ncname <- "dmflow_RCM01_198012_201011_out.nc" #2GB

ND <- 10957 # Number of days


rn <- read.csv(paste0(wd,"CodeABG/InterimData/hasData.csv"),
                      stringsAsFactors=FALSE)
NH <- nrow(rn)


threshDayExcList <- readRDS(paste0(wd,
                           "CodeABG/InterimData/threshDayExcList.rds"))
  #5 lists of NH lists

# Number of events
S <- sapply(threshDayExcList, function(l){length(l[[1]])})
for(i in 1:5){
  print(paste(threshName[i], "events per grid-cell:", S[i]))
}
```

```
## [1] "POT5 events per grid-cell: 151"
## [1] "POT2 events per grid-cell: 61"
## [1] "POT1 events per grid-cell: 31"
## [1] "Q5 events per grid-cell: 7"
## [1] "Q10 events per grid-cell: 4"
```

```
thresMat <- readRDS(paste0(wd,"CodeABG/InterimData/threshMat.rds"))
```

Find size of widespread inundation events.

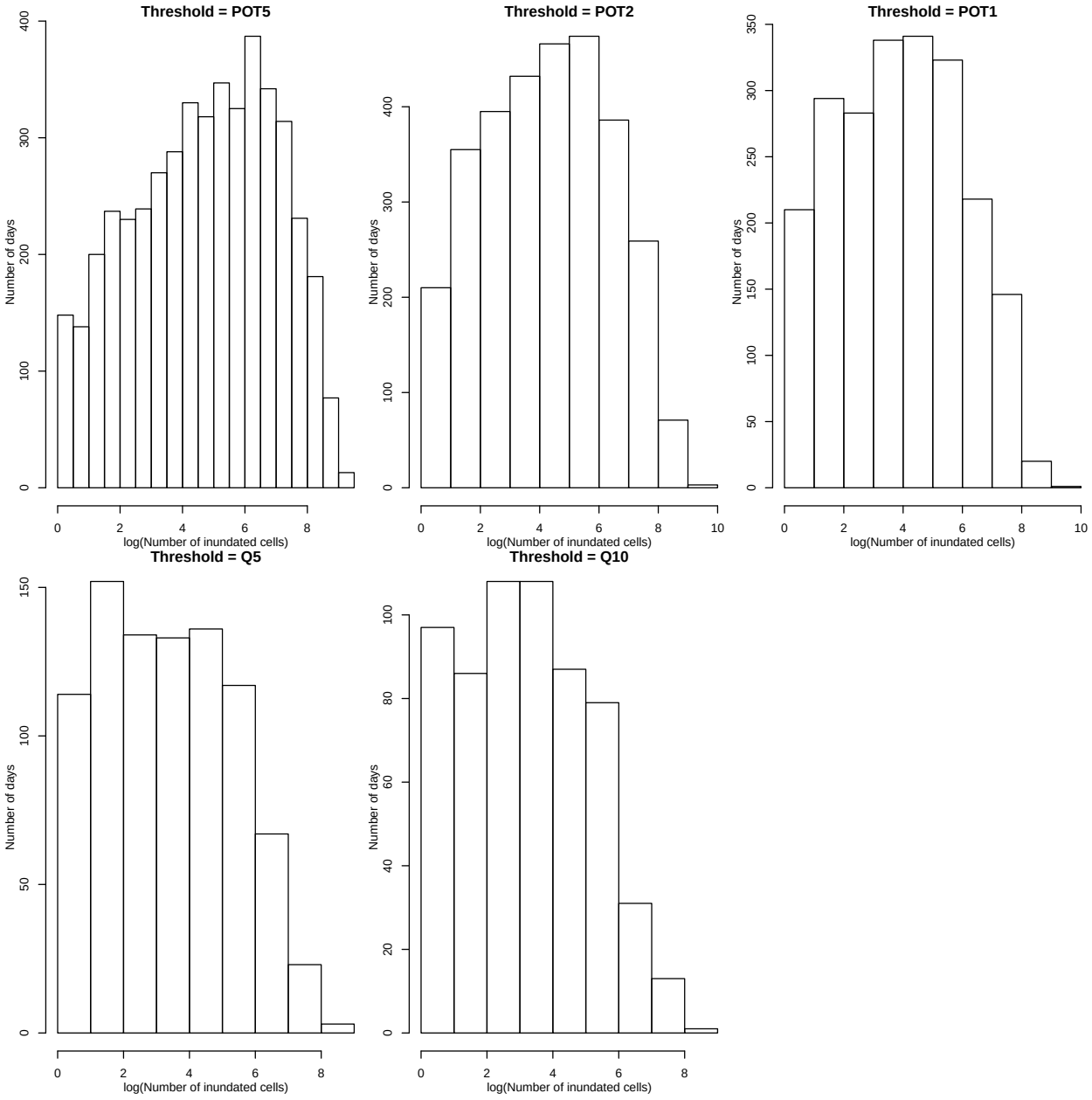
```
# Number of sites exceeded for each day at each threshold
inunMat <- matrix(0, nrow=NT, ncol=ND)
inunDays <- matrix(0, nrow=NT, ncol=NH)

for(j in 1:NT){  # for each threshold value
  #print(threshName[j])
  for(k in 1:NH){ # at each river network gridcell
    tde_jk <- threshDayExcList[[j]][[k]]

    for(n in 1:length(tde_jk)){
      tde <- tde_jk[n] # which days was it exceeded
      inunMat[j,tde] <- inunMat[j,tde] + 1

    }

  }
}

rownames(inunMat) <- threshName

EventSizeSumm <- apply(inunMat, 1, function(v){
    quantile(v[v>0], probs=
               c(0.99,0.9,0.8,0.5,0.4, 0.3,0.2,0.1,0.01))
  })
```

```
knitr::kable(EventSizeSumm/200) %>%
  kable_styling(bootstrap_options = "striped", full_width = F)
```

	POT5	POT2	POT1	Q5	Q10
99%	30.7679	19.5125	14.10845	9.2833	7.25325
90%	9.7110	5.8600	4.07350	2.1350	1.73100
80%	4.5860	2.5350	1.67200	0.9020	0.77500
50%	0.6400	0.3700	0.23500	0.1350	0.11500
40%	0.3200	0.1900	0.12600	0.0700	0.06500
30%	0.1500	0.0950	0.06500	0.0350	0.03850
20%	0.0600	0.0450	0.03000	0.0200	0.02000
10%	0.0200	0.0150	0.01500	0.0100	0.01000
1%	0.0050	0.0050	0.00500	0.0050	0.00500

```
par(mgp=c(2,1,0), mar=c(3,3,1,0), mfrow=c(2,3))
for(j in 1:NT){
  hist(log(inunMat[j,inunMat[j,]>0]),
       main=paste("Threshold =", threshName[j]),
       xlab="log(Number of inundated cells)",
       ylab="Number of days")

}
```

```r
par(mfrow=c(1,1))
```



Number of days with widespread inundation

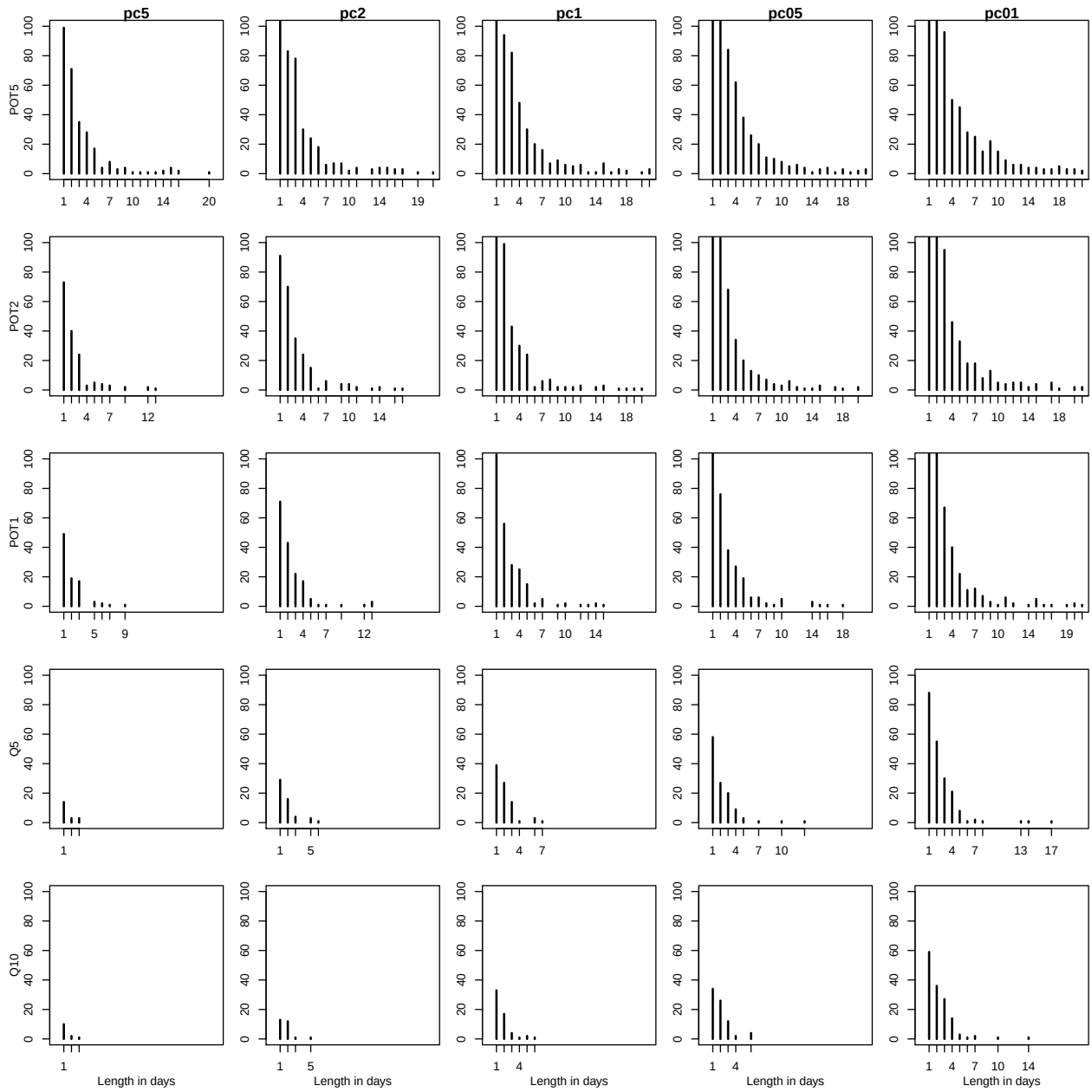
```r
# Percentage of inundated cells
wsBound <- c(0.05, 0.02, 0.01, 0.005, 0.001)
wsName <- c("pc5", "pc2", "pc1", "pc05", "pc01")
NW <- length(wsBound)

widespreadArray <- array(FALSE, dim=c(NT, ND, NW))
for(j in 1:NW){
  # Is there a widespread event on this day (at bound j)?
```

```
  widespreadArray[,,j] <- inunMat >= NH*wsBound[j]
}
dimnames(widespreadArray) <- list(threshold = threshName,
                                  days=1:ND,
                                  inundation = c("pc5", "pc2", "pc1",
                                                 "pc05", "pc01"))

widespreadCount <- apply(widespreadArray, c(1,3), sum)



knitr::kable(widespreadCount) %>%
  kable_styling(bootstrap_options = "striped", full_width = F)
```

	pc5	pc2	pc1	pc05	pc01
POT5	869	1555	2022	2482	3448
POT2	362	727	1049	1383	2111
POT1	181	389	618	832	1402
Q5	29	94	164	253	484
Q10	17	45	99	154	327

Length of events

```
eventLList <- vector("list",5)

for(j in 1:5){
  eventLList[[j]] <- vector("list",5)
  for(k in 1:5){
    eventGo <- 0
    eventL <- c()
    for(i in 1:ND){
      if (widespreadArray[j, i, k]) {
       eventGo <- eventGo + 1
      }else{
        if (eventGo > 0){
         eventL <- c(eventL, eventGo)
        #print(eventGo)
        }
        eventGo <- 0
      }
    }
    eventLList[[j]][[k]] <- eventL
  }
}
```


pc5
pc2
pc1
pc05
pc01
POT5
POT2
POT1
Q5
Q10
Length in days