# Waterproof/Breathable Fabrics

## There is no such thing as bad weather – just bad clothes

*Top Flats Young Valley, Otago. Photo credited to David Ellis.*

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As a manufacturer of waterproof/breathable garments you know something is wrong when the number one request from customers is,

'Do you have a waterproof jacket that will keep me dry?'

There are many misconceptions about waterproof/breathable fabrics. Ironically, in this information age, customers are in danger of becoming even more misinformed and confused.

The main technological advances in waterproof /breathable fabrics were perfected well over a decade ago and in New Zealand Japanese fabric manufacturers have tended to dominate the quality end of this market. All waterproof/breathable fabrics draw on similar construction methods, so these days variation is about quality control during fabric construction and the point-of-sale marketing presentations.

There are two methods used to enable waterproof/breathable fabrics to breathe. 'Microporous', where water vapour passes through a series of minute holes to escape to the atmosphere or 'Solid Barrier', where water vapour escapes via a process called the 'molecular transfer of moisture'. Both methods can be applied to a fabric two different ways – via a coating, which is applied in liquid form to the back of the fabric, or via laminating, a pre-prepared film which is glued to the fabric. All waterproof/breathable fabrics use one or other of these options and some use all four. The thickness of the laminate and the coating tends to increase the durability but reduces the breathability. There is an inverse relationship between these two factors and clothing manufacturers can choose which is best for their market.

There is often confusion about the difference between 'waterproof' and 'water repellency.' 'Waterproof' is the layer on the underside of the fabric that is essential for waterproofness.

To have a jacket that is totally waterproof requires every seam to be seam-sealed. A garment that is 'critically seam-sealed' is not totally seam-sealed and is not 100% waterproof.

'Water repellency' is an outer surface treatment applied to all waterproof/breathable fabrics before leaving the fabric mill. This treatment ensures water beads off the fabric. It is not essential for waterproofness but it is essential to maintain full breathability. When a fabric loses its water-repellent finish it becomes waterlogged and cold causing the temperature gradient between the inside and the outside of the fabric to alter. This immediately reduces the efficiency with which the water vapour passes through the waterproof/breathable layer.

Water repellency can be replenished but in our experience it is difficult to get it back to the level achieved during fabric construction. The water based, fluoropolymer resin used by the factory requires extremely high temperatures to cure so this method is not a particularly good aftercare treatment.

There is a misconception about why waterproof/breathable jackets need to be washed. Dirt on the outside of the jacket is not as critical as skin contamination on the inside surface. The natural oils and salts excreted from the skin are quite harmful over time. Depending on their chemical composition some waterproof/breathable coatings or laminates are more susceptible to contamination than others. Teflon is an oil-loving material so extra care is required to keep it clean. Polyurethane materials are more contamination proof. The main area of concern is around the neck and this area needs special care and attention. On mesh backed, 3-layer fabrics you can spot this potential problem as a dark stain. The extra mesh on 3-layer constructions gives better contamination protection than 2 or 2.5-layer fabrics. If the contamination remains on the fabric for a long period it will hydrolyse the glues and the coatings. Unwashed, this will eventually lead to irreparable delamination or peeling. By wearing high neck collars or bandanas around the neck this contamination can be reduced. This is a good idea as it effectively cuts down the need to wash your jacket.

Be wary of scientific measurements. There are many tests fabric manufacturers can use and it is human nature to pick the one that presents your product in the best light. We are always concerned that most measurements are taken on new fabric which has not been washed or flexed. On poorer quality fabrics it is not unusual to see waterproof figures reducing 50% after the first wash. Breathability measurements are equally confusing as not everyone uses the same standard. Breathability is reliant on air temperature, humidity levels and the physical construction of the fabric. Two layer fabrics are infinitely more breathable than the mesh backed 3-layer fabrics as the physical presence of the mesh reduces the breathable surface area. Some fabric brands have even been known to apply 2-layer breathability figures to their 3-layer fabrics. Wherever figures are quoted you should always make sure you are comparing apples with apples.

The clothing you wear underneath a waterproof/breathable garment is critical for good breathability. The best thermal fabrics are those that do not readily absorb water. Brushed polyester fleece is the most thermally efficient fabric (warmth for weight) and it absorbs only 1-3% of its weight in water compared to the natural fibres 25-30% (wool, cotton, silk). Once a water vapour molecule leaves the body its efficient and quick movement through various layers of insulation without being absorbed or hindered is critical. If you wear more than one heavy layer or two layers of lightweight natural fibre under your waterproof/breathable garment you will find you can overload the physics behind the breathing and you will get wet from condensation.

*Taranaki ACR Team, Avalanche Training, Mt Ruapehu. Photo credited to Peter Zimmer LandSAR NZ.*

These days everyone is looking to reduce the weight of their packs but when it comes to waterproofs in New Zealand, light-weight fabrics definitely trade away durability and strength. Heavier waterproof/breathable fabrics are durable but even these are tested when it comes to matagouri, bush lawyer, blackberry or spaniard grass. If you do not avoid these dangers a brand-new waterproof garment can end up like a sieve within seconds.

Waterproof/breathable fabric technology has revolutionised the wet-weather market. For the benefits you obtain from the technology it is definitely worth taking the extra time to look after your investment. If you do you will be rewarded.

### 5 Key Points for Waterproof/Breathable Garments

1. Should always keep you dry from rain and perspiration.
2. Good breathability requires a water repellent outer surface and non-moisture-absorbing layers underneath.
3. Be wary of fabric performance figures as there are many different standards.
4. Fabric lightness reduces durability.
5. Optimum performance requires care and maintenance

***David Ellis** established the performance outdoor clothing company Earth Sea Sky in 1990. Prior to this he worked in the previous family business Arthur Ellis & Co Ltd for 10 years where he was responsible for expanding the company's range of Fairydown sleeping bags to include packs, tents and outdoor clothing. Earth Sea Sky still manufacture all their clothing in New Zealand and offer a full range of rainwear, windshells, fleece, merino, thermals and travel wear. David is a keen tramper, mountaineer and ski tourer. He spends a great deal of time testing the products he makes.*