

PICO #1.15

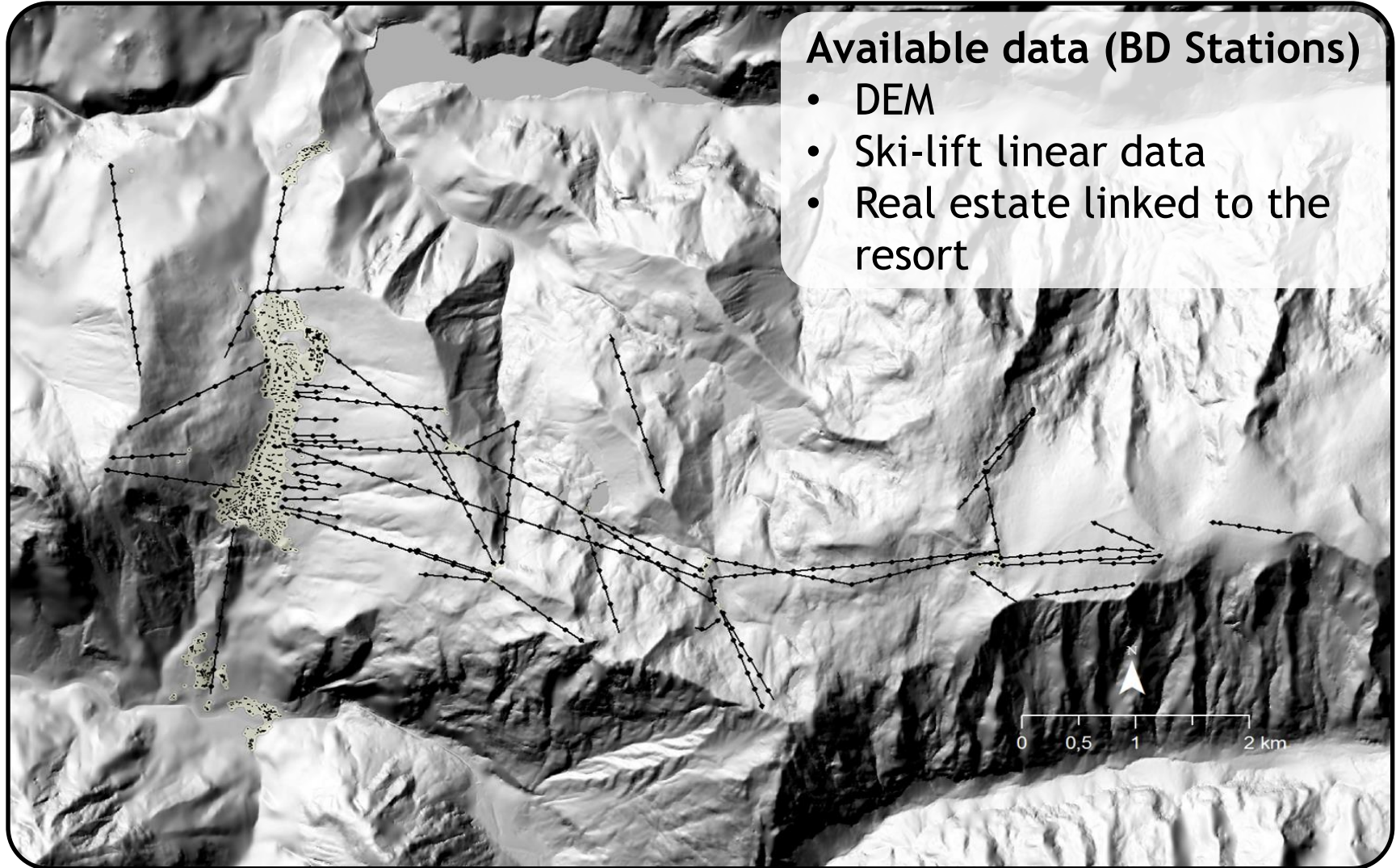
# Crossing physical simulations of snow conditions and a spatial model of ski areas to assess ski resort vulnerability

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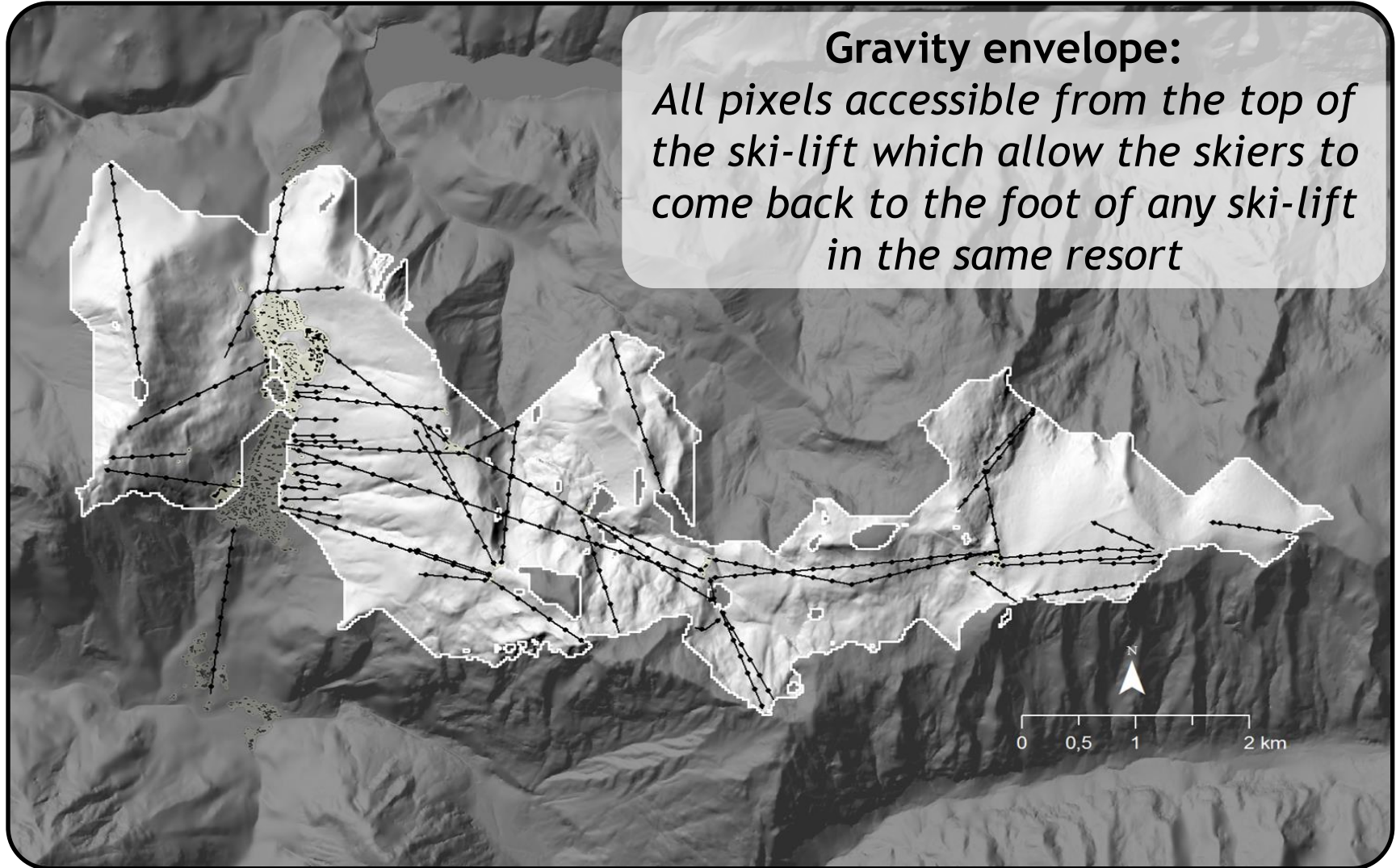
# Building of gravity envelopes for ski areas



## Available data (BD Stations)

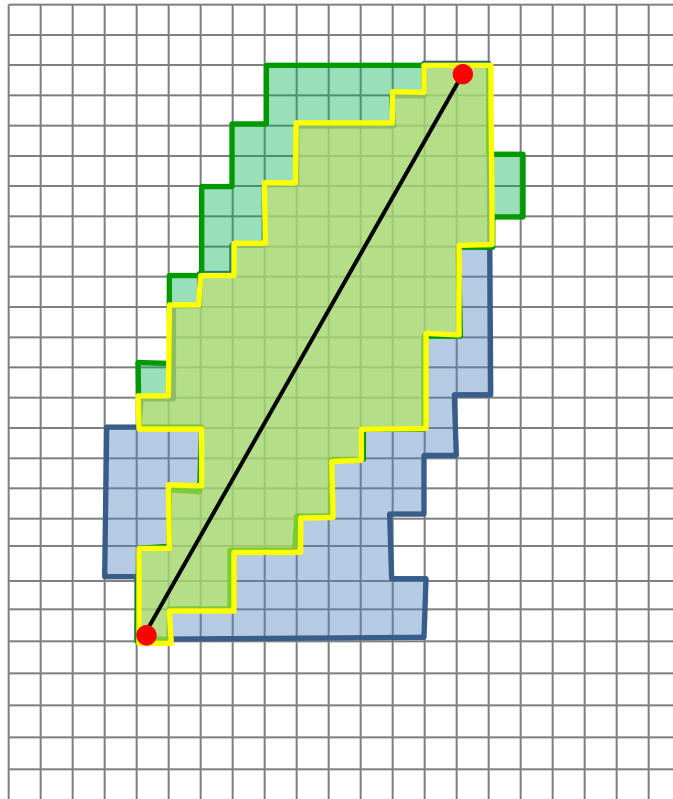
- DEM
- Ski-lift linear data
- Real estate linked to the resort

# Building of gravity envelopes for ski areas



**Gravity envelope:**  
*All pixels accessible from the top of the ski-lift which allow the skiers to come back to the foot of any ski-lift in the same resort*

## Building the ski area gravity envelope

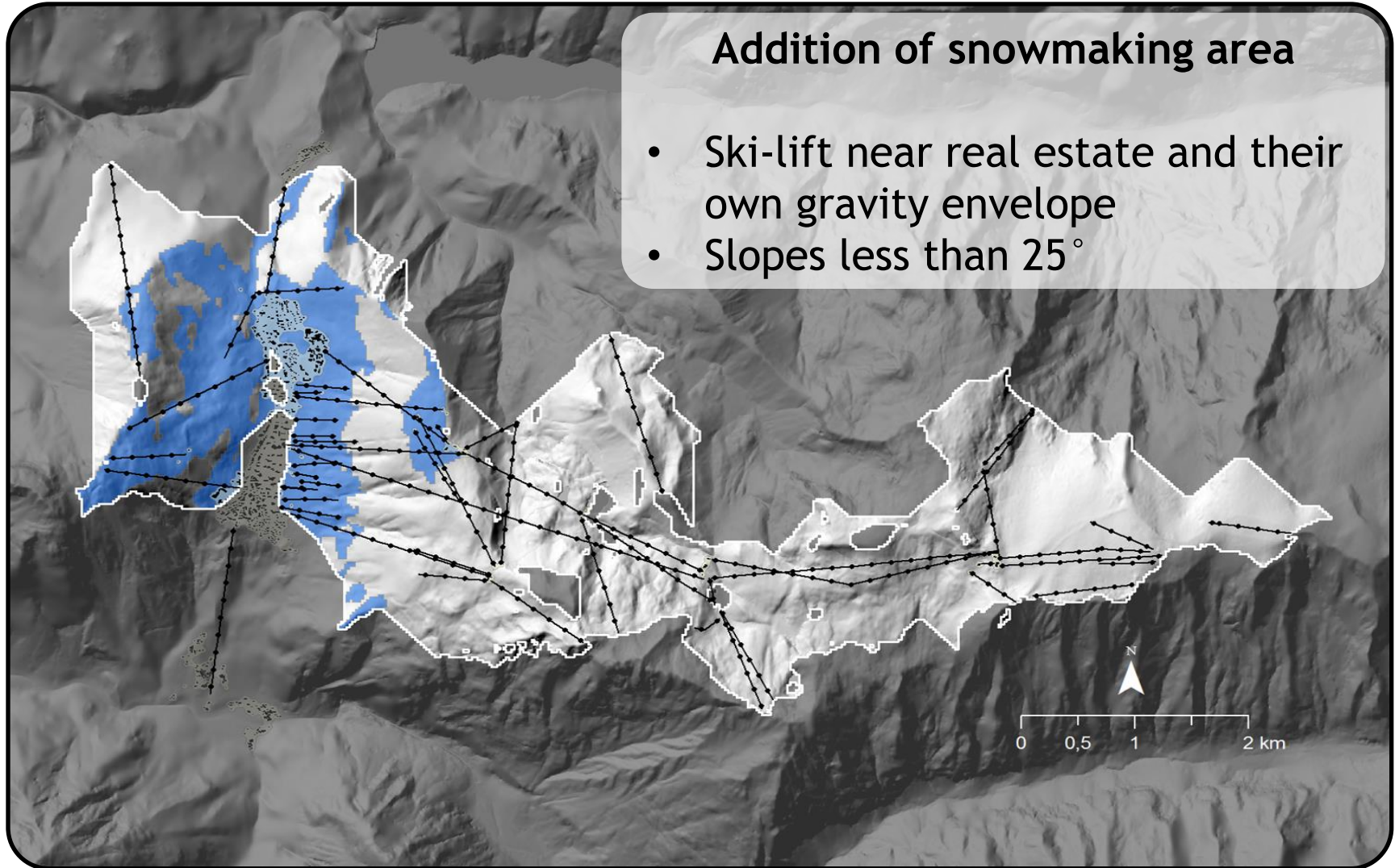


1. From top : find all neighbors pixels in D8 with a lower elevation than central pixel (slight tolerance to consider inertia)
2. From bot : find neighbors pixels with an upper or equal elevation than central pixel
3. Keep the geometries intersection

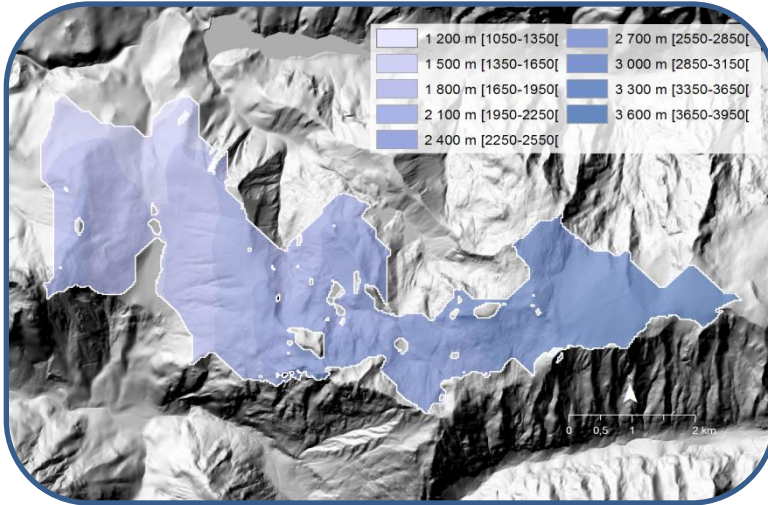
# Building of gravity envelopes for ski areas

## Addition of snowmaking area

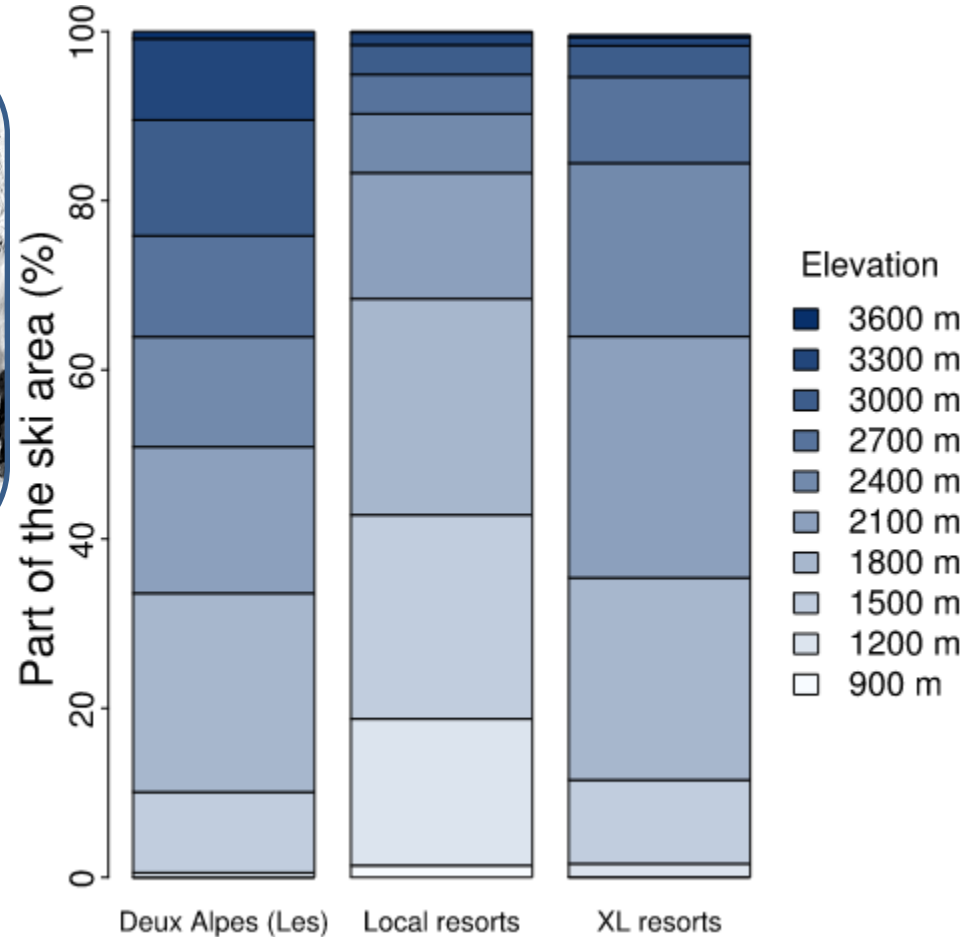
- Ski-lift near real estate and their own gravity envelope
- Slopes less than 25°



# Ski area properties : altitudes

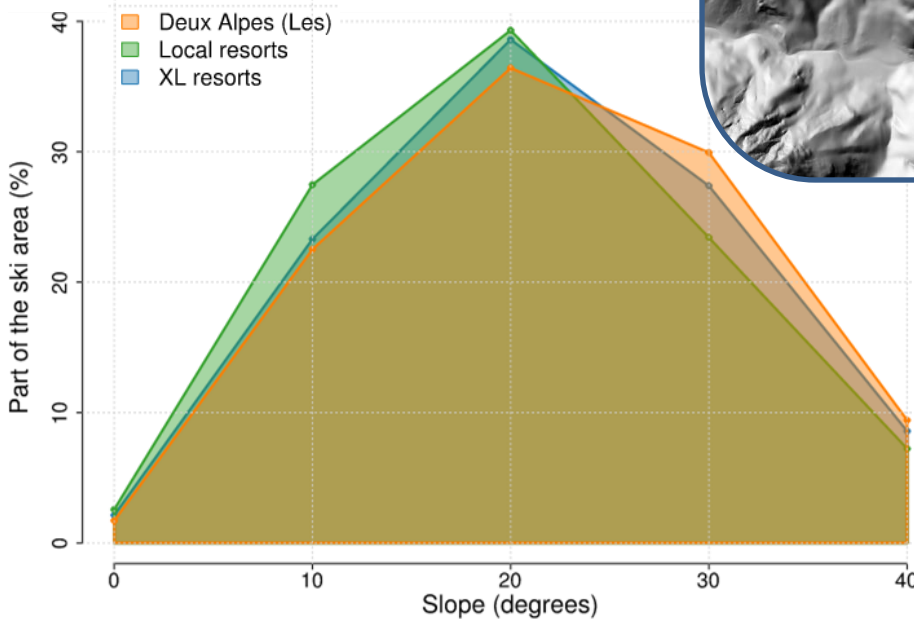
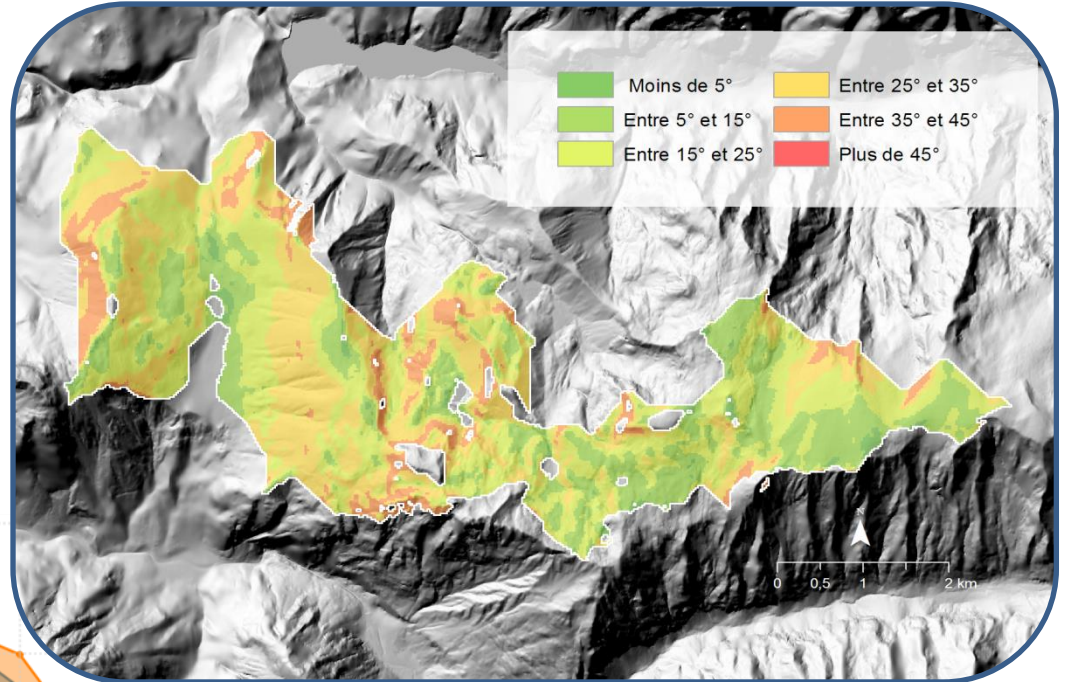


Les Deux Alpes : a well balanced altitude ranges



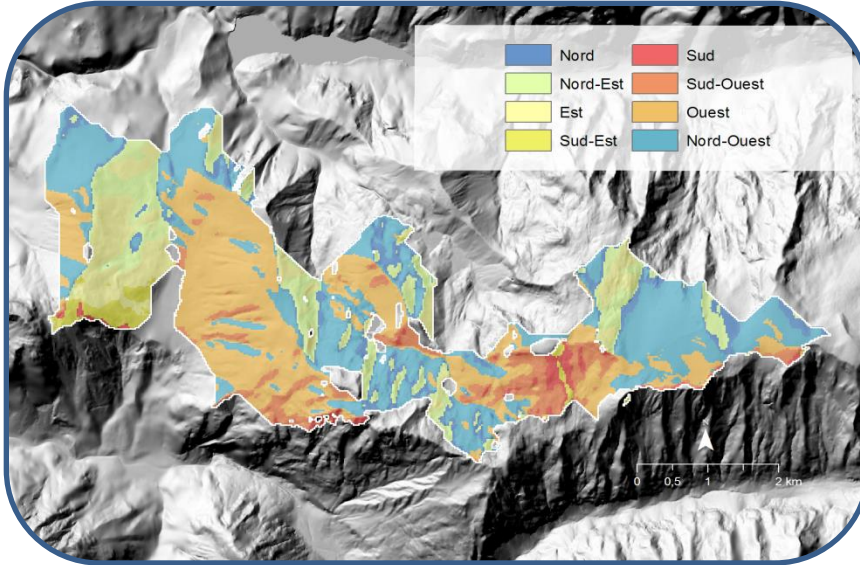
# Ski area properties : slopes

Les Deux Alpes : a similar pattern to other resorts ...

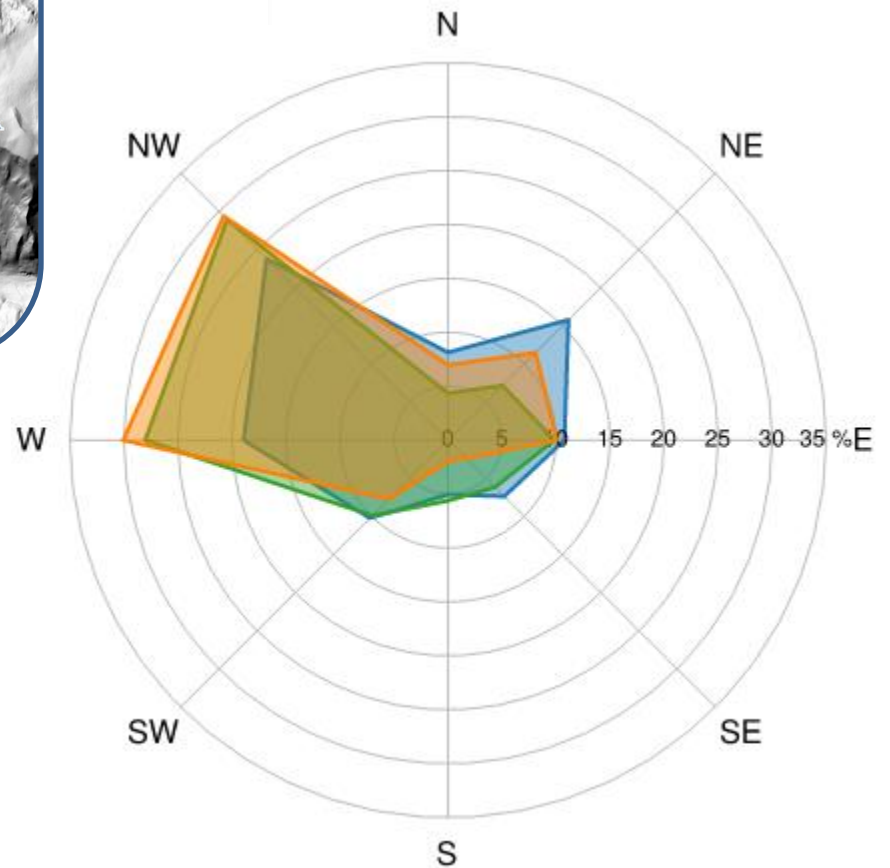


...with a small imbalance favourable to stronger slopes

# Ski area properties : aspects



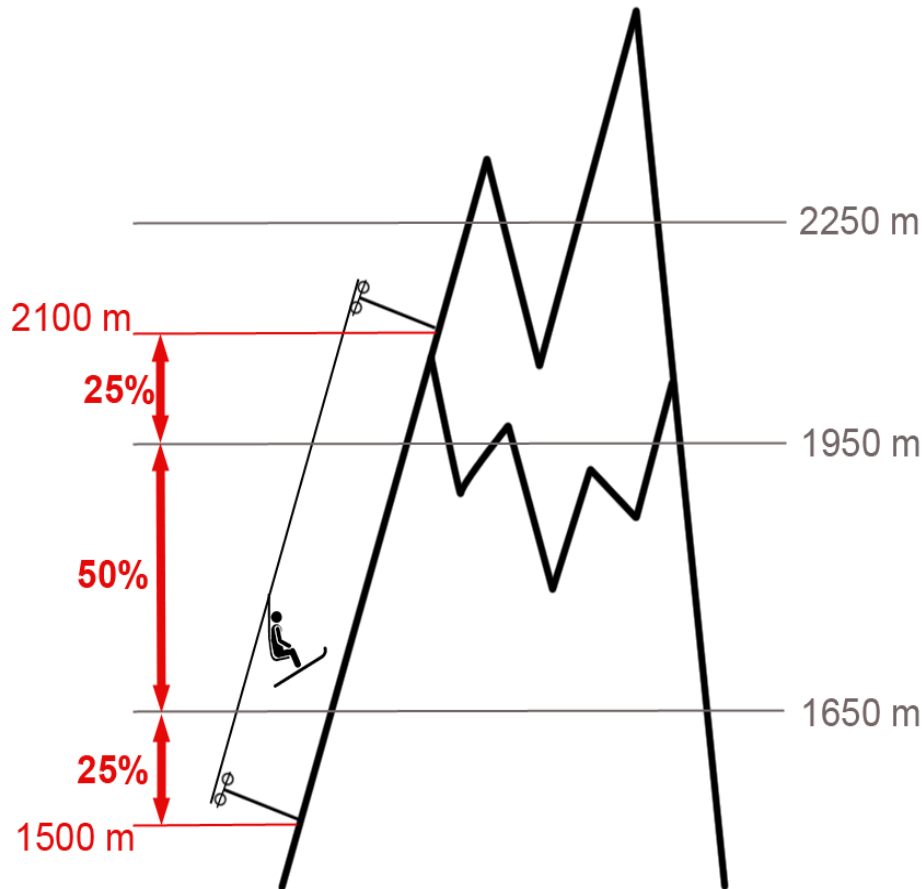
- Deux Alpes (Les)
- Local resorts
- XL resorts



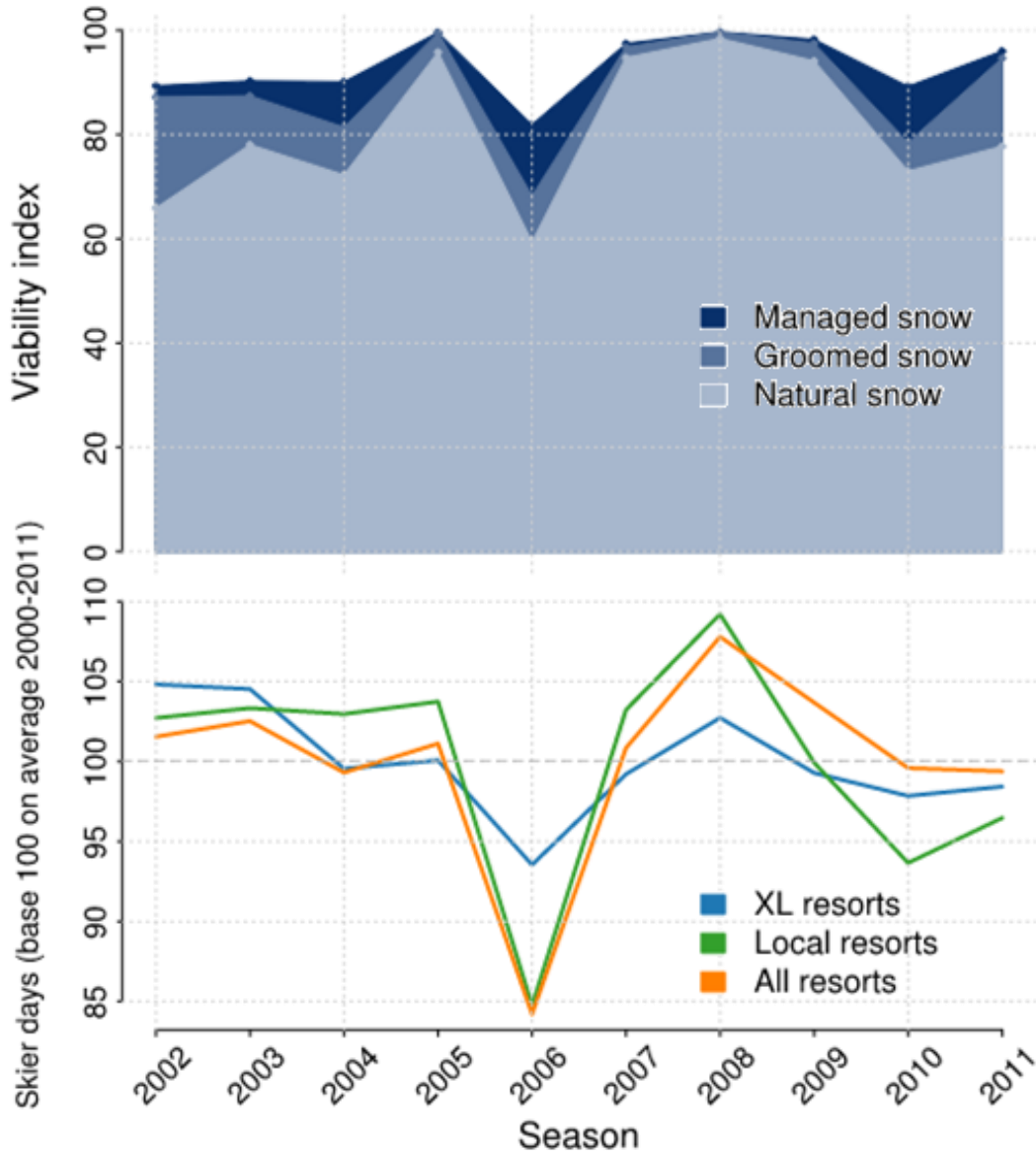
The whole resort has a clear trend to the W/NW which is specific characteristic of local resorts



# Assess the viability by crossing ski resort modelling with SAFRAN Crocus snowpack model



- Previous rasters are used to match the correct Crocus output
- Altitude information about ski-lift is used to weight each elevation range and are homogeneously distributed over pixels
- The 100 days rule has been adapt to take into account Crocus-Resort development and consider snow density rather than simple snow height. Here a threshold of  $SWE \geq 100$  has been used

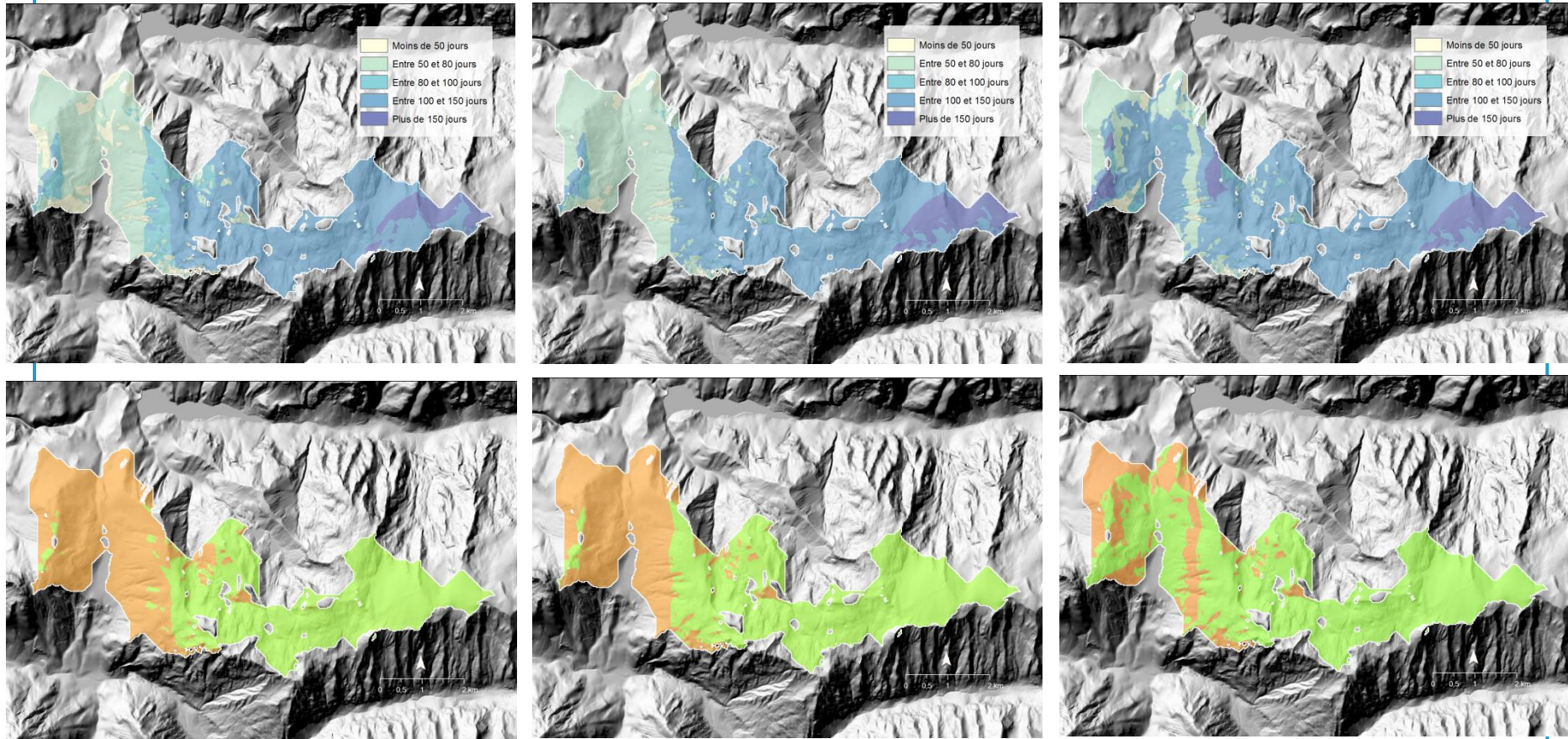


## Viability assessment between seasons from 2002-2003 to 2011-2012

- Up to a certain threshold of natural snow, grooming play an important role
- Seasons we will carefully look for: 2006-2007 and 2008-2009

# 2006 - 2007

Les Deux Alpes held up well to warm winter, thanks to its elevation which secures snow and allows for snow production



# 2008 - 2009

Like other resorts, Les Deux Alpes benefits of a good: grooming and snowmaking certainly help to improve season length

